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Forestry  
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2015

Edited by Prof. D.K.N.G. Pushpakumara and Others

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**MESSAGE FROM PROFESSOR M.S. SWAMINATHAN**  
**CHIEF GUEST AND KEYNOTE SPEAKER**

Several parts of the world are undergoing unprecedented water shortage due to drought. California is an example of the serious water crisis. 97% of world's water is sea water. Therefore, the time has come for us to make use of the sea water in an effective way both for domestic use as well as for agriculture. For domestic purposes, the reverse osmosis method is being used. Another method used in desert areas is solar dehydration of saline water. There is still need for adequate water for farming. This is where the sea water farming technologies developed by the scientists of MSSRF assume relevance. Sea water farming involves, an integrated sylvi-aquaculture system or identifying suitable plants for such a farming system, MSSRF has established at Vedaranyam a Genetic Garden of Halophytes. Many halophytes like *Salicornia* and mangrove species are also economically valuable since they can provide food, feed, fodder, and fuel. The fish species could be chosen on consideration of both adaptation to sea water conditions and market demand. In addition to sylvi-aquaculture systems, coconut, casuarina and cashew nut can also be planted near the sea. Thus, there are possibilities for using sea water for food, jobs and income. I hope that the serious water shortage conditions prevailing in several parts of India as well as other parts of the world will stimulate more research and application in this field. Through the Dandi Salt March, Mahatma Gandhi emphasized in 1930 that sea water is an invaluable social resource. The use of sea water for coastal area farming is an idea whose time has come. Sea water farming will also help fisher families to have additional income and work opportunities when the sea is closed for fish regeneration.

**Professor M.S. Swaminathan**

Founder, Emeritus Chairman and Chief Mentor  
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**MESSAGE FROM PROFESSOR BUDDHI MARAMBE  
KEYNOTE SPEAKER**

It gives me pride and pleasure to send this message to the 2<sup>nd</sup> Annual International Conference on Agriculture and Forestry (ICOAF-2015), which will be held during 10<sup>th</sup>-12<sup>th</sup> June, 2015 in Colombo, Sri Lanka. The theme of the conference "Sustainable Agriculture and Global Food Security", is of global significance and the conference is held on highly opportune time. Agriculture, forestry and fisheries can provide nutritious food for all and generate decent incomes, while supporting people-centered rural development and protecting the environment. According to the Food and Agriculture Organization (FAO) of the United Nations (UN), to be sustainable, agriculture must meet the needs of present and future generations for its products and services, while ensuring profitability, environmental health and social and economic equity. In such a situation, the global transition to sustainable food and agriculture will require major improvements in the efficiency of resource use, in environmental protection and in systems resilience. The presentations made at the ICOAF conference would no doubt strengthen the global efforts to tackle many issues in relation to sustainability in the agricultural systems and food security. I sincerely hope that the deliberations would assist in future policy directives, and planning and implementation of programs in relation to the theme of the conference.

**Professor Buddhi Marambe**

Department of Crop Science

Faculty of Agriculture

University of Peradeniya

Sri Lanka



**MESSAGE FROM PROFESSOR GAMINI PUSHPAKUMARA  
CONFERENCE CHAIR**

It is a great pleasure and privilege to send this message as the Chair of the 2<sup>nd</sup> Annual International Conference on Agriculture and Forestry (ICOAF-2015) organized by the International Institute of Knowledge and Management (TIKM) which will be held from 10-12 June 2015, Colombo, Sri Lanka. The technical program is rich and varied with Prof. M.S. Swaminathan as the Chief Guest and 3 well known keynote speeches, 42 oral, 2 poster and 5 virtual presentations split between 4 parallel oral and 1 poster sessions. During the Conference, over 100 scientists from 12 countries will participate in sharing their findings in the theme of "Sustainable Agriculture and Global Food Security". This Conference is unique in the sense that it try to link traditional and modern thinking on Agriculture and Forestry together. Such integration is fundamental to reach sustainable development. The Conference, in addition to provide opportunity to present and share recent research findings of scientists, integrates and networks research scientists with well known figures in scientific arena in the world. I sincerely hope that the deliberations would assist in future policy directives, and planning and implementation of programs in relation to the theme of the conference.

As the conference Chair, I know that the success of the conference depends ultimately on the many people who have worked with us in planning and organizing both the technical program and supporting social arrangements. In particular, I thank the Chief Guest and Keynote speakers, all scientists, program and publication chairs and entire TIKM team for their hard work to stage ICOAF-2015, in the second successive time.

I welcome you all to the ICOAF-2015 and wish the Conference all success!

**Professor Gamini Pushpakumara**

Department of Crop Science

Faculty of Agriculture

University of Peradeniya

Sri Lanka

10<sup>th</sup> June 2015

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[01]

**SURVEY ON COMMONLY USED MEDICINAL PLANTS - IN MUTHUNAGAR GRAMA NILADHARI DIVISION, TRINCOMALEE DISTRICT, SRI LANKA**

Vidyadharshini, K., Dharshikah, S., Gunadasa, H. L. T. N. and Mohanalohini, N.

*Unit of Siddha medicine, Trincomalee Campus, Eastern University, Trincomalee***ABSTRACT**

Traditional medicine is a prehistoric system of medicine recognized throughout the world as a trustworthy healthcare resource. Medicinal plants are the mainstay of the traditional medical system of Sri Lanka including Siddha Medicine. The Muthunagar Grama Niladhari division is a rural area, including rich flora and fauna, spans an area of 8 km<sup>2</sup>, which belongs to Trincomalee district, Sri Lanka. The aim of the study is to identify the medicinal plants commonly used by traditional physicians. Field survey was done in 2014 and the plants were identified using herbariums, sample specimens, literatures, helps of traditional healers and senior yokels of the area. The survey was documented, 176 species of medicinal plants available belonging to 59 families. The floristics diversity was dominated by higher plants belonging to the family Leguminosae (13%), followed by Cucurbitaceae and Labiatae (each 6%). Further, 2% of rare medicinal plants were identified as *Hugonia mystax* (Linaceae), *Salacia reticulata* (Hippocrateaceae), *Salvadora persica* (Salvadoraceae) and *Erythroxylum monogynum* (Erythroxylaceae), which are specially using by the Sri Lankan traditional medical practitioners. The study revealed that the Muthunagar area is one of the stockpiles for medicinal plants. Currently, the reduction of availability of the herbs has reached a very critical phase with the growth of civilization and urbanization of this area. Unless evolve conservation of the medicinal plants, departing to be grave the flora and fauna including invaluable medicinal herbs in Muthunagar Grama Niladhari division in future.

**Keywords:** Medicinal plants, herbarium, field survey

[02]

**SPECIES RICHNESS OF SOME SELECTED WELL MANAGED AND STANDARD HOME GARDENS IN NAWALAPITIYA AREA, SRI LANKA**

W.G.C. Wekumbura <sup>1</sup>, A.J. Mohotti <sup>2</sup>, E. Frossard <sup>3</sup>, S.T. Kudagammana <sup>4</sup> and K.D.R.R. Silva <sup>5</sup>

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<sup>5</sup>*Department of Applied Nutrition, Wayamba University, Sri Lanka*

**ABSTRACT**

Home gardens of Sri Lanka are considered as one of the best developed agro forestry systems, providing sustenance to most rural populations in terms of food, spices, medicinal plants and income. This study was carried out in an on-going experiment in Nawalapitya, Sri Lanka during December 2014, which consisted of four home gardens each, in two categories namely well managed and standard home gardens. Well managed home gardens were carefully and intensively managed with considerable inputs and continuous attention of the farmer, hence contributing with food and income to the household. Standard home gardens were not so intensively managed and received less attention from the farmers, hence contribution to the household income and food was marginal. The species diversity of crops between the two home garden categories was compared in terms of species richness, which differed markedly: The mean number of vegetable species per home garden was 41.75 and 29.5 in well managed and standard home garden categories, respectively. Most abundant crops were common vegetables, leafy vegetables, and root and tuber crops. Further, the mean numbers of species of fruit, medicinal, timber, weed and ornamental plants recorded were 23.5, 27.25, 17.75, 63.25 and 49.75, and 12.5, 17.5, 18.25, 67 and 28, respectively in the well managed and standard categories. The type of vegetation was directly linked with the type of management. The study emphasizes the importance of maintaining high plant diversities in home gardens since they have a high potential for contribution to food and income of the households.

**Keywords:** management of home gardens, species diversity, food supply

[03]

**ASSESSMENT OF RELIABILITY, RESILIENCE AND VULNERABILITY OF  
IRRIGATION IN PADDY FIELD IN A MINOR IRRIGATION SYSTEM USING  
PEIZOMETER METHOD**

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University of Peradeniya, Sri Lanka*

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**ABSTRACT**

Wetting and drying of paddy field is a common scenario due to scarcity of water in minor irrigation systems in Sri Lanka. Water level fluctuation in the field has been used to measure the yield performances in irrigation systems. Using this method, reliability, resilience and vulnerability were studied in Bayawa minor irrigation system during the vegetative phase in 2014/2015 *Maha* season. Field water level was measured in 22 locations representing Left, Middle, Right channels of Bayawa tank in Head, Middle and Tail ends of the command area. A perforated piezometer with 72 cm length and 10 cm diameter was installed and water level was measured daily. The Critical Tolerance Level (CTL) was identified as the ground level (0 cm). System is considered as “reliable” if the water level is above the CTL, “resilient”, when the water level goes below the CTL and recovers quickly and, “vulnerable” when the water level falls continuously below the CTL. The highest (96%) and the least (0%) reliability were observed in the tail end of the right channel and the head end of the left channel, respectively. A high variability in terms of reliability, resilience and vulnerability was observed among farmers in the left channel. Head end shows the highest variability for all three indices. The average values of reliability, resilience and vulnerability for the entire system are 75%, 4.4 days and 0.2, respectively. This overall assessment reflects the effect of elevation, irrigation capability and scarcity of water on performance of a minor irrigation system.

**Keywords:** Water level, reliability, resiliency, vulnerability

[04]

**WOMEN EMPOWER FOR FOOD AND NUTRITION ISSUES IN BANGLADESH**

Ferdouse Islam

*Olericulture Division, Horticulture Research Centre Bangladesh Agricultural Research Institute (BARI), Gazipur 1701, Bangladesh***ABSTRACT**

Empowering women has multiple benefits for women themselves and for their families and communities. In Bangladesh, women are involved and responsible for food preparation. As a result, their empowerments are increasing beside the food security and nutrition. The main focus of the study was to determine women empowerment status through the participation in IGAs for food security, safety and nutrition, and to examine the selected characteristics of the women both in rural, urban and peri-urban. Data were collected January to March, 2014 through pre-tested interview schedule from randomly selected 105 respondent from three villages of Pabna Sadar Upazilla. The selected ten characteristics of the women were considered as the independent variable while their empowerment status through participation in decision making about issues of income and food safety was the dependent variable. Majority (67.62 percent) of the women were medium empowered while 12.38 and 20.00 percent were highly and lowly empowered respectively. Among the six indicators or aspects of empowerment the mean participation in decision making of food safety and nutrition issues the respondents was the highest (19.5) and access to service providers was the lowest (10.1). The findings also revealed that the mean of contribution to household economy was 18.3, level of networking and friendship was 17.3, access to resources was 15.5 and access to information was 14.3. In the study area, majority of the respondent women were middle aged category, medium family size, small farm size, medium family income, medium knowledge about food issues, short training experience, medium socio-economic status, medium attitude and very slight fatalistic category.

**Keywords:** Empowerment, women, food security, nutrition

[05]

## IMPACTS OF URBANIZATION ON AGRICULTURE AND WATER RESOURCES IN NORTH 24- PARGANAS DISTRICT OF WEST BENGAL, INDIA

Ajit Kumar Bera

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### **ABSTRACT**

Rapid growth of population (1.29/year from 2001-2011) and urbanization are the principal factors for agricultural degradation. In this context this paper present a case study (North 24 – Parganas district of West Bengal, India) through field survey and numerical analysis for the development of hypothesis. The reality of the urban region where is decreasing and changes of land use pattern and water quality by increasing population pressure on land and water resources. The specific problems are identified as decadal growth of population (2001-2011) is 12.8% in the district whereas urban population growth rate is 17.7%; urban area was 7.8% in 1991 of the district but 11.1% in 2001 and 16.6% in 2011; 27.3% people are residing at urban area in 1951 whereas 57.6% people are living in urban area in 2011; it is remarkable that the 57.6% people are living at 16.4% area only; as per 2011 census, the density of population is 9,228/km<sup>2</sup> in the urban area of the district; urban water consumption is continuously increasing i.e. 122,500,170 l was required for per day in 2001 whereas 174,213,840 l for per day in 2011. It is noted that the remarkable situation because consumption of water also converted to waste water which is discharge/spread outside the urban community (due to open drainage system). Not only that there is no waste water recycling facilities; urban water collection system and absent of waste management are mostly unscientific. So that the toxic materials are dumping on agricultural land and that land has been degraded continuously. Finally, to overcome the aforesaid problems, the scientific planning and management strategies are recommended (short-term and long-term planning) for sustainable development of urban livelihood patterns with recycling of water and waste management plants in that urban center. Land use planning strategies are recommended for protection of agriculture and water resources in the district for rural community development.

**Keywords:** Environment, water resources, land use, development

[06]

**ASSESSMENT OF FOREST COVER, DEFORESTATION, HUMAN-INDUCED DISTURBANCES BY USING REMOTE SENSING METHODS IN ISTANBUL**

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*Proline Integrated Intelligence, Turkey***ABSTRACT**

Remote sensing (RS) technology provides innovative/alternative data source in a wide variety of disciplines especially ones have a geospatial property, such as forestry applications. Forest managers require remote sensing data sources for fast, effective and economical decision making and for a sustainable forest management next to conventional forest land survey which also covers classical map surveying methods and special forestry applications. The implementation of remote sensing in forestry includes 1. Forest/land cover; 2. Biomass (changes in volume, development etc.); 3. Disturbances (atmospheric effects, biological, human-induced disturbances etc.). We aimed to propose a roadmap by using most established data acquisition methods in forest applications; optical sensors. We intend to implement a case study within İstanbul forests, and our main concentration is to obtain reliable information on changes in forests and determine forest cover, deforestation and human-induced disturbances by using optical imagery. We targeted to obtain optical data (i.e. LANDSAT, IKONOS), ancillary data (forest management, stand cover maps, etc.) from General Directorate of Forestry, CORINE land database and if required land surveys and additional data sources (i.e. ALOS PALSAR, DEM, DTM). After rectification and image enhancement processing steps, vegetation indices and transformations to obtain more information from optical images and additional data sources will be applied. The following step is to compare and asses all results with ancillary data and CORINE land database and at the last step, due to the results from previous step, we will determine forest cover, deforestation and human-induced disturbances.

**Keywords:** Remote sensing, forest cover, deforestation, human-induced disturbances, optical data, image processing



[07]

## EFFECTS OF PRIMING TREATMENTS ON SEED GERMINATION AND SEEDLING GROWTH OF TWO MEDICAGO SPECIES

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### **ABSTRACT**

A method to improve rate and uniformity of seed germination is the priming or physiological advancement of the seed lot. A laboratory study was carried out to evaluate the influence of different seed priming treatments on seed germination behavior of two *Medicago* species (*M. rigidula* and *M. rotata*) under controlled conditions to find out the most effective priming treatment. Seeds were treated with the following seed-soaking media: (1) hydro-priming with distilled water for 5, 10 and 15 hours, (2) osmo-priming treatments with PEG 6000 were -0.6, -0.9, and -1.2 MPa osmotic potentials with duration of 12, 24, 36 and 48 hours, (3) control. Seeds of both species were placed in liquid priming media at 25C. Priming treatments significantly affected germination vigor of both species. The response of both species to different priming techniques was very similar. Osmopriming treatment (-0.6 and, -0.9 MPa and 12 hours) increased final germination percentage of both *Medicago* species. Priming treatments increased plumule length significantly comparing to control. Hydro priming for 5 and 10 hours exhibited longer plumule than others. Significant higher vigor index was observed in hydro- priming for 10 and 12 hours. *Medicago rigidula* produced more germinated seeds and vigorous seedlings than *M. rotata*, similarly, germination rate in *M. rigidula* was higher than in *M. rotata*.

**Keywords:** *Medicago*, Osmopriming, *rigidula*,

[08]

## INHERITANCE OF PERICARP COLOR IN SRI LANKAN TRADITIONAL RICE

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### ABSTRACT

There was a wide variation in pericarp color among Sri Lankan traditional rice accessions. Red and white pericarp colors are prominent. The objective of this study was to reveal the inheritance of red and white pericarp among plants of same accession. Ninety Sri Lankan traditional rice accessions were grown in short day season (*Maha*) in 2013. Ratios of red and white pericarps were recorded; Accession numbers (AN) 3,641, 5,531 and 3,560 had produced both white and red pericarps while other accessions produced one pericarp color only. The ratios of white to red pericarp were 139:11, 123:27, and 130:20 for AN 3,641, 5,531, and 3,560, respectively. The specific gene interactions could be revealed: AN 3,641 and 5,531 fitted with 13:3 ratio while AN 3,560 was 15:1 at 5% probability level. Five replicates (ten seeds each) of random red and white pericarps of AN 5,531 and 3,641 were germinated *in vitro* to check if seedling phenotypes were affected by pericarp color in each accession. Random seeds of white pericarp of AN 5,531 could not germinate while all seeds with red pericarp could germinate during the first week in all replicates. All seeds of AN 3,641 were germinated and did not show any phenotypic difference among seedlings derived from red and white pericarps. Lack of phenolic compounds in seeds with white pericarp may reduce the viability.

**Keywords:** Pericarp color, Sri Lankan traditional rice

[09]

**THE EFFECT OF CHEMICAL MUTAGENS UPON MORPHOLOGICAL CHARACTERS OF GINGER (*ZINGIBER OFFICINALE*) IN M<sub>0</sub> GENERATION**

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***ABSTRACT***

The effect of chemical mutagens like ethyl methane sulphonate (EMS), sodium azide (SA) and colchicines in different concentrations upon the morphological characters of ginger (*Zingiber officinale*) was studied. Wide genetic variation is needed in plant breeding in order to search ideal plant types during the process of selection. Induced mutations and various biotechnological tools continue to be in great demand to create the variations and screen the mutants respectively. To study the effect of chemical mutagens three wild and indigenous varieties of ginger in India namely Bidar, Himachal and Humnabad were used. The three months plants of the mutant varieties were studied with respect to various growth parameters like survival percentage, sprouting percentage, plant height, number of tillers, etc. The data collected was analyzed and significant variations were observed in the growth parameters between the mutant and wild varieties. It was found that the treatment with chemical mutagens had significant effect on all the growth parameters.

**Keywords:** Ginger, *Zingiber officinale*, ethyl methyl sulfonate, sodium azide, colchicine, morphological characters

[10]

**MORPHOLOGICAL VARIATION WITHIN PROGENY AND DEVIATIONS  
FROM MOTHER PLANT REVEAL THE ALLELE RICHNESS IN  
CINNAMOMUM VERUM GERMPLASM: A CASE STUDY FROM  
MATARA COLLECTION AT EARLY VEGETATIVE STAGE**

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**ABSTRACT**

Crop improvement depends on the genetic variability present in plant germplasm. *Cinnamomum verum* (cinnamon) is one of the most valuable spices grown in Sri Lanka and it contributes 90% of world total production. Cinnamon flowers are small, bisexual and arranged in panicles. It is a cross pollinated plant. The present research focuses on morphological variation among the progenies, mother plants and other plants of a more than 50 years old cinnamon population at Deiyandara in Matara district of Sri Lanka. This study was carried out to determine the contribution of possible cross pollination for morphological variation among mother plant and its progeny of cinnamon. Eighteen accessions were collected from the same cultivated land in Deiyandara, Matara (6°9'16.97"N, 80°36'15.93"E). Cuttings of two mother plants and four seedlings from seeds of each mother plant were grown in nursery at Faculty of Agriculture, University of Ruhuna, Sri Lanka. Observations were made on selected morphological characters after 10 weeks that are age-independent: leaf morphological characters of leaf shape, leaf base and leaf apex. Leaf apex of 25% progenies and leaf base of 75% progenies were alike to mother plant-01 and only leaf base of 50% progenies were similar to mother plant-02. Rest of the progenies showed different leaf morphological traits, some of which were similar to other plants and some were completely different from the collected accessions. This study were carried out on only one plant generation but observations on some more generations would be needed to know allelic combinations among progenies. The present work gives an indication about possible differences in allelic composition and allele richness in cinnamon germplasm.

**Keywords:** *Cinnamon germplasm, morphological variation, progeny, allele richness.*

[11]

## ENHANCING ANTHOR CULTURE RESPONSE IN RICE VARIETY AT 303 WITH MANNITOL AND NITROGEN STRESS

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### **ABSTRACT**

Anther culture is a biotechnological tool to develop homozygous lines in plants. Microspores in anthers are induced to undergo embryogenesis to yield haploid plants in vitro. Chromosome doubling of haploids creates di-haploids, which are fully homozygous, thus providing a rapid route to homozygosity in plants. Several stresses are known to induce microspore embryogenesis from cultured anthers. This study investigated the effect of mannitol and nitrogen stress, over the routinely applied cold-stress, on anther response in rice. Booting-stage panicles were harvested from rice variety At 303 for anther excision and culture. Osmotic stress was applied in vitro by pre-culturing anthers for 48 hours in mannitol incorporated N<sub>6</sub> medium followed by transfer to normal N<sub>6</sub>. Three mannitol concentrations, 0.2 M, 0.4 M, 0.6 M and the control (0.0 M) were used. Nitrogen stress was applied on anther donor plants at field-level. Three applications of N fertilizer were used; half the recommended levels; complete withdrawal and applying recommended levels less frequently. The control comprised regular applications at recommended levels. Anthers harvested from stressed plants were cultured on N<sub>6</sub> medium. Results indicated that both osmotic and nitrogen stresses had a significant positive effect ( $p \leq 0.05$ ) on anther response. Highest callus induction (7.3%) was observed on 0.2 M mannitol-stressed medium. At higher mannitol concentrations as well as in the control, anther response was very poor ( $\leq 0.30\%$ ). Plants stressed with half levels of N fertilizer produced thrice the anther response (10.4%) shown by the control (2.9%). Anthers collected from plants with either no or less frequent applications of N fertilizer produced zero response. Thus, mannitol and nitrogen stresses at specific levels are observed to influence anther response positively in rice variety At 303.

**Keywords:** anther culture, At 303, pre-treatment, mannitol, nitrogen

[12]

**EFFECT OF PHOTOPERIOD ON VEGETATIVE GROWTH RESPONSES OF SRI LANKAN TRADITIONAL RICE: THEORY AND REALITY**

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**ABSTRACT**

Rice is a known photoperiod sensitive crop. The objective of this study was to determine the effect of photoperiod on the vegetative growth responses of different rice genotypes (*Oryza indica*) of Sri Lankan rice including traditional rice, improved rice and wild rice. Forty five traditional rice accessions, 5 improved rice varieties, wild rice (*O. nivara* and *O. rufipogon*) and *O. japonica* accession 6,782 and 6,752 were grown in short day (SD), day neutral (DN) and long day (LD) conditions. Days to reach the fifth leaf stage (DFL), plant height (PH) and tiller number (TN) at fifth leaf stage were recorded. Twenty three genotypes including 21 traditional rice accessions, *O. japonica* 6,752 and *O. nivara* did not respond to photoperiod having non-significant values for DFL, PH and TN. The DFL was affected in 25 genotypes; among them both DFL and PH were affected in 7 genotypes. DFL was significantly increased during LD in 4 traditional rice genotypes while DFL was significantly reduced in all 5 improved rice and 5 traditional rice. The DFL was significantly increased in *O. japonica* 6,782 and in 5 traditional rice under SD condition. In 4 traditional rice genotypes, DFL was reduced under SD. TN was affected in *O. japonica* 6,782 only under SD condition with increased DFL. DFL was significantly increased under DN condition in *O. rufipogon*, 5 traditional rice and 2 improved rice. Our results suggest that the vegetative responses in rice can be a key determinant of its sensitivity for the photoperiod.

**Keywords:** day length, morphological characters, photoperiod sensitivity, rice

[13]

## MORPHOLOGICAL VARIATION AMONG ACCESSIONS OF SRI LANKAN TRADITIONAL RICE VARIETY "*HERATHBANDA*"

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### ABSTRACT

Sri Lankan traditional rice germplasm consists of a vast range of different varieties of rice which are being conserved in Plant Genetic Resources Centre (PGRC). There is a wide variation in morphology and days to flowering among these Sri Lankan traditional rice accessions. We examined Sri Lankan traditional rice variety "*Herathbanda*", a short aged rice variety which would be useful in future rice breeding programs due to its early flowering nature. This experiment was conducted in a field at Kamburupitiya during short day season (*Maha*) 2013/2014. The objective of this study was to examine the diversity of seven *Herathbanda* accessions from PGRC based on selected 18 morphological and 2 physiological characters and days to flowering (DF). A variation was observed in average values of characters among accessions: average DF varied from  $73 \pm 0.25$  days to  $101 \pm 5.76$  days, plant height at 5<sup>th</sup> leaf stage (PHF) from  $48.5 \pm 1.75$  cm to  $89.5 \pm 3.04$  cm plant height at flowering from  $111.9 \pm 4.04$  cm to  $130.5 \pm 3.08$  cm, total number of panicles from  $8 \pm 2.301$  to  $47 \pm 0.02$  and number of grains per first panicle from  $115 \pm 10.15$  to  $153 \pm 14.07$ . Accession 3,624, gave the significantly lowest PHF of  $48.5 \pm 1.75$  cm while the DF was significantly highest with  $101 \pm 5.76$  days. In other accessions, PHF and DF did not show such inverse relationship. Further, the seed of accession 3,624 was with an awn while other accessions lacked awn. In Principal Component Analysis (PCA) five principal components were resulted explaining 95% of total observed variation. In hierarchical cluster analysis six clusters were formed at rescale distance of 25. Accessions 3,693, 3,677, 3,624, 3,904 and 2,063 are grouped in separate single clusters. Although the accessions belong to one variety *Herathbanda* with similar grain length and width among all accessions they exhibited some morphological variation leading to different clusters. Accessions 2,065 and 2,066 clustered together at zero level indicating that they may be duplicates.

**Keywords:** Sri Lankan traditional rice, days to flowering, morphological characters

[14]

**DETERMINATION OF FLOWER BIOLOGY OF UNDEREXPLOITED  
POLLINATOR ATTRACTING VEGETABLE, *LUFFA CYLINDRICA* L. GROWING  
IN HOME GARDENS OF JAFFNA**

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***ABSTRACT***

*Luffa cylindrica* L. is an edible underexploited vegetable crop in Sri Lanka. It has the potential to attract diverse pollinators and to sustain their visits to the home gardens. Conserving the pollinator diversity through the sustained contribution of potential plants that support pollinators in the home gardens were studied. Flower biology of *L. cylindrica* was investigated by assessing the flowering stages over time, anthesis and stigma receptivity. The rate of flower opening was at peak around 03.45 hr to 04.15 hr. Anthesis was prolonged for 2-2½ hours and stigma receptivity was 3-3½ hours after flower opening fully. Nine bee species, three butterfly species, one beetle and an ant were found as floral visitors to *L. cylindrica*. These results confirm the potential of *L. cylindrica* to be grown as one of the pollinator conserving plants in the home gardens of Jaffna.

**Keywords:** *Luffa cylindrica*, home gardens, flower biology, anthesis, floral visitors



[15]

**FEEDING, NON-FEEDING AND BREEDING BEHAVIOR OF CROSSBRED GOATS UNDER FREE RANGE SCAVENGING SYSTEMS DURING COOL AND HOT SEASONS**

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**ABSTRACT**

The study was aimed at investigating the feeding, non-feeding and breeding behaviors of crossbred goats under free range scavenging system. The behavioral activities were observed and recorded during cool season (temperature less than 28 °C) and hot season (temperature more than 32 °C). The first preference of forage type, total time duration spent for feeding activities such as grazing and browsing, for non-feeding activities such as butting, walking, standing, lying, and drinking and breeding activities included the expression of sexual cues, frequency of mating, approaching opposite sex and expressing estrus symptoms were recorded separately. The first preference of the crossbred goats was grass in both seasons. The time duration for searching feed, grazing, browsing, walking and drinking were significantly longer ( $P < 0.05$ ) in dry season while time spent for standing and lying were significantly longer ( $P < 0.05$ ) during cool season. Frequency of expressing sexual cues (4.36 times per day) was significantly high ( $P < 0.05$ ) in cool season while frequency of mating (3.17 times per day) and approaching opposite sexes (6.74 times/day) were significantly high ( $P < 0.05$ ) during hot season. Butting and expressing of estrus symptom were not significantly associated ( $P > 0.05$ ) seasons. The total time duration spent at range land was  $8.6 \pm 0.15$  hours per day, which is from 9.00 a.m to 5.00 p.m in both seasons. The results of the study also showed that the goats spent 43%, 31%, 22% and 4% of their day for browsing, grazing, non-feeding activities and breeding, respectively in both cool and hot climates. However, a few minutes/day at 3-5 times the bucks expressed butting and fighting each other for dominancy. Knowledge of behavioral activities of goats at different seasons is utmost important to the development of management strategies for small scale farmers for optimal and sustainable use of natural vegetation and proper breeding plan.

**Keywords:** browsing, butting, grazing, sexual cues

[16]

**PRODUCTION, QUALITY ASSESSMENT AND SHELF LIFE EVALUATION OF  
PROTEIN - RICH BISCUITS MADE FROM BLENDS OF WHEAT AND  
DEFATTED COCONUT FLOURS**

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*Department of Agricultural Chemistry, Faculty of Agriculture, Eastern University, Sri Lanka***ABSTRACT**

Defatted coconut flour obtained from the whitish kernel residue left after the extraction of virgin coconut oil has potential application in high protein-fiber enriched food products. Therefore, a study was conducted to utilize coconut flour, a byproduct of the virgin coconut oil industry for the partial substitution of wheat flour. In this study, wheat flour was substituted with defatted coconut flour in varying proportions of 0, 10, 20, 30, 40 and 50% w/w to prepare a series of blends for biscuit and the possibility of using coconut flour for the production of biscuits was investigated. Prepared biscuits were subjected to nutritional, physical, textural and organoleptic analysis to evaluate the suitability of biscuits for consumption. Nutritional analysis of coconut flour revealed that it contains 12.6% protein, 13.0% fiber, 9.2% fat, 13.7% sugar, 8.2% ash and 4.2% moisture. Protein, fiber and fat value of defatted coconut flour fortified biscuits increased with progressive increase in proportion of defatted coconut flour and 40% coconut flour added biscuits obtained values of 10.7%, 11.3% and 22.7%, respectively, while the lowest values of 4.9%, 8.3% and 16.9% recorded for the wheat flour biscuits. The moisture and ash were increased with corresponding increase in the percentage of defatted coconut flour while showing the decrease in carbohydrate content. Defatted coconut flour incorporated cookies were found to be lesser harder than control cookies when tested for hardness with texture analyzer. About 40% defatted coconut flour added biscuits scored the highest overall acceptable rating compared to other tested combinations and could be stored up to 5 months in aluminum package without significant changes in keeping quality.

**Keywords:** biscuit, defatted coconut flour, nutritional profile, sensory evaluation

[17]

## IS FEED AND FODDER SHORTAGE A MAJOR IMPEDIMENT TO ACCELERATED LIVESTOCK DEVELOPMENT IN BHUTAN?

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### **ABSTRACT**

Accelerated livestock production in Bhutan is constrained by perceived unavailability of feed/fodder both in quality and quantity. Consequently the domestic livestock are underfed and are less productive. To understand its detrimental effect, a study was conducted in major Agro-Climatic Zone (ACZ) of Bhutan. Availability and contribution of different feed and fodder resource to diet of domestic livestock was assessed to generate information on the extent of feed and fodder shortage at the different ACZ and explore availability of different feeding options to optimize production. Study covered eight out of 20 districts in Bhutan. Within each dzongkhags 16 representative geog (sub-district) in three ACZ was selected and, ten households/geog were chosen for interview. Primary data is collected adopting Feed and Fodder Assessment Tools recommended by International Livestock Research Institute. Results indicated that to supplement conventional fodder resources, farmers across ACZ cultivated improved fodder crops with average acreage of 2.14 ac/household. Some excess summer fodder was conserved as hay and silage. Besides, 79% of available crop residues are conserved to feed animals during lean season. Conserved fodder/straw contributed 25% while fodder trees supplied about 29% of fodder required during winter. Remaining fodder needs was met via forages collected from forests, gruel made out of grains and a little of concentrate feed purchased. Study concluded that fodder shortage is localized and is not uniform across ACZ. In higher elevations, fodder shortage is acute due to longer winter which hampered animal production. However, the farmers in mid and low altitude did not face severe fodder/feed storage because of shorter winter and other feeding alternatives available. The study recommended that proper planning of fodder resource utilization in different ACZ, vigorous promotion of available technologies, nutrient enrichment of crop residues, research on frost resistant fodder varieties, and utilization of breweries waste can bring fodder shortage to near zero.

**Keywords:** ACZ , Bhutan, fodder shortage, livestock production

[18]

**INVESTIGATION ON THE PREVALANCE OF TICK INFESTATION IN CATTLE  
AT DIFFERENT FARMING SYSTEMS IN BATTICALOA DISTRICT**

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*Faculty of Agriculture, Eastern University, Sri Lanka***ABSTRACT**

A study was conducted to investigate the prevalence of tick species on cattle under various farming systems at Batticaloa district. Kiran, Kokkaddicholai, Kaluwanchikudy, Thumpankerni and Chenkalady veterinary ranges at Batticaloa district were randomly selected for the study. From each veterinary range 35 farms were randomly selected irrespective to their size and type of system. A total of 300 animals were randomly selected and examined carefully for tick infestation irrespective to their age, sex and physiological status. The results of the study showed that around 39% of the farms had tick infestation and the prevalence was significantly high ( $P<0.05$ ) in crossbred cattle of exotic breeds (65%) in extensive system and local crosses (61.7%) under intensive system. Cattle breed of temperate crosses (59.6%) had significantly high ( $P<0.05$ ) tick infestation when compared with tropical crosses. Tick infestation was significantly high ( $P<0.05$ ) in female animals (73.6%) than in male and it was significantly higher in adult animals (68%) of age more than 3 years. The infestation recorded was significantly high ( $P<0.05$ ) in lactating animals (56.3%) and low in calves of age more than 3 months (17%). In lactating animals the population dynamics of ticks was significantly higher in underneath of the belly region near to udder. Among the infested farms, 47% of the farmers stated that milk yield reduction was there in the infected animals. Around 85% of the farmers had aware about tick infestation and among them 53% had seeking assistance from veterinary officers. Around 89% of the farmers practiced indigenous methods of controlling ticks such as fumigation with dry neem leaves and sandal and application of margosa oil. Therefore, need more attention of controlling the tick infestation in the study area is utmost important.

**Keywords:** infestation, prevalence, ticks

[19]

**MICROBIOLOGICAL QUALITY OF READY-TO-EAT MEAT BASED FOOD  
PRODUCTS AVAILABLE IN COLOMBO, SRI LANKA**

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***ABSTRACT***

The busy life style of urban people has increased the demand for ready-to-eat (RTE) foods. Alongside with the increase in consumption, there has been a growing concern on the microbiological quality and safety of such foods. The Center for Disease Control, USA, has identified ready-to-eat foods as the source of many recent foodborne outbreaks. Among such foods, nutrient-rich meat products are highly susceptible to microbial spoilage. Therefore, 22 meat based food samples periodically taken from two outlets in Colombo were analyzed for microbiological quality. The samples were identified as two categories: category 1 (Totally cooked meat with no added fresh salads/sauces) and category 2 (totally cooked meat with added fresh salads/sauces when serving). All tests were carried out according to the standards issued by the Sri Lanka Standards Institute. Results were analyzed following the microbiological guidelines imposed by NSW Food Authority (2009). Accordingly, 60% of the samples had Aerobic Plate Counts at unacceptable levels for consumption. 27% of the samples exceeded the limits recommended for total Coliforms, while 40% exceeded the limits for Faecal Coliforms and 31% exceeded the Escherichia coli limits. Salmonella spp. and Staphylococcus aureus were detected in several samples of both categories of food. Based on that, the majority of the tested samples did not comply with the required standards, implying a potential public health hazard. Good Manufacturing Practices are needed to be put in place to rectify the problem. This survey discloses the importance of introducing a microbiological guideline for ready-to-eat foods in Sri Lanka.

**Keywords:** Ready-to-eat foods, meat, microbiological quality

[20]

**BIOSURFACTANT PROCESS SYNTHESIS AND STABILIZATION OF SILVER NANOPARTICLES FOR MODIFIED PRESERVATION METHODS ON COMMON FERMENTED FOODS**

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**ABSTRACT**

A biosurfactant produced by *Pseudomonas aeruginosa* PBSC1 cultivated in a low-cost Cashew Apple Juice medium was employed to synthesize and stabilize silver nanoparticles in the liquid phase. The particles were initially synthesized using NaBH<sub>4</sub> as reducing agent in biosurfactant reverse micelles and were extracted from the micellar solution to disperse in heptane. A silver particle size in the range of 11 nm was observed. The UV–vis absorption spectra proposed that silver nanoparticles could be formed in the reverse micelles and relatively stabilized for at least 3 months without passivator addition. The Transmission Electron Microscope (TEM) shows that the silver nanoparticles are of spherical form and relatively uniform. This method provided a simpler way for nanoparticle synthesis compared to existing systems using whole organisms or partially purified biological extracts, showing that the low-cost biosurfactant can be used for nanoparticle synthesis as a non-toxic and biodegradable stabilizing agent. Thus synthesized silver nano particles along with bacteriocin found to be very effective antimicrobial agent against food spoiling organisms such as *Micrococcus luteus*, *Bacillus cereus*, *Staphylococcus aureus*, *Pediococcus* spp. and *Escherichia coli*. Antimicrobial activity of the silver nano particles and bacteriocin combination made a modification in the preservation methods in fermented foods such as pickled cucumbers, pickled beets and Sauerkraut. This study proved effective control and preservation of the selected common fermented foods. This modified method in food preservation not only improves the quality of fermented foods but also satisfy consumers.

**Keywords:** *Pseudomonas aeruginosa*, Cashew Apple Juice, rhamnolipid, silver nanoparticles, bacteriocin, food preservation

[21]

**KEY ISSUES IN APPLICATION OF COMMUNITY USE ZONE (CUZ) TO  
CROCKER RANGE PARK FROM THE PERSPECTIVE OF SOCIAL WORK**

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***ABSTRACT***

Throughout the world including Malaysia, parks and protected areas are commonly managed by strict top-down enactments that marginalize local people. This often has resulted in recurrent conflict between park management and communities living in and around these areas. To tackle the problem, Sabah parks in collaboration with Borneo Biodiversity and Ecosystems Conservation (BBEC) started implementing a program known as Community Use Zone (CUZ). The major aim of this program is to harmonize situation between Crocker Range Park (CRP) authority and the communities residing in CRP by balancing existing local community needs and conservation through participation and collaboration. The objective of this research is to assess implementation process of CUZ program in its two years span by using thematic analysis of data obtained through interviewing relevant stakeholders, i.e., communities and park management. The result indicated that land use issue, such as different perspective by CUZ community and parks management regarding restriction of planting and no cutting trees policy in CUZ areas, to be the most salient frustrating proper implementation of the program. This study hope more concerted effort by parks management and CUZ committee in conducting discussions regularly from the issues identified. This will be useful in designing future CUZ programs in other regions.

**Keywords:** Social work, community use zone, park conservation, Malaysia

[22]

**STUDIES ON PHENOLOGICAL BEHAVIOR OF TWO CASSIA SPECIES IN  
GIRNAR RESERVE FOREST, GUJARAT, INDIA**

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**ABSTRACT**

Phenological cycle of two tree species viz. *Cassia siamea* Lam and *Cassia fistula* L. was studied in Girnar Reserve Forest, Gujarat, India from August 2008 to August 2011. Both species varied with different phenological behavior in all four phenological events studied such as new foliage, leaf fall, flowering and fruiting by showing significant variation ( $P < 0.05$ ) in number of days. For *C. fistula*, mean new foliage, leaf fall, flowering and fruiting days were 43, 52, 103 and 107 but they were, 40, 162, 160 and 135, respectively for *C. siamea*. Among different morpho-phenological characters studied, positive significant association was recorded between diameter of stem and branches/tree ( $0.84^{**}$ ), flowers/branch and inflorescence/branch ( $0.91^{**}$ ) for *C. fistula*. However, in *C. siamea*, positive correlations were recorded between inflorescence/branch and flowers/branch ( $0.93^{**}$ ). Interestingly, there were negative correlations found between leaves/branch and inflorescence/branch ( $-0.55^*$ ), also between leaves/branch and flowers/branch ( $-0.54^*$ ) for the same species. Climatic factors affected phenology of both species by showing direct association. In *C. fistula*, wind speed showed positive association with inflorescence/branch ( $0.59^*$ ), and with flowers/branch ( $0.56^*$ ) whereas, rain pertained positive correlation with fruits/branch ( $0.64^*$ ). In case of *C. siamea*, positive correlation was observed between wind speed and fruits/branch ( $0.49^*$ ) as well as between rain and fruits/branch ( $0.74^*$ ). This kind of work can be highly useful in understanding adaptation mechanisms of plant species; can also be of immense use for different branches such as physiology, ecology and forestry.

**Keywords:** Phenology, Morpho-phenological traits, Climatic factors, Girnar Reserve Forest



[23]

**IN VITRO PROPAGATION OF TEAK (TECTONA GRANDIS. L)**M.L.W.O.M. Karunaratne<sup>1</sup>, A.M.N.S. Atapattu<sup>2</sup>, S.E. Peiris<sup>2</sup> and W.C.P. Egodawatta<sup>1</sup>

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**ABSTRACT**

*Tectona grandis* L. is well known for its high quality timber and has ever-increasing demand for its mellow colour, fine grain and durability. Micro-propagation of teak was attempted in this study with shoot tip and axillary buds collected from stumps and mature trees as explants. Nodal explants from field grown trees, which were sterilized with 10% Clorox™ for 20 minutes followed by dipping 10 minutes in 0.1% Bavistin™ cultured on 0.05% Bavistin included medium produced 96% vital explants. Keeping excised explants in running tap water for one hour and dipping in mixture of 1.5% each citric acid and ascorbic acid reduced browning to 5%. MS (Murashige and Skoog) medium was found to be the superior to Woody Plant Medium (WPM), White's, 1/2MS and Gamorg (B<sub>5</sub>) media for shoot establishment. In vitro establishment was successful with low contamination, browning and high number of shoots with 1.5mg /l BAP with 0.5 mg/l GA<sub>3</sub> in MS medium. The best shoot multiplication was on MS medium supplemented with 9 mg/L BAP with 2mg/L KN (5 shoots) among 16 treatment combinations. Both the maximum number of roots (10) and root length (1.6 cm) were showed on ½ MS medium supplemented with 5mg/L IBA and 2 g/l charcoal. Roots were initiated on 75% of the cultured shoots with the above treatment. Rooted shoots were acclimatized successfully.

**Keywords:** BAP, browning, contamination, kinetin, *Tectona grandis*

[24]

**POST FIRE EFFECT ON THE PHYSICOCHEMICAL PROPERTIES OF OWERRI -  
WEST COASTAL PLAIN SOIL**

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***ABSTRACT***

The use of fire in the management of vegetative cover is a common agronomic practice in the South-eastern Nigeria. This portends ecological implications the sustainability of the rain forest vegetation as a system. This research work was established to estimate the physicochemical properties of Owerri - West coastal plain soil affected by bush burning system. The experimental treatments consist of two different burning frequencies that include area/ plot severally affected by fire and area/plot partially affected by fire with control on area/plot unaffected by fire. The physical impacts of fire on soil include breakdown in soil structure, reduced soil moisture retention and capacity and development of water repellence, all of which increase susceptibility to erosion. Chemically, burning significantly affect the surface soil concentration of total nitrogen, organic carbon and organic matter content, exchangeable K,Ca,Mg and Na as well as Soil pH which increases in the short run. It was also observed the reduction of vegetative cover biomass with abundant ash deposit on the affected soils which disrupts the activities soil micro and macro fauna.

**Keywords:** Post fire effect, vegetative cover, physicochemical properties, Owerri - west coastal plain soil

[25]

**ASSESSMENT OF THE VARIABILITY OF YIELD OF MAIZE IN LILONGWE DISTRICT (MALAWI) IN RESPONSE TO CLIMATE CHANGE USING DSSAT MODEL**

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***ABSTRACT***

The study generates information on seasonal rainfall characteristics that will be vital in exploiting the possibilities offered by climatic variability and offers opportunities for adapting to seasonal distribution to improve and stabilize maize crop yields. The need to generate agronomically relevant seasonal rainfall and temperature characteristics to guide decision making, for instance, in terms of adaptation and mitigation strategies in agriculture. DSSAT model was used to run the crop simulations for the cropping season of 1996/1997 to 2007/2008 for growth, development and yields of hybrid maize at Chitedze Research Station, and to assess which agronomic management practices can help adapt to climate change. The DSSAT model was used to provide information concerning management options such as the timing of planting, specifically the impact on the yield with reference to different planting dates at Chitedze Research Station in Malawi. The results showed that planting maize early December increases yield than late and early November, late December; late and early January for Chitedze, with Index of Agreement of 0.861 (d-stat) which signifies the closeness of the relationship between the observed and the simulated yield, also the efficiency of DSSAT model to simulate yield with little root mean square of error (220.69 kg/ha),  $R^2=0.770$ , mean difference of  $-143.41$  kg/ha. The mean observed maize yield was 1,350 kg/ha and the mean simulated being 1,206.59 kg/ha through regression analysis they are positively correlated. Planting date is directly related to the yield of maize with reference to rainfall received with minimal variability. Maize yield depends upon the amount and frequency of rainfall as well as its distribution on temporal and spatial scales, especially the reproductive and the vegetative phases which are prone to rainfall variability.

**Keywords:** Crop model, planting dates, maize yield

[26]

**LOCAL CLIMATE KNOWLEDGE IN THE CROPS OF ONION (*ALLIUM CEPA* L.)  
IN THE CENTRAL ANDEAN REGION OF ECUADOR**

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***ABSTRACT***

Changes in market prices, the presence of new diseases in crops in a changing climate is affecting the Andean agriculture and market supply. The study was conducted in Tungurahua Province, South Western area, characterized by its tradition in crops onion bulb, ago 40 years. Since farmers rely on their traditional knowledge rather than weather reports, the aim was to analyze the local climate knowledge of farmers in crops of onions. For which it geo-reference 140 crops in all territory, were selected 50 people of 4 rural communities and were interviewed with open and closed questions. Descriptive and inferential statistics were used. The results show that local knowledge of rain, hailstorm, drought and frost, this relates with the data from the meteorological station. The 70% of farmers are able to predict rainfall by observing clouds groups; the gender analysis revealed that women have more skill than men. Between 1986 and 2014 the temperature increases, this would have affected the advance of crops to higher ground, were found crops from 3053 up to 3526 mamsl. Depending on the periods of planting and harvesting 3 groups of farmers were highlights G2 (42%). It's concluded that for strengthening onion production should be considered climatic cycles, disease resistant varieties, and imports.

**Keywords:** ethnomethodology, onion crop, climate change, peasants

[27]

## IMPACT OF LONG TERM RAINFALL ON PADDY YIELD IN BATTICALOA DISTRICT

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### ABSTRACT

With the advent of rapid developmental activities in the Eastern province of Sri Lanka in the post-war scenario, the government's mandates focus on reviving plans for the agricultural sector to meet the growing demands of the nation. This paper deals with multiple time series statistical modelling of Paddy Production in Batticaloa of Sri Lanka. Ann Leaker (1984) discussed the using of time series technique Auto Regressive Integrated Moving Average (ARIMA) forecasting model for forecasting agriculture product. The time series statistical technique ARIMA model procedure analyzes the paddy production data in Batticaloa district of Sri Lanka. There are a number of factors which influence the production levels of paddy but the significant relationship exist between annual Paddy production and rainfall in both *Maha* and *Yala* seasons. ARIMAX models have been built for paddy production with the covariate as rainfall for each season *Maha* and *Yala* in this district. To assess the effectiveness of these models, we used 32 years of time series records for annual paddy data and monthly rainfall of this district from 1979 to 2011 and validate the model using from 2012 to 2014. The validity of the model is verified with various model selection criteria such as Adj R<sup>2</sup>, minimum of AIC and SBC lowest MAPE values. The following ARIMAX models have been found as appropriate model for this district for both seasons. The Statistical model for Paddy production with input Rainfall data in *Maha* season is

$$(1-B)Mprd_t = \mu + (1-\theta B)Mrfl_t + \frac{1}{(1-\phi B)} a_t$$

Where B is the backshift operator, Mprdt is Paddy production in Maha season,  $\mu = 1.34$ ,  $\theta = 0.821$ ,  $\phi = -0.6742$  and MRflt is Rainfall in Maha season and  $a_t$  is the independent disturbance, also called the random error. The Statistical model for Paddy production with input Rainfall data in *Yala* season is

$$(1-B)Yprd_t = \mu + \frac{(1-\theta_1 B)}{(1-\phi_1 B)} Yrfl_t + \frac{(1-\theta_2 B)1}{(1-\phi_2 B)} a_t$$

Where B is the backshift operator, Yprdt is Paddy production in Yala season,  $\mu = 0.95$ ,  $\theta_1 = 0.22$ ,  $\phi_1 = -0.674$ ,  $\theta_2 = 0.89$  and  $\phi_2 = 0.39$ . YRflt is Rainfall in Yala season and  $a_t$  is the random error.

**Keywords:** ARIMA, ARIMAX, auto regressive

[28]

**NATURAL RUBBER PRICE FORECASTING USING SIMULTANEOUS SUPPLY-  
DEMAND AND PRICE SYSTEM EQUATION AND VECM MODEL: BETWEEN  
THEORY AND REALITY**

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**ABSTRACT**

Malaysia is the third largest producer of natural rubber (NR) in the world. NR price fluctuations become the world debt crisis and global economic slowdown with rubber price-related factors. Meanwhile, most of buyers in China were unwilling to commit themselves due to falling prices and uncertainties of market. In these situations, NR price forecasts are necessary to help in decision-making. The objectives of the study were conducted to investigate the inter-relationships between production, consumption and prices in the Malaysian NR market, to explore a simultaneous supply-demand and price system equation model compared with Vector Error Correction Method (VECM) model between theory and reality of the current market situation, to forecast a short term (ex-post forecast) and long term NR future price (ex-ante forecast) and to make recommendation this study is more efficient and wider applicability in the future. The price forecasting models will be utilized using quarterly data from 1990 Q1 to 2013 Q with providing a total of 96 observations and will be carried out for the period of 2013 Q1 to 2013 Q4 on the short-term and until to 2020 Q1 to 2020 Q4 on the long-term investment decisions. As such, an accurate estimation method of NR price forecasting is vital, to help in the decision-making process of economic planning for the NR sustainable production and the world market economy as well.

**Keywords:** Natural rubber, forecasting, supply-demand and price, VECM, Malaysia

[29]

**EVALUATION OF CONSERVATION TILLAGE ALONG WITH THE  
APPLICATION OF GLYPHOSATE VIS-À-VIS CONVENTIONAL TILLAGE IN  
RICE – PULSE CROPPING SYSTEM IN LOW LAND AREAS OF CAUVERY  
DELTA**

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***ABSTRACT***

Field experiments were carried out in the Department of Agronomy, Faculty of Agriculture, Annamalai University, Tamil Nadu to evaluate the conservation tillage along with the application of glyphosate vis-à-vis conventional tillage in rice – pulse cropping system in low land areas of Cauvery delta. The experiments were laid out in Randomised Block Design with seven treatments. Results of the field experiments conducted in all the three years revealed that conservation tillage (two ploughings) + pre – planting application of glyphosate at 1.02 kg/ha + butachlor at 1.25 kg/ha at 3 DAT (T<sub>3</sub>) was significantly superior to other treatments by way of resulting maximum values of growth and yield components. This treatment was significantly superior to the conventional tillage with twice hand weeding at 20 and 40 DAT (T<sub>7</sub>) as now practiced by farmers, by recording an additional grain yield of 450, 690 and 640 kg/ha in first, second and third year, respectively. This treatment also resulted in higher net income and return per rupee invested and it also resulted in significant reduction in population and biomass of all types of weeds (grasses, sedges and broadleaved weeds) with a higher WCE. Treatment, T<sub>7</sub> (Conventional tillage (farmers' practice) with twice hand weeding at 20 and 40 DAT) was the next in order of magnitude.

**Keywords:** Weed, rice, glyposate, conventional and conservation tillage

[30]

**EFFECT OF WEED MANAGEMENT PRACTICES IN CONVENTIONAL AND  
MECHANICAL PLANTING OF TRANSPLANTED RICE**

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**ABSTRACT**

Transplanting is the major method of establishment and it requires more labour about 250-300 man hrs/ha. Lower plant population unit/area, a higher percentage of missing plants, uneven transplantation in paddy fields and high wages of labour are the major problem. Under such circumstances a less expensive and labour saving method of rice transplanting is the urgent need of the hour. This promoted to mechanized planting of rice, is gaining importance among the rice farmers. Weeds are considered to be one of the foremost limiting factors due to manifold harmful effects. In India, the yield losses due to season long weed competition in transplanted rice have been put on a range of 12 to as high as 69.5%. Consequently, keeping in view of these perspectives, the present experiment was conducted at Pinnalur and ThambiPettai villages of Tamil Nadu, India to find out an efficient method of planting and weed management practices in transplanted rice with cv. BPT 5204 in Samba and Kuruvai season. The experiments were laid out in split plot design with three replications. The study revealed that M<sub>2</sub>S<sub>6</sub> – Mechanical planting method and application of metsulfuron-methyl + chlorimuron-ethyl and 2,4-D significantly recorded the higher grain yield of 5.23 and 5.41 t/ha in Samba and Kuruvai seasons, respectively. The same treatment resulted with the higher net return of Rs. 40,783 and 37,902 and return/rupee invested of 2.59 and 2.53 in both the seasons, respectively.

**Keywords:** Weed, rice, mechanical and conventional transplanting



[31]

## EFFECT OF CROP ESTABLISHMENT METHODS AND WEED MANAGEMENT FOR IRRIGATED REDGRAM

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### ABSTRACT

A field experiment was conducted at Experimental Farm, Faculty of Agriculture, Annamalai University, Annamalai Nagar, to study the effect of weed management practices and crop establishment methods for irrigated redgram grown in clayey soil during 2014. The experiment was laid out in split plot design with three replications. The treatments were comprised of two crop establishment methods viz., transplanting and direct sown, were assigned to main plot. In sub plot, pre-emergence application of herbicides viz., Alachlor 1.0 kg/ha and pendimethalin 1.0 kg/ha followed by post-emergence application of herbicide, each in combination with one hand weeding on 40 DAS and Imazethapyr 1.0 kg/ha were compared with two hand weeding and unweeded control. The important weed floras of the experimental field were *Echinochola colonum*, *E. crusgalli*, *Panicum flavidum*, *Leptochola chinesis* among grasses, *Cyperus rotundas* among sedges, *Phyllanthus niruri*, *Moschosma polystachym* among BLW (broad leaved weeds). Higher seed yield (1,025 kg/ha) was recorded with transplanted redgram which was significantly higher over direct sown method. The seed yield was higher with application of pendimethalin 1.0 kg/ha followed by hand weeding was superior than other treatments. Transplanted redgram with application of pendimethalin followed by HW on 40 DAS controlled weed density (28.1 number/m<sup>2</sup>), weed dry weight (18.1 g/m<sup>2</sup>), recorded higher weed control efficiency (84.1) and produced an increased seed yield (1,230 kg/ha) and fetched higher revenue (Rs. 40,665/ha).

**Keywords:** Redgram, transplanting, direct sown, weed and herbicide

[32]

**POTATO PRODUCTION UNDER BRACKISH WATER AND COMPOST USE**

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*Department of Plant Production and Protection, Al-Balqa Applied University, Jordan***ABSTRACT**

Potato yield reduction and soil salt accumulation are the main obstacles of using brackish water in irrigation. This study was carried out at Al- Balqa Applied University research station, to investigate the impact of compost use on potato production and salt accumulation in the soil under brackish water, during 2014 growing season. Whole tubers of three imported potato cultivars (Spunta, Faluka and Ammbetion) were planted in pots with different soil and compost percentages (0, 20, 40, 60, 80, and 100%) and were irrigated with three water salinity levels (1.25, 5 and 10 ds/cm). A split-split plot design was used, where potato cultivars were arranged in the main plots, the brackish water treatments were in the sub-main and the soil amended treatments were in the sub-sub plots. Potato yield was generally, decreased only when pots were irrigated by water of 10 ds/cm salinity compared with 1.25 and 5 ds/cm. Drainage water salinity, however, was increased as compost percentage increased. Nevertheless, salt accumulation in the growing media was decreased as the compost percentage level increased. Therefore, it can be concluded that brackish water, up to 5 ds/cm can be used to irrigate potato especially, when organic amendments were added to the soil to promote plant growth, yield and reduce salt accumulation.

**Keywords:** potato, brackish water, compost, salt accumulation

[33]

**ALLEVIATION OF CHROMIUM TOXICITY IN CHICKPEA (*CICER ARIETINUM*  
L.) THROUGH EXOGENOUS APPLICATION OF SALICYLIC ACID**

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**ABSTRACT**

Role of exogenous application of salicylic acid (SA) under chromium stress in two chickpea cultivars were investigated in hydroponic experiment with five treatments comprising of control, 5  $\mu$ M Cr + 5 mM SA, 5  $\mu$ M Cr + 10 mM SA, 10  $\mu$ M Cr + 5 mM SA and 10  $\mu$ M Cr + 10 mM SA. Results revealed that treatments of plants with 10 mM SA application under both 5  $\mu$ M Cr and 10  $\mu$ M Cr stress resulted in maximum improvement in plant morphological attributes (root and shoot length, root and shoot fresh and dry weight, membrane stability index and relative water contents) relative to 5 mM SA application in both chickpea varieties. Results regarding Cr concentration showed that Cr was more retained in roots followed by shoots and maximum reduction in Cr uptake was observed at 10 mM SA application. Chickpea variety BRC-61 showed maximum growth and least concentration of Cr in root and shoot relative to BRC-390 variety.

**Keywords:** Chromium, salicylic acid, chickpea

[34]

**INFLUENCE OF SUPPLEMENTARY ILLUMINATION FOR GREENHOUSE  
GHERKINS TO REDUCE THE PRE-MATURE FRUIT DROP AND TO INCREASE  
GRADE-1FRUIT YIELD**

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**ABSTRACT**

Gherkin (*Cucumis sativus*) industry experiences a problem of greater pre-mature fruit drop, resulting lower crop production, hence this research was undertaken to investigate the influence of supplementary illumination for greenhouse gherkins to reduce the pre-mature fruit drop and to increase Grade-1 fruit yield. This study was conducted at a commercial production greenhouse in the Low Country Wet Zone during September to November, 2014 (Maha season). Four treatments were applied 3 weeks after sowing (WAS); T<sub>1</sub> (supplementary lighting to extend day length during 5.00 - 7.00 a.m. and 5.00 - 7.00 p.m. using LEDs (light-emitting diode), T<sub>2</sub> (supplementary lighting under rainy/cloudy weather in between 7.00 a.m. and 5.00 p.m.), T<sub>3</sub> (supplementary lighting to extend day length during 5.00 - 7.00 a.m. and 5.00 - 7.00 p.m. using combination of fluorescent lamps and incandescent lamps at the ratio of 2:1) and T<sub>4</sub> (without supplementary lighting). The research was laid out as a Complete Randomized Design (CRD) with three replicates, assigning 20 plants per each experimental plot. Results revealed that fruit drop in T<sub>1</sub> (109 fruits/plant), T<sub>2</sub> (105 fruits/plant) and T<sub>3</sub> (111 fruits/pant) has significantly reduced through supplementary lighting when compared to the control (159 fruits/plant). However, no significant differences were observed among the supplementary lighting treatments related to fruit drop. Grade-1 fruit yield was significantly ( $P \leq 0.05$ ) greater in T<sub>2</sub> (885.3 g/plant) as a result of increased overall fruit yield (993.3 g/plant) and reduced fruit drop, compared to that of T<sub>1</sub> (747.5 g/plant) and T<sub>3</sub> (709.4 g/plant). Given T<sub>2</sub> was more cost effective than T<sub>1</sub>. I conclude T<sub>2</sub> as the most appropriate solution to address the pre-mature fruit drop as well as to increase Grade-1 fruit yield of greenhouse gherkin cultivation in the low country wet zone of Sri Lanka.

**Keywords:** Fruit drop; Gherkin; grade-1 yield; greenhouse; supplementary lighting

[35]

**INFLUENCE OF SELECTED PADDY VARIETIES ON CHALCIDID  
(HYMENOPTERA: CHALCIDOIDEA) PARASITOID POPULATION**

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***ABSTRACT***

Studies were conducted from December 2012 to Feb 2014 to assess the possible role of paddy varieties on the chalcid parasitoid population at Department of Entomology, Faculty of Agriculture, Annamalai University, Chidambaram, Tamil Nadu, India. The paddy varieties tested were ADT 43, CR 1009, CO 43 and Basmati 370 checked from the possible role. Chalcid parasitoids were recovered from paddy field mainly by yellow pan trap, net sweep and malaise trap. Results revealed a total of 541 Chalcids, of which 142 numbers belonged to Chalcidids, 195 to Mymarids, 72 to Eulophids, 34 to Trichogrammatids, 23 to Aphelinids, 43 to Encyrtids and 32 to Eupelmids. Out of the Chalcidid pupal parasitoids recovered [representing eight genera Viz., Brachymeria (11), Antrocephalus (14), Hockeria (82), Dirhinus (9), Proconura (5), Kriechbaumerella (4) Epitranus (10) and Tainaniella (1)] 38 were from basmati 370, 37 from CR 1009, 34 from CO 43 and 33 from ADT 43. This indicated that the various rice varieties tested did not show any significant effect in the population of Chalcidid parasitoids recovered.

**Keywords:** Parasitoids, Chalcididae, Paddy

[36]

**MORPHOLOGICAL AND PATHOGENIC VARIATIONS OF *COLLETOTRICHUM* AND *FUSARIUM* ISOLATES RESPONSIBLE FOR LEAF TWISTER DISEASE OF ONION IN TRINCOMALEE DISTRICT, SRI LANKA**

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**ABSTRACT**

The present study was aimed to determine morphological and pathogenic variations among *Colletotrichum* and *Fusarium* isolates, the causal organisms of Leaf Twister Disease (LTD). Fungal isolates obtained from LTD-infected onions, collected from 4 locations of Trincomalee district, Sri Lanka were studied for colony characters, spore dimensions, colony growth rate and fungicide sensitivity both in vitro and in vivo, to determine morphological variations of fungal isolates. Pathogenic variations of the fungal isolates in terms of pathogenicity and virulence were determined by in vivo inoculation assays using red onion (variety Vethalan). Morphologically-different 4 isolates of *Colletotrichum* and 10 isolates of *Fusarium* were collected from different farmer fields of Trincomalee district. Colony growth rate and in vivo sensitivity to Homai (Thiophanate-methyl 50% +Thiram 30% WP) fungicide were highly variable among the tested isolates of *Colletotrichum* and *Fusarium*. Virulence of the *Colletotrichum* and *Fusarium* varied significantly among the isolates in terms of rapidity and extent of disease spread. Variety Vethalan was not completely resistant against any isolate of the two fungal genera tested.

**Keywords:** morphological variation, virulency, *Colletotrichum* spp., *Fusarium* spp., leaf twister disease, onion

[37]

**ORIENTATIONAL EFFECT OF AQUEOUS LEAF EXTRACT OF *CITRUS AURANTIFOLIA* (LIME) ON HOUSEFLY, *MUSCA DOMESTICA* (DIPTERA:MUSCIDAE)**

NithiyagowryRajan

*Department of Zoology, University of Jaffna, Jaffna, Sri Lanka***ABSTRACT**

Housefly, *Musca domestica* (L.) is a major public health pest act as vector for human and animal disease causing organisms therefore the control of housefly is vital to human health. Products obtained from certain medicinal plants have proved as alternatives to synthetic chemicals. In this view the present study was aimed to study the repellent activity of aqueous leaf extract of *Citrus aurantifolia* (lime) in comparison with neem leaf extract and additive Turmeric rhizome powder using self made six-armed olfactometer. Five gram of meat pieces soaked separately for one minute in 1:10 (w/v) aqueous citrus leaf extract (aq.CLE), 1:10 (w/v) aqueous neem leaf extract (aq.NLE), 1:10 (w/v) aqueous turmeric rhizome powder (aq.TRP), mixture of 1:10 (w/v) [aq.CLE + aq.NLE], mixture of 1:10 (w/v) [aq.NLE + aq.CLE + aq.TRP] and one ml of distilled water for control and were tested for repellent activity against 1-2 days old adult flies based on the number of adults oriented towards each treatment. Orientation of housefly towards extracts was significantly less in numbers ( $P < 0.05$ ) in all treatments than the water control after 10 – 60 minutes and 24 hours of adult exposure. From the LSD analysis, Aq.CLE showed significantly ( $P < 0.05$ ) high repellent activity as much as Aq.NLE, mixture of Aq.NLE+Aq.CLE and mixture of Aq.NLE+Aq.CLE +AqTRP after one hour and 24 hours of exposure. After 24 hours of exposure, the percentage repellency range from 74 % (for TRP) to 96 % (for mixture of CLE+NLE+TRP). Citrus leaf extract alone showed 83% repellency. It was concluded that the aqueous citrus leaf extract at 1:10 (w/v) has potential repellent effect against house fly and could be considered for integration with other control options in the control of housefly and also pave the way for its use as eco friendly control measure.

**Keywords:** Housefly, *Musca domestica*, *Citrus aurantifolia*, neem, repellent, orientation

[38]

**STUDIES ON ANTIBIOSIS RESISTANCE OF OKRA ACCESSIONS AGAINST  
SHOOT AND FRUIT BORER *EARIAS VITTELLA* (FAB.)**

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**ABSTRACT**

Okra (*Abelmoschus esculentus* (L.) Moench), is an important vegetable crop grown in India. Okra is mainly grown for its young immature fruits and consumed as a vegetable. One of the important limiting factors in the cultivation of okra is insect pests. The spotted bollworms are the most dreaded pests causing serious turn down of the produce in terms of quality as well as quantity. Control measures commonly used against insect pests in horticultural crops mainly on the use of pesticides, but these products is often toxic to the environment and to non-target species. Consequently, there is a general opinion that the best way to solve the pest problem is utilization of resistant plants has long been considered as one of the most effective components of IPM. Keeping this in mind, the present study was undertaken to analysis the antibiosis resistance of okra accessions against shoot and fruit borer *Earias vittella* (Fab.). Antibiosis studies were conducted in the laboratory on each accession. The experiments were conducted under controlled conditions of temperature viz.,  $27 \pm 2^{\circ}\text{c}$  and relative humidity 75-85 percent. Among the accessions, AC 3 found minimum larval duration (17.60 days), lowest larval weight (0.032 mg), higher larval mortality (70%), lowest pupal weight (0.042 mg) and lowest adult emergence (40%) were recorded. There was no larval mortality (0%) and 100% adult emergences were recorded on the accession AC 6. Therefore, cultivation of Accession 3 will be the best choice to decrease *E. vittella* problem for the better production of okra.

**Keywords:** Okra accessions, antibiosis resistance, *Earias vittella*



[39]

**A POTENTIAL BIOSURFACTANT MEDIATED CONTROL OF FUSARIUM WILT  
IN TOMATO CROP AND A NOVEL METHOD FOR CLEANING PESTICIDE  
RESIDUES IN TOMATOES**

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**ABSTRACT**

The biosurfactant produced by *Serratia rubidaea* SNAU02 (NCBI accession number KC560769, has rhl gene KF 835609) was isolated from hydrocarbon-contaminated soils of Cuddalore district, Tamilnadu, India. The molecular characterization of the biosurfactant revealed the presence of rhamnolipid. The strain exhibited antifungal activity and demonstrated no toxicity against the seeds of *Brassica oleracea* and *Artemia salina* employed as a bio-indicator. The concentration of 250 µg/ml biosurfactant application controlled the Fusarium wilt of tomato crop. The feasibility of pesticide residues cleaning in tomatoes was studied five times using HPLC analysis. One kg of each tomato was treated with the 100 ppm of Monocrotophos solution and allowed to stand for 24 hours. After that, the tomatoes were collected and air dried for 1 hour. Further, the tomatoes were soaked for 30 minutes in the following treatments, T<sub>1</sub> (1000 ml distilled water), T<sub>2</sub> (1,000 ml luke warm water), T<sub>3</sub> (2% NaCl<sub>2</sub> in 1,000 ml of distilled water), T<sub>4</sub> (2% NaCl<sub>2</sub> in 1,000 ml of luke warm) and T<sub>5</sub> (10 mg biosurfactant in 1,000 ml distilled water), respectively. Followed that the tomatoes were carefully washed with 100 ml of double distilled water and the washings were then collected and subjected to UV/Vis detector HPLC analysis. The treatment washings revealed that, there was no change in peak observation for T<sub>1</sub> and T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>. Whereas, T<sub>5</sub> showed three broad peaks with the retention time of 2.432, 2.784 and 2.955, respectively, which denote the cleanup of pesticide into intermediate products which may be non-toxic.

**Keywords:** *Serratia rubidaea*, rhamnolipid, biocontrol, *Fusarium* wilt, pesticide, tomato

[40]

**SULPHUR AND MICRONUTRIENTS (ZN & B) EFFECT ON COTTON GROWTH  
CHARACTERS, YIELD ATTRIBUTES, YIELD AND ECONOMICS**

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***ABSTRACT***

Cotton is one of the important fiber crops playing a key role in the economic and social affairs of the world, providing basic input to the textile industry. Poor agronomic management practices like imbalance and inadequate use of secondary, micronutrients, hormonal imbalance, pests and diseases infestation are some of the important reasons for low productivity. This study was conducted to determine the effect of S, Zn and B on growth characters, yield attributes, yield and economics of irrigated cotton. Field experiment was conducted at Experimental Farm, Department of Agronomy, Annamalai University, Chidambaram, Tamil Nadu, India. The experiments consisted of fifteen treatments and replicated thrice. The test crop was cotton cv. LRA 5166. The results revealed that, addition of 45 kg S + 10 kg Zn + 1.0 kg B/ha (T<sub>15</sub>) recorded the maximum growth, yield and quality parameters. But 45 kg S + 5 kg Zn + 0.5 kg B/ha (T<sub>9</sub>) recorded the higher net return and return/rupee invested due to the prohibitive cost involved in excessive application of zinc and boron to T<sub>15</sub> treatment.

**Keywords:** Sulphur, zinc, boron and cotton

[41]

## WEED MANURE AS AN ALTERNATIVE SOURCES TO CHEMICAL NITROGEN FOR SUSTAINED PRODUCTIVITY IN RICE

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### ABSTRACT

*Parthenium hysterophorus* and *Eichhornia crassipes* are obnoxious weeds. *Parthenium* is found in all types of land, whereas water hyacinth is found in aquatic ecosystems and also in low land rice field. Effective controls of these weeds are a major problem which harbours labour cost and other inputs too. The alternative use of these weeds would be as organic manure source of plant nutrient. The prerequisite for a sustainable agriculture is the balanced supply of plant nutrients through integrated nutrient management approach, which involves the use of high value organic manures along with inorganic nutrients for increasing the crop yield. Hence, field experiment was conducted to study the utility of *Parthenium* and water hyacinth as a bio-nutrient source in rice cultivation. The experiment comprised of eight treatments and laid out in RBD with four replications. Among the treatments, integrated application of 50% RDN through fertilizer and 50% N through water hyacinth compost (T<sub>8</sub>) proved their excellence by registering higher growth, yield attributes and yield of transplanted rice. Remarkable improvement in economics of rice viz., gross return (₹84,758), net return (₹54,480) and return/rupee invested (2.80) were registered with the same treatment (T<sub>8</sub>). This was closely followed by integrated application of 50% RDN through fertilizer and 50% N through *parthenium* compost (T<sub>6</sub>). Based on the results of the present investigation, integrated application of 50% RDN through fertilizer and 50% N through water hyacinth compost proved its superiority in augmenting the yield and economics of rice.

**Keywords:** Water hyacinth, *Parthenium*, compost and rice

[42]

## INTEGRATED PLANT NUTRIENT SUPPLY SYSTEM FOR SUSTAINABILITY IN RICE-PULSE CROPPING SYSTEM

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### **ABSTRACT**

Rice is one of the most predominant and staple food crop that is being extensively cultivated and consumed all over the world and by more than two billion people in Asia. Excessive use of inputs such as chemical fertilizers and pesticides in the intensive rice bowls, will likely result in resource degradation and environmental pollution with adverse effects on human health. Therefore, it is envisaged that for sustainable agricultural production in the country, integrated plant nutrient supply system (IPNSS) appears to be more promising and such system would also reduce the cost of farming in addition to maintain the soil productivity, improving the ecosystem and ultimately resulting in improved soil-plant-health in a sustainable agricultural ecosystem. Keeping in view of the above facts the present study was proposed to develop a promising sustainable eco-friendly and economically viable IPNSS for rice-black gram cropping system. Field investigations were conducted to evaluate a sustainable, eco-friendly and economically viable integrated plant nutrient supply system for rice-black gram cropping system. The experiments were laid out in Randomised Block Design with seven treatments. The study revealed that application of organics in conjunction with inorganic N is a suitable and sustainable practice of integrated plant nutrient supply system (IPNSS) for rice- pulse cropping system. The reduction in inorganic nitrogen application to a tune of 50% and being substituted with remaining 50% as vermicompost was proved to be better in augmenting the production potentiality of rice-pulse cropping system.

**Keywords:**rice, black gram, vermicompost and cropping system

[43]

**AZORHIZOBIUM CAULINODANS ORS 571 – ASPERGILLUS SPP. BIOFILM AND NARINGENIN: A PERFECT COMBINATION FOR ACHIEVING THE FULL POTENTIAL OF VEGETATIVE GROWTH OF RICE WITH 50% REDUCTION OF UREA FERTILIZER**

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**ABSTRACT**

Multitudes of benefits are associated with the use of biofilms. A biofilm constructed between *Azorhizobium caulinodans* ORS 571 and *Aspergillus* spp. (AAB) had resulted in excellent rice root colonization in the presence of the flavonoid naringenin (Nar). This study aims at investigating the effects of this AAB/Nar combination on rice growth, under different levels of nitrogen fertilizer: 100% urea recommendation with no AAB/Nar, 75% urea & AAB/Nar (75% U<sup>AAB/Nar</sup>), 50% U<sup>AAB/Nar</sup>, 25% U<sup>AAB/Nar</sup>. Shoot height, root length, number of tillers per hill, shoot and root dry weights and chlorophyll content of leaves were compared on the 30day old plants and the data were statistically analysed using SAS version 9.0. Statistically significant increase at 5% probability level in chlorophyll content and root dry weight was observed in 75% U<sup>AAB/Nar</sup> revealing the possibility of gaining even higher vegetative growth than 100% urea. The 50% U<sup>AAB/Nar</sup> and 25% U<sup>AAB/Nar</sup> showed no significant difference in root dry weights making it equal to 100% urea application. There was no significant difference in the shoot heights between 100% urea and 75% U<sup>AAB/Nar</sup>. Shoot dry weight, root length and the number of tillers per hill had no significant difference between any of the treatments at 5% probability level, but numerically highest root lengths were obtained for 50% U<sup>AAB/Nar</sup> indicating the possibility of substituting AAB/Nar for 50% of urea. It can be concluded that, AAB/Nar is a perfect combination for enhanced vegetative growth in rice even with 50% reduction in fertilizer urea.

**Keywords:** Biofilm, bio-fertilizer, nitrogen fertilizer, rice, growth parameters

[44]

**INTERACTION EFFECT OF AM FUNGI AND SALT STRESS ON THE GROWTH  
OF CURCUMA LONGA L. GROWN UNDER GREEN HOUSE CONDITION**

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**ABSTRACT**

Arbuscular Mycorrhiza (AM) is a ubiquitous fungus which is associated with root system of higher plants. The distribution and abundance of AM fungi vary greatly among different sites including natural and manmade ecosystems. The AM fungal hyphae extend into the soil specifically penetrating into nutrient depletion zone and increased the effectiveness of mineral nutrients uptake. *Curcuma longa* L. is a herbaceous perennial plant belongs to the family: Zingiberaceae, commonly called as turmeric which is a native of South Asia particularly India. India is a leading producer and exporter of turmeric in the world. It is used as condiment, dye, drug and cosmetic in addition to its use in religious ceremonies. The present study dealt with the interactive effect of AM fungi and salt stress on the vegetative growth, nutrient mobilization and rhizome development of turmeric plants grown under green house condition. The study reported that the low concentration of sodium chloride does not affect the plant growth when they treated with AM fungi compared to control plants. Thus this AM fungi stimulated the salt tolerance in turmeric plants against the low concentrations of sodium chloride. The present study suggested that the application of AM fungi in agriculture field not only enhance the plant growth but also improve the soil structure and stability.

**Keywords:** AM fungi, turmeric, nutrient mobilization and salt stress

[45]

## **PRODUCTION POTENTIAL AND SOIL FERTILITY MANAGEMENT IN CASTOR BASED INTER CROPPING SYSTEM**

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### **ABSTRACT**

The need to increase food production is one of the major world problems, since land area under cultivation cannot be increased. Intercropping is one of the potential cropping systems to exploit the natural and artificial resources more efficiently and consequently increase productivity over space and time. Foliar fertilization to crop plants recorded significantly higher yield besides reducing the loss of nutrients and economizing the crop production under intensive farming. Hence, the present investigation was carried out to find out the possibility of intercropping of castor with grain and vegetable cowpea along with and without foliar application of Panchakavya. The experiment consisted of fourteen treatments i.e. sole crop of castor, grain and vegetable cowpea, additive series and paired row intercropping of castor with grain cowpea and vegetable cowpea with and without foliar application of Panchakavya at 3% at 30 and 45 days after sowing. The intercrops and foliar application of Panchakavya had significant influence on growth and yield of crops. The highest castor equivalent yield of 1,681 kg/ha and land equivalent ratio of 1.41 were registered with intercropping of grain cowpea with castor and foliar application of Panchakavya at 3% at 30 and 45 DAS. Intercropping of grain and vegetable cowpea in castor left a positive balance of major nutrients, whereas, sole castor and sole castor with foliar application of Panchakavya left a negative nutrient balance in soil. Based on the present investigation it can be concluded that growing of castor with grain cowpea under normal intercropping system along with foliar application of Panchakavya was found to be most viable and remunerative technology to augment the productivity and income of the rainfed small farmers without deteriorating soil health and environmental quality.

**Keywords:** Foliar nutrition, intercropping, castor and cowpea

[46]

**AN ANALYSIS OF "COMMUNITY PARTICIPATION" ADOPTED BY****COMMUNITY DEVELOPMENT PROJECT IN SRI LANKA:****A CASE STUDY ON RE-AWAKENING PROJECT**N.U. Senarathne<sup>1</sup>, D.M.N. Diyawadana<sup>2</sup>& S.I. Fernando<sup>2</sup>*<sup>1</sup>Postgraduate institute of Arts, University of Peradeniya, Peradeniya, Sri Lanka**<sup>2</sup>Postgraduate institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka***ABSTRACT**

Community participation is the most discussable topic in the rural and community development context in the recent period. Participation comes into play in development projects in identifying problems, planning, project implementing and monitoring & evaluation steps. However, incorporation of participation in development interventions has to be further examined. Reawakening project was one of the largest community development project conducted in Sri Lanka and Project aims to reduction poverty of selected villages. This study reviews the getting community participation in improving the effectiveness and the success of achieving the expected outcomes of the project. Data for the study was collected with PRA repots, progress reports, CBO documents and focused group discussions with community and project staff. Research findings indicate that community participation is taken in different steps of the project cycle in different forms and different levels. The projects is planned well to get the community participation in each steps for achieving the expected outcomes. In village level project activity planning, active participation of the community was gained adequately to identify the resource availability and to identify the poorest and vulnerable group. Implementation was mainly done through the Community based organization which is called "Village Development Organization (VDO)" with the guidance and technical support of the project. Finally the whole project has been handed over to the community. However, the project has faced difficulties in achieving the expected level of participation in implementing level due to the inability to get the required level of participation of youths and men. Further the project is perceived by the community as a money lending institute rather than a village development project. Therefore the introducing activities that fulfill the needs of every group in the community and prioritizing more on capacity development can improve the community participation and sustainability of the project.

**Keywords:** community participation, village development project, Community Based Organization



[47]

**THE EFFECTS OF MEXICAN SUNFLOWER (*TITHONIA DIVERSIFOLIA*)  
APPLICATION AND ARBUSCULAR MYCORRHIZAL FUNGI (AMF)  
INOCULATION ON GROWTH PERFORMANCE AND YIELD OF COTTON  
(*GOSSYPIUM HIRSUTUM*)**

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**ABSTRACT**

A pot experiment was conducted in Department of Agronomy, University of Ibadan to investigate the response of cotton to tithonia application as organic fertilizer and arbuscular mycorrhiza (AM) inoculation. The Experiment was a 2 x 2 x 2 x 2 factorial arrangement in a completely randomized design with three replicates. The treatment applied were: tithonia application (with and without); AM inoculation (with and without); soil type (topsoil and subsoil) and cotton varieties (Samcot 9 and Samcot 10). Inoculation with arbuscular mycorrhizal fungi and tithonia application significantly ( $p < 0.05$ ) increased the stem dry weights of the two varieties in both soil types (11.03 g respectively for samcot 9 and samcot 10 in the topsoil and 5.80 g and 3.20 g for samcot 10 and samcot 9 respectively in the subsoil) compared to non-inoculated and without tithonia application (control) with 7.80 g and 10.60 g for samcot 9 and samcot 10 respectively in topsoil and 1.73 g and 0.33 g for samcot 9 and samcot 10, respectively in subsoil. Tithonia application significantly improved the production of bolls in the two varieties of cotton. Samcot 9 ( $V_1$ ) with mycorrhiza and tithonia and  $V_1$  under tithonia without mycorrhiza inoculation had 6.73 g and 7.83 g respectively compared to (0 g) observed in treatment without tithonia application. Bolls were produced only in samcot 10 ( $V_2$ ) with mycorrhiza inoculation and tithonia application. Mycorrhiza and *Tithonia* improved the performance of cotton in both soils and therefore can be used for cotton production as well serve as amelioration of degraded soil.

**Keywords:** *Tithonia*, arbuscular mycorrhizal fungi, inoculation, cotton, soil

[48]

**POTENTIAL OF GOAT FARMING IN AMPARA DISTRICT OF SRI LANKA**

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**ABSTRACT**

Easy management, low cost of production and disease tolerance are the main advantages of goat farming over other livestock enterprises. Ampara district is a potential place for goat farming but the baseline data on the status of goat farming in Ampara is not available. These data are essential to implement any development projects in goat farming. In this context a study was formulated to evaluate the present status of goat farming and to identify the potentials to develop the goat farming in Ampara. One hundred and two goat farmers were randomly selected for this study. The interview was conducted by using a pre-tested questionnaire. The collected data were analyzed by using SPSS and MS Excel. The results revealed that women participation in goat farming was high in Tamil and Sinhala villages while men's participation was high in Muslim villages. Majority of the respondents were in 30-45 years age group and 57% respondents had completed secondary education. This attributes show good potential for goat farming. Majority of the farmers had a herd size between 11-20 goats. Eighty percent of farmers were practicing semi-intensive system. Jamunapari, Sannen, Kottukachiya and Sri Lankan Boer breeds were found in Ampara while 50% of farmers rearing cross breeds. Majority farmers were marketing their products through middlemen. There were several potentials found in Ampara district to improve goat farming such as human resource, traditional knowledge, suitable climate, feed sources, water sources etc. Modern techniques should be introduced to improve the goat production in Ampara district.

**Keywords:** Goat, Ampara, potential

[49]

## **EFFECT OF MODIFIED ATMOSPHERE PACKAGING ON THE POSTHARVEST QUALITY AND SHELF LIFE OF MATURE GREEN TOMATOES**

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### **ABSTRACT**

Tomato (*Lycopersicon esculentum*) is one of the most important supplementary sources of vitamins and minerals in human diet. Tomato is highly perishable and it encounters several postharvest problems during transportation, storage and marketing. Therefore, a study was undertaken to extend the shelf life of tomatoes using modified atmosphere packaging (MAP) which developed within sealed packs of plastic films with different gas permeability properties. Mature green tomatoes (cv.Thilina) were packaged in several plastic films and stored at 10 °C for 30 days. The films used were 20 μ polyethylene (PE), 20μ polyvinylchloride (PVC), 10 μ polypropylene (PP) and 20μ polystyrene (PS) compared with unwrapped tomatoes as a control. Changes in firmness, colour, soluble solids content, ascorbic acid, titratable acidity and sensory attributes were monitored during the storage period. In packs sealed with polyvinylchloride (PVC) film, an atmosphere containing 9-10% CO<sub>2</sub>+2-4% O<sub>2</sub> developed within 3–4 days at 10 °C. All unwrapped tomatoes were overripe and soft after 15 days of storage. In packs sealed with low permeable films such as PP and PS, have been found to contain over-modified atmospheres of 28–35% CO<sub>2</sub>+ < 1% O<sub>2</sub>, resulting in complete inhibition of ripening, a high incidence of rotting and tainting of the fruit. Tomatoes sealed within PVC and PP films had the lowest weight loss and the highest soluble solids following storage. Unwrapped tomatoes changed colour rapidly over the first 10 days whereas fruits sealed in plastic films changed colour more slowly especially those in PVC and in PS. Storage temperature and duration had significant influence on the ascorbic acid content of tomatoes. Tomatoes stored at 10 °C for 30 days in PVC packs and unwrapped fruits lost 6.7 and 11.7% of its ascorbic acid, respectively. Additionally, MAP slowed down the diminishing trend of titratable acidity and firmness in tomatoes. Among the tested films, best results were obtained in PVC packs and the tomatoes stored well for 30 days at 10 °C without any significant changes in the quality attributes.

**Keywords:** Cold storage, modified atmosphere packaging, quality characteristics, tomato

[50]

**EFFECT OF TEMPERATURE ON ANTIBACTERIAL ACTIVITY OF CINNAMON OIL AND CINNAMON POWDER AGAINST LISTERIA MONOCYTOGENES BY EMPLOYING INDIRECT CONDUCTIMETRY**

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**ABSTRACT**

Many incidences of food borne illness were recorded in fruit juices related to *Listeria monocytogenes*. Cinnamon oil and cinnamon powder apply as an antimicrobial compound to reduce the risk. The attempt was taken to evaluate the growth of *L. monocytogenes* under two temperature regimes by adding cinnamon oil and cinnamon powder. The growth rates of *L. monocytogenes* in tryptone soy broth plus yeast extract (TSBYE) were estimated using indirect conductimetry by Don Whitley RABIT system under 25 °C and 37 °C by adding cinnamon oil and cinnamon powder to the media. Concentrations 0.05%, 0.10% and 0.15% (v/v) cinnamon oil and 0.01%, 0.03% and 0.05% (w/v) ground cinnamon were added to TSBYE as treatments. Treated samples with inoculated *L. monocytogenes* were incubated for 48 hrs using Don Whitley RABIT system at 25 °C and 37 °C. Detection solution (KOH + 0.1% Agar) with conductivity more than 6000 µS was used throughout the investigation. Conductivity measurements of the detection solution were taken for every 6 mins and recorded by detection software. Results indicate cinnamon oil exerted significant effect on TSBYE media against *L. monocytogenes* in both 25 °C and 37 °C. Cinnamon oil has the ability to suppress the growth of *L. monocytogenes*. Growth suppression of *L. monocytogenes* was not observed from ground cinnamon in TSBYE at 25 °C and 37 °C.

**Keywords:** *Listeria monocytogenes*, indirect conductimetry, cinnamon oil, cinnamon powder

[51]

**IMPROVEMENT OF NUTRITIONAL AND SENSORY QUALITIES OF  
TRADITIONAL MAIZE PORRIDGE USING LOCALLY AVAILABLE PLANT  
SOURCES**

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***ABSTRACT***

Malnutrition is a major health burden in developing countries. Considerable efforts are needed to improve the health and nutritional status of the population by the development of nutritious foods with locally available materials. Therefore, a study was conducted to enhance the qualities of traditional maize porridge using germinated green gram (GG) and moringa leaves (ML). GG flour, in the amounts of 10, 20, 30 and 40 g and ML pieces as constant amount of 10 g were incorporated with maize flour (MF) for 100 g of porridge mixture. These formulated porridge mixtures were subjected to nutritional, microbial and sensory assessment. The nutritional analysis of the developed products revealed that protein, fiber and iron were increased from 10.43 to 20.71%, 1.87 to 3.08% and 0.94 to 4.92 mg%, respectively while moisture decreased from 3.51 to 3.03%, when increasing GG flour from 10 to 40%. Sensory assessment revealed that, there were significant differences between the treatments. Based on the quality characteristics, most preferred porridge mixtures were selected and subjected to storage studies in ambient condition of 30 °C and 70 – 75% RH. Quality assessments were carried out in two weeks interval throughout the storage period of 20 weeks. The results of storage studies revealed that, the declining trends in protein, fiber and iron and an increasing trend in moisture of the porridge mixtures. There was no total plate counts observed in the formulated porridge mixtures during storage. The results indicated that the porridge mixtures containing 70% MF, 20% GG flour and 10% ML could be stored for 20 weeks without any significant changes in the quality characteristics.

**Keywords:** Germinated green gram flour, iron enrichment, nutritional quality, porridge

[52]

**INCREASING THE YIELD OF ONION THROUGH IMPROVED PRODUCTION TECHNOLOGY IN KALABURAGI DISTRICT OF KARNATAKA**Raju, G.Teggelli<sup>1</sup>, Siddappa<sup>2</sup>, Zaheer Ahamad<sup>2</sup> and Anand Naik<sup>2</sup><sup>1</sup>*Programme co-ordinator, Krishi Vigyan Kendra, Kalaburagi-585101, Karnataka, India*<sup>2</sup>*Subject Matter Specialist (Horticulture, Plant Pathology and Soil science, respectively), Krishi Vigyan Kendra, Kalaburagi-585101 Karnataka, India***ABSTRACT**

Onion is extremely important vegetable crop not only for internal consumption but also as highest foreign exchange earner among the fruits and vegetables. Krishi Vigyan Kendra, Kalaburagi has made 60 demonstrations in farmers' field at different villages of Kalaburagi district during the period from 2009-10 to 2013-14 to enhance the yield of onion through improved production technology and sustainable development. The result showed that, on an average the highest yield achieved by adopting improved production technology was 247.10 quintals/ha whereas the corresponding yield ranges under farmers practices was to 202.60 quintals/ha of onion. Adoption of improved production technology will increase the yield 20.30% over farmer practices. The average technological gap, extension gap and technological index were noticed 196.66 quintals/ha, 44.6 quintals/ha and 43.54 % respectively. The economics of data indicated that an average of Rs. 2,26,437/ha was recorded net profit under recommended practices while it was Rs1,74,750/ha under farmer practices. Cost benefit ratio was 7.09 under demonstration, while was 5.79 under farmer practices. Practicing of improved production technology and sustainable development will improve the farmer socio-economical level and sustain the fertility of soil.

**Keywords:** Onion, technology gap, technology index, extension gap, economics

[53]

## INTER-RELATIONSHIP OF ENVIRONMENTAL AND MANAGEMENTAL PARAMETERS ON BULL SEMEN EVALUATION

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### **ABSTRACT**

Sri Lanka is being with the tropical and sub tropical nature and also the usage of cattle and buffalo for milk, meat and draught purpose is in an advance. Quality semen is the key indicator towards the successful breeding program. The present study was designed to identify the effect of environmental and management conditions on semen evaluation (volume, concentration, motility and production). Four stud bulls (Friesian, Sahiwal, AFS and Murrah) have been used at the Artificial Insemination Centre, Polonnaruwa, Sri Lanka. Semen from those stud bulls was collected twice per week using artificial vagina. Environmental temperature was ( $p < 0.05$ ) influenced with the relative humidity ( $r = 0.76$ ) and temperature humidity index ( $r = 0.76$ ). The mean volume (ml) of Friesian, Sahiwal, AFS and Murrah were  $4.1 \pm 0.87$ ,  $6.0 \pm 1.78$ ,  $8.3 \pm 1.96$  and  $4.5 \pm 2.09$ , respectively. Mass motility of the fresh semen was  $83.2 \pm 2.5\%$ ,  $80.5 \pm 1.46\%$ , and  $80.3 \pm 1.28\%$  and  $80.0 \pm 0.00\%$  for Friesian, Sahiwal, AFS and Murrah, respectively. The mean value of semen concentration was 1785.3, 1411.5, 438.1 and 735.0 million/ml for Friesian, Sahiwal, AFS and Murrah, respectively. The production performance of Friesian, Sahiwal, AFS and Murrah reached 183.8 ml, 203 ml, 105.6 ml and 97.9 ml, respectively which need to be enhanced with the best quality semen in future.

**Keywords:** Semen, stud bulls, volume, concentration, motility

[54]

**EFFECT OF NACL AND ROOT-MEDIA SELECTION ON YIELD ATTRIBUTES,  
OIL COMPOSITION AND MINERAL COMPOSITION OF ROSE GERANIUM  
(*PELARGONIUM GRAVEOLENS* L.)**

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**ABSTRACT**

Irrigation water varies greatly in quality depending upon the type and quality of dissolved salts, pH and mineral content which induces physiological and metabolic activities in plants. The most common salts in irrigation water are NaCl, CaSO<sub>4</sub>, MgSO<sub>4</sub> and NaHCO<sub>3</sub>. Rose geranium is an essential oil crop that is commercially produced worldwide for use in perfumery, medicinal and aromatherapy industries. The objective of the study was to evaluate the effect of NaCl levels (1.6, 2.4, 3.2 and 4.0 mS/cm) and root-media selection (sand and sawdust) on yield, oil composition and mineral composition of rose geranium. Treatments were arranged in a split plot layout where NaCl was allocated to the main plots and root-media to the subplots replicated three times under a climate controlled greenhouse tunnel. Sodium chloride at 4.0 mS/cm level significantly reduced herbage yield, iso-methone and the ratio of citronellol to geraniol. Furthermore, sodium content was significantly affected by the interaction between NaCl level at 4.0 mS/cm and sand. In conclusion, water containing more than 4.0 mS/cm concentration of NaCl must be avoided for a successful production of rose geranium on soil-less culture.

**Keywords:** rose geranium, oil composition, root-media, NaCl



[55]

## **GENDER AND PRODUCTIVITY DIFFERENTIALS AMONG RICE FARMERS IN NIGER STATE, NIGERIA**

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### ***ABSTRACT***

The study compared the differences in the productivity of male and female rice farmers in Niger State, Nigeria. Data used for the study were obtained from primary source using a multi-stage sampling technique with structured questionnaires administered to 150 randomly selected male and female rice farmers from the study area. Descriptive statistics such as means, standard deviations and percentages were used to summarize the variables used in the analysis while input– oriented data envelopment analysis (DEA) was used to empirically determine the total technical, pure technical and scale efficiency with respect to gender in the study area. The DEA results revealed that the male rice farmers were more scale efficient than their female counterparts with mean scale efficiency scores of 0.71 and 0.63 for male and female rice farms, respectively. The results also showed that about 77% and 83% of male and female rice farms operated at increasing returns to scale level respectively. This implies that the two farm groups could achieve higher efficiency level by increasing the production scale. The comparison test for significant differences in mean technical efficiency among the two farm categories confirmed that the mean total and pure technical efficiency with scale efficiency are statistically and significantly higher on male rice farms than on female rice farms. The implication of these findings is that male rice farmers are fairly efficient in utilizing their resources than their female counterparts and any expansion in the use of resources would bring more than proportionate increase in their outputs. The study therefore recommended that research efforts directed towards the generation of new technology, especially for rice farmers, should be encouraged in the study area.

**Keywords:** Gender, productivity, scale efficiency, rice production.

[56]

**DENDRO POWER PLANT WASTE BY PRODUCT AS A BIOAMENDMENT TO  
REDUCE HEAVY METALS TRANSLOCATION INTO MAIZE**

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**ABSTRACT**

Heavy metal contaminated soil rich in Pb and Cu in extreme concentrations, generate an unfavourable surroundings for human and agriculture through phytoaccumulation. This study was conducted to assess the possibility of Biochar (BC) on the reduction of bioavailable Pb and Cu in such contaminated soil. BC produced by *Gliricidia sepium* biomass (BM), a waste from Dendro power plant was used to examine its ability to be used in soil remediation. At the same time BM also applied separately to comparison with BC. A pot experiment was conducted with Maize by adding BM and BC at three different percentages, 1.0, 2.5 and 5.0%(w/w). Soil without any amendments served as control. Experiment was arranged in a randomized complete block design and triplicated. Translocation rate of heavy metals into maize were determined. Sequential extraction was conducted to determine the bioavailability and other phases of heavy metals in soil. The total, and exchangeable concentrations of Pb were 20,843, 2,058 and for Cu were 1861, 102 mg/kg, respectively. After sixth week, maize was harvested and analysed followed by digestion. The most significant immobilization ( $p < 0.05$ ) was indicated by treatment 5% BC for Pb and Cu with 49% and 84%, respectively and 5% BM for Pb and Cu showed 40% and 56%, respectively than control. Metal translocation towards plant was decreased with increasing application rate of amendments. Determination of Plant factor (PF) and Translocation factor (TF) indicated that PF was greater than TF in maize. The plant with high PF could be used for phytostabilization. Thereby maize could be considered as a phytostabilizer.

**Keywords:** biomass, biochar, dendro, phytostabilizer, translocation

[57]

## **IN-VITRO ASSESSMENT OF ALOE VERA GEL AS A BIO PRESERVATIVE OF PAPAYA FRUITS**

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### **ABSTRACT**

The medicinal plant, *Aloe vera* has potential in industrial perspective as well as traditional usage. The gel obtained from the leaves of *A. vera* has numerous properties such as it has oxidase, an antioxidant and also its natural biocide activity or the incorporation of antimicrobial compounds. This study aims using the gel to extend the shelf life of papaya fruits. Even size, uniform shaped and coloured, matured Red lady cultivar of papaya fruits were surface cleaned and coated with 33%, 66% and 100% gel while another group of papaya fruits were not coated and kept as control (0.0%). Gel dilutions were prepared with distilled water then fruits were dipped for 2-3 sec. The experiment was conducted using completely randomized design. Twenty four even size papaya fruits were selected and kept as four main groups. Each group had six papaya fruits. Physicochemical parameters such as colour, decay percentage, weight loss, pH, and Total Soluble Solids (TSS) were measured. Due to the coating, the ripening process was delayed, The TSS (Total Soluble Solid), pH and weight loss were high in uncoated fruits. Decay or damage percentage also high for the control fruits than coated fruits. The mean pH of the pulp of control fruits was 5.11 at 4 days Fruit preservation period (FPP) and was slightly increased to 5.32 within 12 FPP, whereas minimal pH was noticed in 100% (4.17 at 4 FPP and 5.09 at 12 FPP) gel coated fruits. The TSS was significantly higher levels (12.9 within 4 FPP and 13.33 within 12 FPP) in control fruits, whereas the minimum TSS value was 11.40 and 11.97 within 4 days and 12 FPP, respectively, and recorded from the 100% gel coated fruits in storage. The WLP (Weight Loss Percentage) was significantly ( $p < 0.05$ ) higher in 33% gel treated fruits (44.80+4.88%) whereas lower WLP (24.80+7.33%) was found in 100% gel coated fruits after 12 days of storage. Lowest disease signs and decay were observed in 100% gel coated fruits. This was due to the anti-microbial potential of coated materials. The gel coating prolonged the fruits shelf life by delaying the ripening and preventing the microbial activities due to their bioactive agents.

**Keywords:** *Aloe vera*, bio-preservation, total soluble solid, pH, gel, damage and weight loss percentage

[58]

**BIOCHEMICAL CHARACTERIZATION AND INSECTICIDAL ACTIVITY OF  
DIFFERENT SOLVENT CRUDE EXTRACTS OF *LANTANA CAMARA* L. ON  
DIAMONDBACK MOTH (DBM), *PLUTELLA XYLOSTELLA* (L.)**

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**ABSTRACT**

A study was conducted to evaluate the insecticidal action of *Lantana camara* L. against diamondback moth, *Plutella xylostella* (L.) (Lepidoptera: Plutellidae), one of the most destructive insect pests caused severe damage to crucifers worldwide. 60-75 g of each ground plant material were successively extracted using eight organic solvents in soxhlet apparatus for 12-16 hours. Each extract was evaporated under vacuum pressure using a rotary evaporator. Plant metabolites are highly diverse, having distinct functions according to their structure and Gas chromatography mass spectrometry (GC-MS) analysis revealed the presence of 6-19 major phytochemicals including caryophyllene, caryophyllene oxide, 2-hexadecen-1-ol, benzene, hexatriacontane, tetrapentacontane, 1, 3-cyclohexadiene-1-carboxaldehyde, 6S-2,3,8,8-tetramethyltricyclo[5.2.2.0(1,6)] undec-2-ene, 3-nonanone, phytol and squalene. The compounds were identified by comparing their retention time and peak area with interpretation of mass spectra. The *L. camara* crude extracts were tested against *P. xylostella* at six concentrations (1, 2, 4, 6, 8 and 10% (v/v)). Different instars of DBM larvae were exposed to the treated cauliflower leaves at 25±3°C and 70±5% RH and mortality was assessed after 24, 48 and 72 hours. The bioassay results indicated that the toxicity was proportional to the concentrations of the extracts. Higher concentration had stronger ovicidal, larvicidal and oviposition deterrent effect under laboratory conditions. *L. camara* had a low contact and ovicidal activity but a potent insect growth regulator (IGR) and high oviposition deterrent activity. It caused larval, pupal and adult deformities and reduced fecundity in cauliflower plant. The DBM parasitoid, *Cotesia plutellae* Kurdjumov (Hymenoptera: Braconidae), and the predator, *Chrysoperla zastrowisillemi* (Esben-Petersen) (Neuroptera: Chrysopidae) were tested to *L. camara* crude extract which was observed to be safe.

**Keywords:** *Lantana camara*, diamondback moth, insecticidal activity, GC-MS analysis

[59]

**CURRENT STATUS OF MARGINAL TEA LAND (MTL) UTILIZATION BY SMALL HOLDERS. A CASE STUDY IN BADULLA DISTRICT SRI LANKA**Palihakkara, I.R.<sup>1,3</sup>, Aruna Shantha., H.R.<sup>2</sup>, Mohommed, A.J.<sup>3</sup> and Inoue, M.<sup>3</sup><sup>1</sup>*Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka*<sup>2</sup>*Tea Small Holder Development Authority (TSHDA), Badulla, Sri Lanka*<sup>3</sup>*Dept. of Global Agricultural Sciences, Graduate school of Agricultural and Life Sciences, The University of Tokyo, Japan***ABSTRACT**

Tea (*Camellia sinensis* L.) is one of the most important commercial crops for Sri Lanka's economy including local people generates income from this livelihood activity. Such role of tea farming is being frustrated by ongoing tea land marginalization, a decline in productivity of tea land below national average. This study analyzes small holder farmer's current utilization of Marginal Tea Land (MTL). Data was collected by surveying tea plantations and conducting questionnaire for 31 marginal tea farmers in the district. The result showed that majority of MTL was in the range of 49-61 % slope with maximum 30% uncultivated areas inside MTL. This has reduced income generated from tea farming for farmers. Considering this, possibility of conversion to fuelwood plantation should be considered. Currently, despite high demand for fuelwood from tea factories and other small to medium scale industries, MTL contribution for fuelwood supply was negligible compared to supply from the home gardens and other agriculture lands. Conversion into fuelwood will open new income generation ventures and also safeguards land and surrounding environment from heavy soil erosion and land slide problems as was evidenced during recent heavy rains in November to December 2014.

**Keywords:** Marginal tea land, livelihood, fuelwood production, environment service, Sri Lanka

[60]

## USE OF THREE COMPUTER MODELS IN AGRICULTURE: A REVIEW

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### ABSTRACT

Computer models are being highly used in agriculture sector to increase efficiency of decision making, and to find out the best cropping and management options. However, to get good output from those models, need to select best models for particular crops and good data source for calibration and validation process. Otherwise outputs of the model do not address the real situation in the field. In this study select three crop models used in rice cropping system and discussed about present data requirement, their application in rice cultivation and model limitations and future potentials. APSIM, ORYZA2000 and DSSAT models were evaluated in this research. However those available models are highly depended on the technical data such as climate, soil, crop and management data and those models do not significantly consider economic and social-cultural factors in agriculture systems. Therefore, simulation results by models do not match with the observed values. Due to this Limitation there is a mandatory requirement to make necessary adjustment or improvements in those models by considering farmers' socio-economic and cultural indicators. In addition, most of the computer models are concentrating in the same crops. When consider the Sri Lankan context, Sri Lanka cultivate comparatively considerable amount of other field crops mainly vegetables with rice where most of these computer models have not been developed to capture the management of vegetables with rice. Hence these limitations in current computer models create an opportunity for researchers to think about new computer models which can capture local conditions and resulting with better model outputs.

**Keywords:** Efficiency, computer models, socio-economic and cultural data