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ABSTRACTS

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ABSTRACTS

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Foreword

I am extremely honored to have this opportunity to serve as the Editor for the "Publication of Abstracts of Presentations (Volume 7), Undergraduate Research Forum – 2015". The Undergraduate Research Forum is one of the most significant annual events of the Faculty of Agriculture organized solely for the students to present their research findings which they carried out during their final year study period. The research findings are published in the form of abstracts to disseminate the research knowledge to the community.

I express my sincere thanks to Dr. P. Sivarajah, Dean / Faculty of Agriculture for his support and contribution in publishing this document. I extend my gratitude to staff, Faculty of Agriculture for their great support and effort in this task. Finally, I thank our students who made this event a success through their valuable presentations and contribution of articles for the publication.

Mrs.Brintha Karunarathna
Coordinator & Editor/ Undergraduate Research Forum - 2015
Faculty of Agriculture

Message of Dean/Agriculture

The Faculty annually conducts a presentation of all final year research projects of students who had completed their research in their area of specialization. This compilation of abstracts of the research presents their findings in brief in order, to disseminate there to interested stakeholders.

I wish to congratulate the students, their supervisors and Heads of Departments for completion of research projects and presenting them. It is hoped that all interested in further research will may use of this publication.

Dr. P. Sivarajah
Dean/Faculty of Agriculture

Contents

AGRICULTURAL BIOLOGY

Effects of soil moisture stress in combination with different potting media on the growth and yield of brinjal (*Solanum melongina*)

S.J. Nuwan Chathuranga

An experiment was conducted at the Crop farm of the Eastern University in the *Yala* 2015 to investigate the effects of soil moisture stress under four potting media during different growth stages on the growth and yield of brinjal cultivar "Palugamam Purple". The treatments consisted of moisture stress and control in Combination with four potting media. T_1 where top soil: red soil: compost 1: 1: 1 ratio was done under regular irrigation. The same potting media with moisture stress was followed for the T_2 treatment. In T_3 top soil: red soil: goat manure was added in similar ratio. The same potting media with moisture stress in T_4 treatment. T_5 where top soil: red soil: cow dung in similar ratio. T_6 was the one with the same media under moisture stress treatment. T_7 served as the control (top soil only). T_8 had top soil under moisture stress condition. The experiment was laid out in the Completely Randomized Design with eight treatments and four replications. The results revealed that there were significant ($p< 0.05$) differences between treatments in the plant height, leaf area index (LAI), leaf dry weight, fruit dry weight, stem dry weight, fruit length, fruit girth, root dry weight and yield. Among the treatments the highest growth attributes were found in the T_1 treatment. T_3 (top soil + red soil + goat manure-regular irrigation) and T_5 (top soil + red soil + cow dung-regular irrigation) treated plants showed similar results. The lowest values were recorded in the T_8 treated plants during the vegetative, flowering, early fruiting and fruiting stages. The highest yield (14 $t.ha^{-1}$) was recorded in treatment whereas the lowest (5 $t.ha^{-1}$) was found in the T_8 treatment. From these results it was found that regular watering compost potting media showed remarkable changes in the growth physiological attributes and yield of brinjal. Hence, it could be recommended to practice the regular watering and compost potting media when growing this cultivar of brinjal in order to obtain high yields. Increasing the intensity of moisture stress and low nutrient potting media would drastically reduce fruit yields of this brinjal cultivar.

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Evaluation of the salinity tolerant capacity of selected rice (*Oryza sativa* L.) cultivars grown on soils from saline tract of Batticaloa

S. Puvanitha

Salinity is a major factor reducing plant growth and productivity in rice cultivation. The development of salt resistant rice cultivars has become an urgent priority because of the increased salinity in rice lands. This experiment was conducted at the Agronomy farm of the Eastern University, Sri Lanka to assess the responses of salinity on the growth, physiological and yield attributes of selected rice cultivars. Three cultivars of rice namely: "Pachaiperumal", "At 307" and "At 308" were used for this study. The experiment was laid out in the Completely Randomized Design with two factor (salinity*variety) in a factorial arrangement and consisted of six treatments and four replications. A set of 3 weeks old rice seedlings were subjected to salt stress by transplanting them in a polyethylene bags. These bags were filled with saline soil, collected from a saline tract near the Eastern University. Forty-eight plants from each cultivar were evaluated for the selected characters such as plant height, Relative Water Content of leaves, chlorophyll contents, number of reproductive tillers per plant and other yield attributes. Salt stress had significant effect on the growth physiological attributes of the tested cultivars. "At 307" exhibited the highest height (58.5cm) when exposed to salinity at the vegetative stage while "Pachaiperumal" showed the highest height (132.8 and 124.6cm) at the reproductive and ripening stages respectively than the rest of the cultivars.
"Pachaiperumal" showed the highest root dry weights at all three stages while "At 307" exhibited the highest shoot dry weight at all three growth stages under salt stressed condition. Salt stress significantly reduced the Relative Water Content of the tested cultivars. Cultivar "Pachaiperumal" had the highest Relative Water Content (66.8%). "At 308" and "At 307" showed the highest amount of "chlorophyll a", "chlorophyll b" and "total chlorophyll" contents of the leaves under salt stress while "Pachaiperumal" had lowest amounts of these pigments. "At 308" and "At 307" showed the lowest leaf number and leaf width while "Pachaiperumal" had the highest leaf number and leaf width at the ripening stage. The results indicated that salinity significantly reduced the number of tillers per plant, number of productive tillers per plant, number of filled grains per panicle, and total number of spikelets per panicle. The percentage of unfilled grain was increased in plants under salt stress than the control treatment. All these results indicated that cultivar "At 307" was able to withstand salinity stress

much better than the other rice cultivars and may be identified as a salt tolerant cultivar. As a result, it was recognized as the most salinity tolerant rice cultivar among the tested ones which could be grown in the salinized tracts of the Batticaloa district.

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AGRICULTURAL CHEMISTRY

Development and Storage of Ginger (*Zingiber officinale*) blend with Lime (*Citrus aurantifolia*) Ready-To Serve (RTS) Functional Beverage, Sweetened by Palmyra Sugar Candy

G. Hariharan

In this modern world, there has been growing recognition of the key role of foods and beverages in disease hindrance and treatment. Thus, the production and consumption of functional beverages has gained much importance as they provide a health benefit apart the basic nutritional functions. Therefore, a study was conducted to develop a functional RTS beverage by exploiting the medicinal, nutritional and organoleptic properties of ginger juice, lime juice and palmyra sugar candy.

Local and Chinese varieties of ginger rhizomes were collected and their physico-chemical and organoleptic parameters were analysed to select the best variety of ginger for RTS beverage formulation. Considering the findings of several preliminary studies, six formulations of the functional RTS blends were prepared by blending different percentages of ginger juice and lime juice including a control (where only ginger juice was added). The freshly prepared formulations were subjected to physico-chemical, microbial and sensory analysis to evaluate the nutritional qualities and consumer preference and most preferred formulations (four formulations including a control) were selected for storage studies. The formulations were stored at 30°C room temperature and 70-75% of RH for 12 weeks. Physico-chemical parameters such as pH, TSS, titratable acidity, ascorbic acid content and total sugar, organoleptic qualities of colour, aroma, pungency, taste and overall acceptability and microbial analysis (total plate count) were analysed after formulation and during storage period.

The study on comparison of physico-chemical and sensory qualities of selected varieties of ginger rhizomes revealed that Local variety was more preferred than the Chinese variety. The nutritional analysis of the freshly prepared RTS beverage shown increasing trend in titratable acidity (from 0.22 to 0.52%, as % of citric acid), TSS (from 12.6 to 16.8 °Brix), ascorbic acid content (from 12.4 to 56.9 mg/100 ml) and total sugar (from 16.6 to 20.39%) with increase in lime juice extract from 2 to 10%. The pH was reduced when lime juice concentration is increased from 2 to 10%. Seven point hedonic scale was used to evaluate the organoleptic characters. According to Friedman's test, the mean scores for all the assessed sensory characters varied significantly ($p < 0.05$) in the freshly made RTS beverages

formulations. The declining trends in pH, TSS and ascorbic acid and an increasing trend in titrable acidity and total sugar was noted with advancement of storage period of 12 weeks. The results of chemical analysis showed that, there were significance differences ($p<0.05$) between the tested formulations. The sensory analysis also showed that there were significant differences ($p<0.05$) for organoleptic characters between RTS beverage formulations. The highest overall acceptability was observed in formulation with 12% of ginger juice with 8% of lime juice and the all formulations were microbiologically safe for consumption.

Based on the results of physico-chemical characteristics, sensory attributes and microbial test, the RTS functional beverage with 12% of ginger juice with 8% of lime juice was selected as best formulation and could be stored at for 12 weeks without any significant changes in the quality characteristics.

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Effect of Salt Stress on the Germination and Growth Performance of Vegetable Cowpea (*Vigna unguiculata* L.)

S.M.S. Himaya

Salinity is a continuing problem in the arid and semi-arid tracts of the world. This study was conducted in order to evaluate the effect of salinity stress on growth parameters, yield and germination percentage of vegetable cowpea. Research was carried out under laboratory condition and shade house condition. This experiment was laid out in a Complete Randomized Design (CRD) with four treatments and four replicates. The treatment groups were non-saline, 0.5% saline, 1% saline and 1.5% saline. Data were analyzed using Statistical Analytical System (SAS) and means were separated by Duncan Multiple Range Test (DMRT).

Seeds of vegetable cowpea variety Sene were chosen for this experiment. Germination test was conducted in the laboratory conditions. Petri dishes having dimension of 87 mm diameter and 15 mm height with a tight-fitting lid were used for this experiment. Filter papers were soaked in a 5ml solution of the respective salt concentration and placed at the bottom of petri dish, 10 seeds were maintained in the Petri dishes. The Petri dishes were arranged in a completely randomized design (CRD) with four replications. The Petri dishes were kept in the incubator at 25 $\pm$ 1 ^{0}C, 12 h of day length for five days. Germination percentage (GP), seedling weight, average shoot and root length of seedlings from each replicate were measured.

Sixteen plastic buckets were taken and filled with 6 kg of NaCl saturated soil. To achieve different soil salinity levels (0.5%, 1% and 1.5%), dry potting soil was saturated with the treatment sodium chloride concentration. Five seeds of Sene variety of cowpea was sown in each plastic buckets. Plastic buckets were spaced 0.5 m x 0.5 m. The treatments were irrigated with respective salt solution after transferring the pots to a shade house when the seedlings had the primary leaves developed. Two weeks after sowing, seedlings were thinned to three plants per pot. One month after planting root length, plant height plant weight and number of branches were recorded. Yield was recorded 55 days after planting. At the end of experiment soil was analyzed for organic matter content, total nitrogen and available phosphorous content.

Results of the laboratory experiment showed that the germination percentage was significantly affected by salinity level, especially by the higher salt

concentration. The highest seed germination percentage (100%) was found with the control (0% NaCl) and the lowest seed germination percentage (62.5%) recorded for T4. Same trend was observed for shoot length (2.02 cm), root length (6.07 cm) and fresh weight of seedling (0.54 g/plant). The second best treatment was T2 except root length other parameters were no significant with control.

Results of statistical analysis of pot experiments revealed that salinity made highly significant effects ($p \leq 0.05$) for the investigated parameters. Highest root length (4.47 cm), plant weight (4.12 g), plant height (33.42 cm), number of branches per plant (3.5) and pod yield (2.28 g) were observed in 0% NaCl (control). Root length, plant height and plant weight were no significant among treatment but significant with control. Where no yield was recorded in treatment T4 (1.5% soil salinity).

Results of soil analysis indicated that increasing salinity levels significantly decreased nutrients such as nitrogen and phosphorus and organic matter content in the soil. Highest value for organic matter content (1.28%) was observed for control but it was no significant with T2 and T3. Total nitrogen and available phosphorus content was significantly varied with control.
The study showed that all studied parameters for vegetable cowpea decreased with increasing salinity. Increasing salt concentration negatively affecting germination percentage, seedling growth, vegetative growth and pod yield.

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Effect of Sulphate of Potash and Partially Burnt Paddy Husk on the Growth Performance of Rice (*Oryza sativa* L.) in Saline Soil

M. Kanimoly

Productivity of most of the paddy growing lands in Sri Lanka declines every year due to increased soil salinity. In Batticaloa District Vaharai is located in Koralai pattu North D.S. division. These lands are often influenced by the salinity and this is one of the important constrain on cultivation. A pot culture experiment was conducted at Eastern University, Sri Lanka during May to August 2015 to investigate the effect of various potassium rates; 0, 18, 36 and 72 Kg K_2O /ha in the form of sulphate of potash and partially burnt paddy husk (with and without), on soil pH, electrical conductivity and available phosphorus, plant potassium and phosphorus content, growth and yield components of rice. A bulk soil sample was collected at 0-20cm depth from salt-affected area at Vaharai. It was processed and sieved through 2mm sieve. The experiment was laid out in a Completely Randomized Design (CRD) in a factorial manner with three replications.

Results revealed that the application of sulphate of potash in amended soil decreased soil pH and electrical conductivity from 8.3 to 7.4 and from 19.1dSm^{-1} to $\leq$4 dSm^{-}1 respectively. Amendment increased the soil available phosphorus from 9.69 to 74.673 mg/Kg. Furthermore the use of potassium fertilizer remarkably elevated the uptake of essential nutrients of potassium up to 51.91 mg/g (DW), and phosphorus content up to 4.54 mg/g (DW) in saline soils. The application of 72 Kg K_2O/ha in the form of sulphate of potash proved to be the best to increase the growth and yield components in saline environment. Highest 1000-grain weight, paddy yield and straw yield were obtained at partially burnt paddy husk with 72 Kg K_2O/ha of combination and was followed by 36 Kg K_2O/ha, 18 Kg K_2O/ha combination compared with control. The results of this study suggested that incorporation of partially burnt paddy husk and sulphate of potash could be used as an ameliorative way in improving saline soil fertility and productivity.

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Formulation and Development of Shelf Stable Composite Nutrient Bar with no added Preservatives

G. Buddhini

The change in the lifestyle of consumers and their health awareness have made that scientists and food industries change formulations and ingredients for increasing food nutritional value and safety. Cereal-bars are very versatile product, made of processed cereals mixed with a variety of ingredients, which selection depends on the targeted population group. There has been increase in the consumption of fast-foods and snacks which are defined as small meals, light or substantial, and may be related to the attributes of healthy. Therefore, a study was conducted to develop a protein and fiber rich composite shelf stable nutrient bar with no added preservatives by using constant amount of Maize, Green gram flour, Puffed rice, Dates, Roasted ground nut and Tutti-fruitti and changing the binding agents of xanthun gum, liquid glucose and lecithin along with sugar syrup to identify the suitable combination of binding agent and consumer acceptability for the commercial preparation of composite nutrient bar with longer shelf life. Then suitable sample (binding agent as liquid glucose) was undergone three different packing materials and also to identify the shelf stability of product for different packing materials. The physico-chemical properties of pH, hardness, moisture were analyzed during storage with different packing materials. Nutritional qualities of ash, protein, fat, fiber, iron, Ca and P contents of the final product was analyzed. Organoleptic characteristics such as stickiness, odour, chewiness, taste and overall acceptability and total plate count, coliform tests were analyzed after formulation and during storage. The consumer acceptability of the nutrient bars was carried out using 5-point hedonic scale.100g of nutrient bar had carbohydrate 38.163g, protein 8.744g, fat 12.23g, dietary fiber 2.68g, ash 1.78%, Fe 4.314 mg, Ca 52.356mg, P 151.63mg and energy value of nutrient bar was 295.61 K Cal. According to Tukey's test, the mean scores for all the assessed sensory characters varied significantly ($p< 0.05$) in the nutrient bars which were stored in polypropylene (gauge 150 and 300). But no significance difference in TLAF (Triple layered aluminium foil) packing material. No harmful total plate count was observed in the nutrient bars which were stored in TLAF.

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Study on Ready to Serve Beverage Prepared from Fermented and Unfermented Carrot with Sour-Orange Juices

S.M.M.S Afreen

A study was designed to prepare RTS beverage by blending juices of Carrot with Sour- Orange juices. Ready to serve beverage was prepared using Fermented Carrot juices and Unfermented Carrot juices with different combinations of Sour- Orange juices with sugar, citric acid, distilled water and Sodium metabisulphite, considering the recommendations of Sri Lanka standards for RTS beverages. Carrot was fermented by using culture. Eight formulations of the blends of Fermented Carrot juice with Sour-Orange juices and Unfermented Carrot juice with Sour- Orange juices at the ratios of (100:0, 60:40, 50:50 and 40:60) were prepared in the preliminary trial. Juice blends were preserved by pasteurization (85^0C, 20 min). The preservative was added into blended Unfermented Carrot juice with Sour- Orange juice RTS beverage only because, preparation of RTS using fermentation is a method of Preservation without the addition of chemical preservatives.

All freshly prepared RTS beverages were analyzed for sensory, chemical and microbiological evaluations. Chemical analysis showed that there was a decline in pH, and increase in titrable acidity, ascorbic acid, total sugar and Total Soluble Solids (TSS) with the increase in the concentration of Sour-Orange juice in RTS beverages. In sensory evaluation, there were significant differences between some treatments and some were not different significantly with respects to colour, aroma, taste, consistency and overall acceptability at 5% level of significance ($p<0.05$) differences. According to Tukey's test, the uppermost overall acceptability was observed in the RTS beverage with 50% Carrot juice and 50% Sour-Orange juice in both Fermented and Unfermented combination. Microbial analysis indicated that there were no microbial populations in all freshly prepared RTS beverages. From the eight formulations; two combinations which are most acceptable (50:50) were selected. A total of two best formulations and their controls belonging to the two groups were selected and stored at refrigerated Temperature for storage study. Changes in chemical qualities, organoleptic characteristics and microbial safety of RTS formulations were studied during storage.

Chemical parameters like titrable acidity, pH, Total Sugar, total soluble solids and ascorbic acid content were evaluated for two months of storage at two weeks interval. The results of the physico- chemical properties showed

that ascorbic acid, pH, TSS and total sugar were decreased and titrable acidity was increased in the samples during storage. Sensory evaluation was completed after two months of storage indicated a gradual decrease in all sensory parameters in all RTS beverage formulations. However the organoleptic properties of the formulations which were blended in the ratio of 50:50 of Unfermented Carrot juice with Sour-Orange juice and ratio of 50:50 Fermented Carrot juice with Sour-Orange juice were found to have higher scores than the control. Findings of microbial study performed at monthly interval revealed there was no microbial growth up to two months of storage in all beverage formulations.

From the results of quality assessments, the formulated RTS beverage blended in the combination of 50 % Unfermented Carrot juice with 50 % Sour-Orange juice and 50 % Fermented Carrot juice with 50% Sour-Orange juice were found to be superior in quality and could be stored at Refrigerator for a minimum period of two months with minimum changes in quality. The blend had good sensory attributes and shelf life. Therefore, it is safe for consumption up to 60 days of storage.

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AGRICULTURAL ECONOMICS

A study on smallholder rubber production in Monaragala District

D. M P. Dissanayake

A study on smallholder rubber production was carried out in the Monaragala district. Pre-tested, structured questionnaires were used to collect primary data from the rubber farmers. Secondary data were collected from relevant sources. The study was conducted in five DS divisions of Monaragala district and the simple random sampling method was used for the primary data collection among the farmers in the selected five DS divisions. Twenty respondents (rubber producers) were randomly selected from each selected DS division. The total sample size was 100 rubber producers.

The results of the study indicate that majority of the farmers (54%) were between the age range of 41-60 years. Rubber cultivation was predominantly a male occupation and majority of the farmers (52%) had attended the primary level education. More than half of the respondents (57%) had the farming experience of less than 7 years. The average extent of land cultivated was 1.7 acres. Around 47% of rubber farmers had produced 50 – 100 kilograms' rubber per month. Average numbers of untapped trees were 112 and average tapped trees were 205. Yield obtained per month was 160 sheets and the average of cost of production per month was Rs. 6, 240. The results of the multiple regressions analysis show that experience in rubber farming and number of tapped trees had positive and highly significant correlation, whereas extent of land used had negative significant relationship with rubber production of smallholder rubber farmers. Despite impressive progress in the Sri Lankan rubber industry, it is still plagued by a series of critical issues such as declining planted area, labour shortage, more specifically skilled tappers, low land and labour productivity, an ageing labour force, inadequate resources, and high cost of production.

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Constraints and potentials for mushroom production in Batticaloa District

T. Kunanathan

This study was broadly designed to analyze constraints and potentials for mushroom production in Batticaloa District. In the study, the cost of production and the marketing process of mushroom was analyzed. The study was mainly based on primary data obtained from a sample survey in six D.S Divisions in Batticaloa district. All of the farmers in the study area was selected as the respondents and data were collected through pretested questionnaires. In addition to that, secondary data was also used. Data were analyzed using a SPSS, Descriptive statistics, frequencies and multiple regressions were done. Aspects of socioeconomic features of farmers, productivity parameters, marketing cost, cost of production and constraints in mushroom production were studied.

Most of the mushroom farmers had own shelter house and had used hired labour for mushroom cultivation. It was found that unavailability of planting materials and media, severe pest and disease attack and marketing were the major problems faced by farmers. Wholesaler, middlemen were involved in marketing activities. The main marketing channel was producer to consumer in this district. The total cost of production was high and also cost of mushroom media and planting material were major components. The cost of production of mushroom per kg was Rs.281.16. Quantity of mushroom marketed, experience in mushroom cultivation, depreciation on equipment and building had significant impact on net profit of mushroom production. Breakeven point of mushroom production was 12.7kg and market efficiency was 27.82. Benefit Cost ratio for mushroom production was 1.25, where indicates that mushroom production was profitable and has potential for expansion as a livelihood activity in Batticaloa district.

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Household willingness to pay for safe drinking water in Ampara District

M.H.M.Minhajkhan

Presently drinking water has become a critical global issue. In Ampara district, with tropical climate and long dry season creates a greater demand for safe drinking water. The district is rural and primarily agricultural, relying on a large irrigation network of reservoirs and canals for farming. However, there are water quality and scarcity issues with the traditional water sources due to intensive farming and resultant fertilizer, soil and chemical run-off. In order to improve the health status of the people residing in these areas, there is a vital need to study the existing status of drinking water and to estimate their willingness to pay for safe drinking water. This study was conducted to assess the household willingness to pay for safe drinking water in Ampara District. This study was done in 120 households in three D.S. Divisions. Results revealed that average age of head of household was 40.7 years. The average household income was Rs 23,142 per month. About 68% of household used unsafe drinking water and 48% households were affected by diarrheal disease due to the consumption of unsafe drinking water. Households spent Rs.624/month for treating water related diseases. Majority (55%) of households were using well water for their daily use. 46% of households used water with good quality but the use of excellent quality water was very low (1%) at household level. Majority of respondents in Navithanveli D.S. Division used poor quality water (62%) compared to Pottuvil and Thirukkovil. Multiple linear regression analysis was used to determine the factors that influence Willingness to Pay of households for safe drinking water. The mean willingness to pay of households was Rs. 134.17/month. The result showed that age and availability of water throughout the year were significantly and negatively influences the value of household willingness to pay. While the minimum and maximum willingness to pay of the households was recorded to be only Rs 50.00/month and Rs 350.00/month respectively. From the result, it is recommended that households must be educated with proper water purification methods and awareness on importance of safe drinking water. It is recommended to improve the water supply system in Ampara district.

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Production and marketing of Palmyrah leaf based products in Eravur Town DS Division of Batticaloa District

J. F. Raasitha

A study on production and marketing of palmyrah leaf based products was carried out in Eravur Town DS division of Batticaloa district. Using the random sampling procedure, a sample of 100 palmyrah leaf producers were selected and a structured interview schedule was used to collect the information through personal interview. Data were analysed using the SPSS package. Results indicated that 100% palmyrah leaf based producers were female and 53% were under young age (15 to 35 Years) category. Majority of respondents (67%) were married and 63% were completed their primary education. Around 66% were belonged to low income group.

The majority of respondents (95%) were selling their products through salesperson and 100% of the respondents were selling their products on weekly basis. The majority of respondents (70%) were not taking loans for their production; 17% of respondents were taking loans from Samurdhi Bank Society for their production. The majority of population (96%) was getting the information related to production and marketing of the products from the individual sources.

Chi-square analysis was done to find out the association between the quantity of production per day and selected socio-economic characteristics of palmyrah leaf based product producers. The results indicated that there was significant association between the quantity produced per day and producers' age, type of work, monthly family income levels and expenditures on production.

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Productivity of Rice milling industry in Polannaruwa District, Sri Lanka

M.L. H. P. Medawala

Rice milling industry contributes as one of major livelihood of Polonnaruwa district, Sri Lanka. Though the research studies about the socio-economic and problematic environment of this industry are lack in. Therefore, this study was designed to identify the socio-economic characteristics of the milling industries, analyze the factors affecting the productivity and identify the problems and solutions faced by milling industries. For this purpose 60 rice mill owners were selected by simple random sampling in 5 major rice producing Divisional Secretariat Divisions of Polannaruwa District. Among those, 20 mills were selected from each category under the Modern, Semi modern and traditional type mills. The respondents were directly interviewed using pre-structured questionnaire. The responses were obtained as the type of commercial mill, age of respondent, level of education, age of enterprises, annual capacity of mill, annual production amount of rice and byproducts, labor information, variable costs of industry, quality standards of rice, problems & solutions faced by millers, supporting services to millers. The study found all millers produced raw rice, while 71.67% produced parboiled rice. Significant differences were found in sold price by mode of selling. Variable cost of industry per ton of paddy is higher in modern mills rather than the others. High percentage of impurities was found in rice of traditional mills. The study found that majority of modern millers was affected by Government legislations than other two types of millers. Majority of traditional millers were affected by competition among the millers. All respondents had access to adequate amount of labor, availability of transportation facilities, electricity and water.65% of studied millers did not use advertising. Large fractions of studied millers were members in millers' association, and had not participated in any training program related with rice milling. 68.33% of millers had practiced risk management and average stock keeping time duration was three months. The study found average productivity of mill was 68.03% this was significantly affected by education of millers, type of mill and impurities percentage in rice. According to study 55% of modern millers were affected by paddy scarcity, while 80% semi modern and 95% of traditional millers were affected by capital scarcity.

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Socio economic determinants of market participation by indigenous poultry farmers in Eravur Pattu DS Division, Batticaloa District

R. Harisuthan

This study was broadly designed to analyze indigenous poultry market participation in Eravur Pattu DS division in Batticaloa district. The study was mainly based on primary data obtained from a sample survey in four G.N Divisions in Eravur Pattu DS Division. The simple random sampling technique was used to draw the sample and data were collected through pretested questionnaires. In addition to that, secondary data were also used. Data were analyzed using a statistical software, and descriptive statistics, frequencies and regression were done.

Aspects of socioeconomic features of farmers, management practices, productivity of animals and socio economic determinants of poultry market participation decision were studied. Most of the indigenous chicken owners were females and practiced indigenous chicken farming as a part time work. Main purpose of Indigenous chicken rearing was both egg and meat production for 91% of farmers. It was found that high loss of birds due to improper housing/predation and disease attack were the major problems faced by chicken farmers. There is no organized marketing for indigenous chickens and eggs. However, middlemen, households and village shops were involved in the marketing activities. The main marketing channel was producer to consumer (75%) through households.

The regression results showed that households' decision to participate in the poultry market was significantly ($p<0.05$) affected by sex of household head, bicycle ownership, market accessibility and source of market information. Further the results suggest that, establishment of effective market information service will enhance the sales of indigenous chicken farmers.

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AGRICULTURAL ENGINEERING

Effect of different tillage operations on some selected soil physical and hydraulic properties under maize cultivation

Abdul Jabbar Fathima Rifka

Farmers in Batticaloa district use different tillage practices. Most of the farmers perform tillage operations without being aware of the effect of tillage operations on soil physical properties and crop responses. Therefore, a field study was conducted during May - July, 2015 on loamy sand soil at the Agronomy Farm of Eastern University to compare the effect of different tillage practices on some selected soil physical properties under maize cultivation. The experiment was arranged in a split plot design with three replications where the experimental variables were two types of implements (mould board plough and rotovator) as main plot factor and the speed of operation of the implements such as 0.45, 0.65 and 0.85 m/s as sub plot factors. Effects of tillage implements on soil moisture content, bulk density, porosity, hydraulic conductivity, field capacity of implements and seedling emergence rate index (ERI) of maize were studied. Tillage implements had a significant effect on all soil physical properties, hydraulic conductivity, field capacity and ERI at $P < 0.05$. However, the soil moisture content and field capacity of implement were significantly affected by rotovator with an operating speed of 0.85 m/s. Compared with the other treatments, the tillage with rotovator treatment enhanced favourable soil conditions, such as decreased dry bulk density, increased soil moisture content, total porosity, hydraulic conductivity, field capacity and seedling ERI. The tillage plots with mould board plough produced comparatively less favourable soil conditions such as increased dry bulk density, decreased soil moisture content, total porosity, hydraulic conductivity, field capacity and seedling ERI. Therefore, under the soil and weather conditions of this experiment, the better tillage practice identified for improved soil properties is tillage with rotovator at an operating speed of 0.85 m/s.

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Estimation and characterization of municipal solid waste generation at Thirukkovil Pradeshiya Sabha

J. Muhilini

Municipal solid waste is a growing problem in urban areas of Sri Lanka and this problem is aggravated due to absence of proper solid waste management systems at Local Authorities. The management of solid waste requires in depth studies on waste generation and characterization. The aim of the study is to determine the quality of solid waste generation and composition in Thirukovil Pradeshiya Sabha, Ampara District. Solid wastes collected from households, shops and by Local Authority were quantified. Then, collected sample were separated into different material categories of wastes. The questionnaire surveying covered sixty households in the study area. The data were analyzed using Microsoft Excel and statistical package for social science.

The average waste generation per household was 2.24 kilogram of waste**.** Approximately 16.345 tons of solid waste generated per day by household sector and household sector contributed more than 45.64% of total waste generation than other sources. Correlation study revealed that the household waste generation shows positive correlation with monthly income and family size. The average composition of the household waste in weight basis were organic waste (88.66%), paper (4.26%), plastic (3.96%), metal (0.86%), glass (1.67%), and hazardous waste (0.57%). Average solid waste generation per shop was 1.56 kilogram, approximately 74.88 kilogram of solid waste generated per day and the average composition of the shop waste were organic waste (79.79%), paper (9.47%), plastic (9.10%), glass (0.94%), metal (0.62%), and hazardous waste (0.046%). The total solid waste collected by Local Authority was 250.65 tons per week. The average composition of the solid waste collected by Local Authority were organic waste (88.86%), plastic (2.73%), paper (4.83%), glass (1.03%), metal (0.56%) and hazardous waste (1.96%).

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Spatial variation of some cation concentrations, texture and organic matter content of the bottom sediments in Batticaloa lagoon

A. Narmilan

The Batticaloa Lagoon is a chocked lagoon of primary concern for its biodiversity, its habitats and its resource supply, which have been severely impacted by human activities. Lagoon sediment has an important role in the nutrient cycle of aquatic environments. In some cases, sediment is responsible for the transport of essential nutrients as well as pollutants. Most surface sediments in water originate from surface erosion and contain mineral, and organic components during the process of soil formation. Continuous discharge of industrial and residential waste water into the Batticaloa lagoon is a potential source of environmental pollution.

Therefore, this study was aimed to investigate the on spatial variation of sediment quality in Batticaloa lagoon. Sediment samples from the Batticaloa lagoon were collected from January 2015 to February 2015 to assess the characteristics of physical and chemical parameters of lagoon bottom sediments. Samples of sediment were collected from the Batticaloa lagoon at twenty six (26) different locations.

All the samples were analyzed at the Eastern University, Sri Lanka. Cations such as Sodium (Na) and Potassium (K) concentrations were analyzed using the Flame photometer. Calcium and Magnesium concentrations were analyzed by titration method. Further, pH, EC, texture and Organic matter content were measured using standard methods.

Analysis of sediment samples revealed that the lagoon sediment is slightly acidic (pH 6.17) during the wet season. Mean EC value of Batticaloa lagoon sediment is 12.995 (dS/m). The texture analysis of sediments shows that sand was found to be the major contributor to the sediment texture of the lagoon bed. The average percentage of sand, silt and clay in the sediment was 87%, 7% and 6% respectively in the Batticaloa lagoon.

Average amount of organic matter in the Batticaloa lagoon sediment is 2.56%. This increased value indicates the accumulation of organic pollutants in the forms of agricultural waste, aquatic plant debris and animal excreta etc.

As far as the cation concentration is concerned, average Na and K concentration of the sediment was 164.17 ppm and 14.02 ppm respectively. Likewise, mean concentration of both Ca and Mg concentration is 95.09 meq/l in the Batticaloa lagoon sediment. Among the analyzed parameters the sediments are highly contaminated with the Na concentrations followed by Ca and Mg ions.

As it is a preliminary investigation it is recommended and proposed to analyze the heavy metals and trace elements of this Batticaloa lagoon sediments to make it as a comprehensive analysis.
However, the present study results of sediments will be a baseline information and useful tool for future researchers for actual assessment of environmental pollution of this lagoon in terms of cation concentrations, organic matter and total carbon concentrations.

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ANIMAL SCIENCE

Effect of broiler starter and finisher feed replacement time on the performance of broiler chicken

Atham Bawa Thasleem

Broiler meat is the most consumed meat in Sri Lanka as an animal protein source. However, the cost of producing broiler meat is high due to higher feed cost. Therefore, an experiment was conducted to find out the optimum time of broiler starter and finisher feed replacement on the growth performance, carcass quality and organ size of broiler chickens.

The experiment was conducted at the Livestock farm of the Department of Animal Science, Faculty of Agriculture, Eastern University, Sri Lanka for a period of 42 days beginning from June17 to July 29, 2015.This experiment was carried out using Complete Randomised Design (CRD). A total of 120, unisex, day-old chicks of Indian River strain were purchased from the Prima (Pvt) Ltd., Sri Lanka. The birds were allocated into four treatment groups such as T_1,T_2,T_3,T_4.The treatments were replicated thrice and each replicate consisted of ten birds. Feed and water were provided *ad libitum* and proper litter management, sanitation and vaccination were adopted. Commercial starter and finisher diet were used throughout the experimental period.

The growth performance results revealed that the birds fed starter diet up to day 18 (T_2) gained the highest body weight ($P \leq 0.05$) while the birds fed starter diet up to day 21 (T_3) gained the lowest. Therefore, it could be concluded that increasing the starter diet period would not increase the body weight gain of broiler chickens.

The feed intake was significantly higher in the birds fed starter diet up to day 15 (T_1) and 21 (T_3) while it was lowest in the birds fed starter diet up to day 24 (T_4). Increasing the starter diet period up to day 24 reduced the feed intake in the birds.

Even though, the FCR of bird fed starter diet up to day 21 was significantly higher when compared to those in other treatments, the values reported for FCR in all treatment groups were less than two. Live weights of birds fed starter diet up to day 18 (T_2) and day 24 (T_4) were significantly highest while it was lowest in those fed starter diet up to day 21 (T_3).

Dressing percentage was significantly highest in the birds fed starter diet up to day 21 (T_3) while it was lowest in those fed up to day 18 (T_2). Increasing

the duration of feeding starter diet increased the dressing percentage up to day 21.

Increasing the duration of feeding starter diet up to day 24 reduced the relative weights of gizzard, heart and liver. In addition, the period of feeding starter diet did not influence the immune organ spleen in broiler chickens. Significant difference was recorded for the broiler performance efficiency factor in which the birds fed starter diet up to day 18 (T_2) recorded the highest BPEF while those fed up to day 21 (T_3) recorded the lowest. The findings of the present study showed that the broiler feed cost per bird is keep on increasing significantly with the prolonging of starter diet period from day 15 up to day 24.

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Evaluation of the performance of small and medium hold cattle farming under current feeding practices and potential feed resources in Horowpothana DS division of Anuradhapura district

M.A.A.Ahzan

Horowpothana Divisional Secretary (DS) of Anuradhapura district is famous for agriculture activities such as paddy cultivation and animal husbandry. Next to paddy cultivation, the income source of farmers is animal husbandry especially cattle production which was mostly reared for milking purpose (100%) under different type of rearing system such as tethering, extensive, semi intensive and intensive. There was mostly observed tethering of small holders and extensive system of medium holders in the Horowpothana DS division respectively**.**

A study was conducted in Horowpothana DS division for a period of four months (May 2015 to August 2015) by using a questionnaire based survey. A total of 100 small and 100 medium hold cattle farmers from 8 GN division of Horowpothana DS division were interviewed using a formal questionnaire. The questionnaire included issues on socio economic condition of farmers, data on cattle farming; cattle production, problems faced by the cattle fanners and extension services.

The study revealed that almost more than half of the small (52%) and medium (54%) hold cattle farmers had experience more than 2 years, which is sufficient for better management and care for more milk production. Almost 77% of the small hold cattle farmers were tethering system while 53% of medium hold cattle farmers were adopting extensive system. All farmers were rearing cattle for milk purpose. With regard to educational level, most of the small holders were coming under secondary level (49%) but medium holders at 43% under primary level and another 9% and 15% of small and medium holders were not even schooled. Most of farmers reared their cattle under grazing while no one fed their cattle with concentrates. Most of the farmers reported that the major constraints (100%) in farm was high cost for concentrate feeds followed by lack of knowledge about concentrate, poor performance of cattle, lack of credit facilities, and lack of water due to the drought.

The result of the study showed that the small and medium hold cattle farming increase the farmer's annual income significantly. This enables them to feed

their family more months than before because of most of farmer's occupation were in other jobs such as labour, carpenter and small business.

The implementation of small and medium hold cattle farming highly benefited the farmers in improving their livelihood. But the management systems were very poor, in some special cases like rearing system and feeding specially concentrate feeding. If this kind of practice will change, it may leads to good performance of cattle farming.

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Goat meat consumption trends in Trincomalee district

W.A.M. Kais

Meat and meat products are the part of staple diet of many Sri Lankan families. In general, various external factors influence the consumer's purchase decisions. The culture, traditions, customs, taboos are influencing the consumption of chevon, especially in Sri Lankan societies.
A field survey was conducted to find out the chevon consumption at five DS division in Trincomalee district. The objective was to investigate the goat meat consumption trend, identify the feasibility, limitation and marketing problems of chevon in the area and the problem faced. A random sample of 100 chevon consumers and 10 chevon sellers, were interviewed using a pre tested structured questionnaire that used to collect the data, which were analyzed by using SPSS package. Descriptive statistics, frequencies and regressions were done.

Aspects of socio economic characters of chevon consumer and sellers, chevon marketing patterns, consumer behavior, buying characters were studied. The findings of the research showed that most of the chevon sellers sold chevon in lower quantity and they purchased animals for slaughter from other village households. Consumption of chevon was found to be low due to its high price. Most of the consumer preferred to purchase chevon, but they mostly lower quantity of chevon at a higher frequency per once a month. Highly Tamils preferred to purchase chevon, but there was few chevon stalls in this area.

Most of consumers spent more money for buying chevon was Rs 1233. Monthly household expenditure for buying chevon was Rs1849.5 which was 8.77% of monthly family income.

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Preliminary investigation on the prevalence of selected external parasites on different breeds of neat cattle

S.Mehala

Cattle farming is a key component in Sri Lankan agriculture. Primarily, it provides high quality protein by producing milk, milk products and meat. Growing population need more improvement in the dairy production level in Sri Lanka.

External parasites transmit a wider variety of pathogens to their host, such as babisiosis, Q fever, anaplasmosis, bovine leucosis virus, anthrax, cost fever, heart water disease *etc*. Diseases transmitted by external parasites to livestock constitute a major factor which limits animal production in many tropical and sub-tropical areas of the world and have been reviewed elsewhere.

External parasites represent a major obstacle to development and utilization of cattle resources and causes huge livestock production loss. In this regard, a research was conducted to study the prevalence of selected external parasites on different breeds of neat cattle in Batticaloa district. Selected main parasites were ticks and lice and other available external parasites also observed during the study.

Study was carried out in four Veterinary ranges namely Kiran, Vaharai, Karadiyanaru and Kokkaddichcholai in Batticaloa district. A number of 200 cattles in 100 farms were examined for this study. And other relevant data were collected by interviewing the farmer.

According to the survey, Prevalence of external parasites in dairy cattle is 73 % in Batticaloa district. Prevalence of tick and lice was 73 % and 5%, respectively. The tick species infests on cattle in the area are belong to the genus *Ixodes* (10%), *Amblyoma* (20%), *Rhiphicephalus* (60%) and *Hyalomma*(10%). At the same time 100 percent lice belongs to the *Linognathus vituli.*

The prevalence of ticks was 86%, 72%, 61% in poor, medium and good body condition scores. In farming system, intensive rearing system showed no prevalence and semi intensive system showed 73% prevalence of external parasites. And also, the farms where only cattle is reared showed lower prevalence (68%) than the mixed farms (78%).

In this investigation local cross breed animals showed lower prevalence (40%) to external parasites than exotic breeds Jersey (60%), Sahiwal (60%), and Friesian (80%).

The correlation analysis indicated that, there was a negative significant correlation ($P< 0.01$) between Body condition Score of the animal and the prevalence of External parasites. Chi square analysis showed significance association with Body condition score of the animals ($P<0.05$ and $X^2 = 49.72$) and different farming system ($P < 0.05$ and $X^2 = 24.2$) with prevalence of ticks. Local cattle is well adopted to the dry zone. Therefore, knowledge on the breed resistance for external parasites also vital in implementing effective control strategies such as through proper breed selection and management.

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Prevalence of Bovine subclinical mastitis (SCM) in Batticaloa district

N.Sanotharan

Subclinical mastitis (SCM) is one of the most economically important diseases in lactating cows in worldwide dairy farms. Present study was carried out to investigate prevalence of SCM in dairy cows in Batticaloa District, and relation to the major pathogens, risk factors and economic losses. In this study, total of 152 lactating cows were randomly selected to identify the SCM using California Mastitis Test (CMT) from 15 veterinary ranges of Batticaloa District. Milk samples were collected aseptically from CMT positive cows and dispatched to laboratory in the ice box. Microbiological and biochemical analysis were carried out to isolate pathogens in the milk sample by a standard procedure. Result showed that 66 lactating cows were positive to CMT, in which 19.1% quarters showed CMT positive. While, 93.9% of CMT quarters showed a bacterial growth after the culturing. Majority of microorganisms such as *Staphylococcus spp*. (90.5%), *Escherichia coli* (6.0%) and *Streptococcus spp.* (3.5%) were isolated from milk sample. Factors such as breed, age, parity, stage of lactation, farming system, housing system, calf suckling after milking, isolation of infected cows, hygienic practices and milk production were significantly ($p<0.05$) affected prevalence of SCM. Prevalence of SCM was high in European crosses in terms of odds ratio (OR: 21.34) compared with local breed. More than 8 years old cows (OR: 4.5) and, more than 5 parity number (OR: 8.8) had higher chance of SCM compared with lower age and parity number cows. Later stage of lactation (OR: 6.4) compared with early stage of lactation, intensive farming system (OR: 10.3) compared with extensive farming system, closed housing system (OR: 10.3) compared with open housing system, calf not suckling after milking (OR: 17.9) compared with calf suckling after milking, rearing of infected cow with other cows (OR: 7.0) compared with rearing of infected cows with isolated shed, poor hygienic practices (OR: 12.6) compared with good hygienic practices, and milk production of 3-6 L (OR: 6.9) were associated with higher chances of subclinical mastitis in terms of odds ratio. In general, estimated economical loss from 66 infected cows was Rs. 471,744 per lactation. Current study revealed that prevention of SCM could reduce loss in milk production.

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Water quality parameters of shrimp farms and growth performance of shrimps in Batticaloa district

T. Mirnalini

Shrimp culture received maximum importance worldwide due to its unique taste, high nutritive value and persistent demand in the world market. In Sri Lanka, shrimp culture operations are concentrated in North Western province. At present this farming has become as an important industry in Batticaloa with a newly established shrimp hatchery in Puthukudirippu. Although the profitability in shrimp farming is lucrative, high risk is associated in the production processes due to rapid degradation of pond water quality and consecutive disease outbreak on shrimps.However, there are lack of information available on the water quality parameters of shrimp culture conditions in Batticaloa. Hence, a study was conducted to analyse the water quality parameters and growth performance of farmed shrimps in Batticaloa district to predict the standards of shrimp culture conditions. The study was carried out in Vattawan, Kavathamunai, Eachchantivu and Karaiyakkantivu shrimp farming areas of Batticaloa district. A total of 21 farms were selected using stratified random sampling method to collect data on water quality parameters (temperature, salinity, pH, total ammonia, alkalinity, dissolved oxygen), growth performance of shrimp (growth rate, cumulative FCR) and other management practices (pond size, stocking density, usage of paddlewheel). The study revealed that *Penaeus monodon* was cultured under semi intensive system in Batticaloa. The average stocking density of post-larvae was 14 ± 3 m^{-2}. The average paddlewheel usage was one per 0.2 ± 0.1 ha. Stocking density and paddlewheel usage was different ($P<0.05$) among shrimp farming areas. The water quality parameters of shrimp ponds were maintained within the acceptable range throughout the growth cycle in all areas. Mean values of temperature (30.1 ± 1.0 ^{o}C), salinity (11 ± 2.4 ppt), pH (8.3 ± 0.3) ,total ammonia (0.22 ± 0.2 $mgL^{-1)}$, alkalinity (135 ± 16 mgL^{-1}) and dissolved oxygen (7.43 ± 0.73 mgL^{-1}) were within the tolerable limit. There was different ($P<0.05$) in salinity, pH and alkalinity of pond water. However, there was not different ($P<0.05$) in pond water temperature and total ammonia concentration among the farming areas. Average body weight of shrimps was 30.8 ± 6.4 g and average length was 15.3 ± 0.9 cm at harvest. Condition factor of cultured *P. monodon* was 0.86 ± 0.06 in Batticaloa district. The length-weight relationships and condition factor revealed that Batticaloa district is suitable for the culture of *P. monodon*. Shrimp farmers in Batticaloa district take considerable efforts

in managing the farm in all aspects, including pond preparation, water quality, feeding and biosecurity measures throughout the growth cycle.

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CROP SCIENCE

Effect of foliar application of nutrition solution (Albert) on growth and yield of Tomato (Lycopersicon esculentum Mill)

A.M.M. Ikram

An experiment was carried out to study the effect of Albert nutrition solution as a foliar spray on growth and yield of tomato (Lycopersicon esculentum Mill). This experiment was laid out in a completely randomized block design (RCBD) with four blocks, each block with the seven treatments, T1-no spray, T2- (1 g/l nutrition solution applied two times), T3– (1 g/l nutrition solution applied three times), T4- (1 g/l nutrition solution applied four times), T5- (2 g/l nutrition solution applied two times), T6- (2 g/l nutrition solution applied three times), T7- (2 g/l nutrition solution applied four times).The results showed that foliar application of nutrition solution had significant ($P<0.01$), effects on agronomic parameters of tomato over the control. The maximum plant height (70.58 cm), number of branches (10.25), number of flower clusters per plant, number of flowers per plant, number of fruits per plant (18.25), fresh weight of fruits (48.45) per plant was observed in foliar application of 2 g/l nutrition solution applied four times and also increased pulp weight, seed weight, dry weight of leaves, stem and roots per plant, total soluble solid (5.85 ^{o}brix) and total fruit weight per plant (981.11 g) were high in the treatment of 2 g/l applied four times. In all parameters, the lowest performance was recorded in the control treatment. The results suggested that under the conditions in the experiment, yield could be increased by the application of 2 g/l Albert nutrition solution applied at 2, 4, 6, and 8 weeks after transplanting. Therefore, foliar application of nutrition solution is one of the ways to increase yield and also can be reduced usage of chemical fertilizer.

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Effect of graded levels of nitrogen on vegetative growth and reproductive performance of Jasmine (*Jasminum sambac* L) in Batticaloa district

T. Tharmayalini

An experiment was carried out to evaluate the effects of graded nitrogen levels on plant height and flower yield of Jasmine (*Jasminum sambac* L.) cv. 'Local' in Batticaloa district during the period of May to September 2015. The experiment was arranged in a completely randomized design with three replications. Graded levels of nitrogen were defined as treatments viz 0 (T1), 50(T2), 100(T3), 200(T4), 300(T5), and 400(T6) g of nitrogen/plant/year. Phosphorous and potassium levels were kept constant throughout the experiment and applied as basal dressing. Urea was used as nitrogen source in this experiment. Split application of nitrogen was practiced at one month interval. Agronomic practices were followed uniformly for all treatments. Growth parameters viz. plant height, leaf area, number of leaves, plant biomass and flowering parameters viz. number of flowers, weight of ten flowers, days taken to first flower emergence and diameter of the flower were measured at monthly interval. Analysis of Variance was performed to determine significant difference among treatments ($p < 0.05$). Results revealed that plant height, leaf area, number of leaves, plant biomass, number of flowers, weight of ten flowers, days taken to first flower emergence and diameter of the flower were significantly higher in T4. Plants grown at this nitrogen level would have received optimum amount of nitrogen. Therefore growth and flower production of Jasmine was higher at this treatment. Lower (50 g/plant/year) and higher (400 g/plant/year) nitrogen levels reduced the growth and flowering of Jasmine. Through polynomial regression analysis, it was found that, optimum nitrogen level for the production of flowers with highest diameter was 243.75 g/plant/year. From this experiment, it could be stated that nitrogen level of 243.75 g/plant/year applied in split at monthly interval is optimum for growing Jasmine in dryzone (Batticaloa district) of Sri Lanka. A commercial scale evaluation is needed to recommend these findings to floricultural industries.

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Growth and yield of dry seeded rice (*Oryza sativa* L.) in natural farming system

R. Kokularathy

Rice (*Oryza sativa* L.) is the world's most important staple food for more than two billion people in Asia and hundreds of millions in Africa and Latin America. Within Southeast Asia, rice provides about 60% of the human food consumption. Presently paddy consumes the largest share of chemical fertilizers and it accounts for approximately 50 percent of the overall use of chemical fertilizers in Sri Lanka. The application of chemical fertilizers is costly and gradually lead to the environmental problems. Organic residue recycling is becoming an increasingly important aspect of environmentally sound sustainable agriculture. Now-a-days, agriculture production based on organic applications is growing in interest and the demands for the resulting products are increasing. Therefore, the effective use of organic materials in rice farming is also likely to be promoted. Natural Farming involves collecting and culturing indigenous microorganisms (IMO) and reintroducing them into an agro ecosystem, which has been managed by people. However, there is little available research and information related to growth and yield of rice in natural farming system. To fill the gap, field experiment was conducted to investigate growth and yield performance of rice in natural farming system.

An experiment was conducted during *maha* season in 2014.The location was selected for the experiment in farmer field at Vaakarai DS Division. The experiment was arranged in a randomized complete block design (RCBD) with twelve replicates in which farmer fields were selected for the experiment and each farm was considered as block. In each farmers field conventional rice plot and natural farming system plot were prepared.Bg 352 rice variety was used for the experiment. Growth parameters and yield parameters was taken within the confined area.

The results revealed that both farming systems affected significantly difference in yield and most of the yield contributing components in rice under local conditions. Among different farming methods, the maximum value of paddy yield (601.5g/m^2) was observed in the natural farming system. Maximum value of plant height (88.1 cm), number of tillers (9.11), number of grains per panicle (105.6), 100 grains weight (2.73g), were observed in natural farming system.

Economic analysis of the data presented in this study shows that natural farming method for rice cultivation is the most economical and attractive option for farming community. The high yield grain and less cost of production per hectare were noted in natural farms (Benefit/Cost= 4.824) as compared with conventional farms (Benefit/Cost=2.39). Finally, the adoption of natural farming technology improves rice farmer's profit.

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Natural and conventional farming of Chilli (*Capsicum annum L.*) cultivation with emphasis on intercropped legumes under natural farming

A. Ponnegipprenthiraraja

The experiment was set up on sandy regosol at Crop Farm, Eastern University Sri Lanka during the period of May – September 2015. Chilli (cultivar KA-2), Blackgram (*cv* MI-1) and Cowpea (*cv* waruni) were included in the experiment which was laid out in Randomized Complete Block Design with four replications to evaluate the production of chilli under natural and conventional farming with emphasis on intercropped legumes under natural farming. Treatments were 45-60 cm spacing of chilli and two rows of blackgram (30 cm × 15 cm) between the chilli rows and 45-60 cm spacing of chilli and two rows of cowpea (30 cm × 15 cm) between the chilli rows under natural farming system. Chilli, blackgram and cowpea under natural and conventional farming systems were also grown in pure stands. Plant height, number of branches, number of flowers, yield and fruit per plant were recorded at regular intervals or at harvest. in addition, land equivalent ratio (LER) as an index of intercropping advantages and economic net return and cost of cultivation were determine to assess the efficiency of intercropping in comparison to natural and conventional farming.

The result showed that there was no significant difference ($p>0.05$) in blackgram and cowpea yield among the treatments. However, there was significant difference ($p>0.05$) in the yield of chilli. In the economic point of view chilli intercropped with cowpea (T5) gave higher return (Rs.342,967.00 per ha) followed by chilli intercropped with blackgramT4 (Rs.335,578.00 per ha), sole chilli under natural farming system T1 (Rs.173,845.00 per ha) and the sole chilli under conventional farming system T6 (Rs.118,913.00 per ha). Land equivalent ratio was superior in all tested intercropping system compared to mono-cropping. Cost of cultivation was high in chilli intercropped with cowpea T5 (Rs. 83,074.00 per ha), followed by chilli intercropped with blackgram T4 (Rs. 80,470.00 per ha), sole chilli under conventional farming system T6 (Rs. 67,538.00 per ha) and sole chilli under natural farming system T1 (Rs. 50,630.00 per ha).

In the present study, the production potential of chilli cultivation is more with intercropped legumes under natural farming system. The net return and rupee per invest is higher in sole chilli under natural farming system

compared to sole chilli in conventional farming system. Intercropping could be recommended for farmers if they could invest money for their cultivation. On the other hand, small holding farmers could establish natural farming system.

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Studies on *in vitro* regenerative performance of different explants of sandal wood (*Santalum album* L.)

T. Vanajah

Sandalwood plant (*Santalum album* L.) is a commercially and culturally important plant species, known for its fragrant heartwood and oil. Due to the high value of heartwood and oil, this species is illegally harvested in large amount which can lead to possible extinction. The present study was aimed to examine the *in vitro* regenerative performance of different explants of *Santalum album.* Therefore, various types of explants namely, shoot tips, stem segments, immature leaf, immature leaf segments, mature leaf, petiole, and single nodal segments were excised from the healthy stem cuttings of two years old seedlings and also mature seeds from ten years old healthy mother plant. The excised explants were dipped in 70% ethanol for 30 sec and immersed in 25% Clorox^{TM} (Sodium hypochlorite, 5.25% active ingredient) with 1 - 2 drops of tween 20 for 20 min then rinsed three to four times thoroughly in sterilized distilled water until free from Clorox residues. Sterilized segments of plant parts were separately cultured on MS medium containing 0.5 mg/l BAP aseptically. The result revealed that *in vitro* response percentage of the cultured explants clearly showed significant difference ($P<0.01$) among the explants. It ranged from 13.3% to 56.6%. Immature leaf segments were showed higher (56.6%) *in vitro* response and better survival rate (65%). Single nodal segment and shoot tip explants showed moderate *in vitro* response but the survival rate was significantly high (80%) in shoot tips at four weeks of culture. Petiole and mature leaf explants failed to show *in vitro* response and lower survival rate. Seed explants cultured on MS media supplemented with 0.5 - 1.0 mg/l GA_3 were swollen after four weeks of culture. These swollen seed explants were transferred to MS medium containing 1.0 mg/l BAP at eight weeks of culture and there was no germination response.

Further, study was done to optimize the growth regulators and their concentrations for efficient direct or indirect organogenesis from shoot tips, single nodal segments and immature leaf explants of sandal wood. Therefore, the explants were cultured on MS medium supplemented with two different concentrations of BAP (0.5 mg/l, 1.0 mg/l) and 2,4 D (0.5 mg/l, 1.0 mg/l). Shoot tip explants were showed significantly higher (63.3%) *in vitro* response on 1.0 mg/l BAP. Shoot elongation and growth were occurred at the second week of culture then the succulent shoot growth and the callus formation were observed within four weeks of culture. 2,4 D supplemented

medium was showed significantly lower (16.6%) *in vitro* responses. The single nodal explants were exhibited axillary shoot formation significantly high on 1.0 mg/l BAP within four weeks of culture thereafter no further proliferation. Immature half leaf explants was exhibited significantly higher (73.3%) *in vitro* response on 1.0 mg/l 2,4 D than other media. Better nodule formations were observed after ten days of culture. Then, the nodules were developed into compact greenish yellow callus within four weeks beyond this period no proliferations occurred and prone to browning. The extent of nodular formation was slightly lower on 0.5 mg/l 2,4 D medium. Then the explants were subcultured on MS medium supplemented with 1.0 mg/l BAP. After four weeks of subculture showed better proliferation on callus was noted and the colour was changed from greenish yellow to creamy white. The callus formed in 1.0 mg/l 2,4 D medium failed to show any morphogenetic response within eighth week of culture.

Furthermore, another study was done to induce the embryogenic callus from the shoot tips and half leaf explants (vertically cut with midrib). Therefore, the explants were cultured on MS medium containing 1.0 mg/l BAP and 1.0 mg/l ascorbic acid with or without 1.0 g/l casein hydrolysate. Immature half leaf (vertically cut with midrib) explants were cultured on 1.0 mg/l BAP with antioxidant exhibited yellowish white calli. The shoot tip explants cultured on 1.0 mg/l BAP with antioxidant were exhibited better formation of creamy white friable embryogenic callus at sixth week of culture. This friable callus modified into somatic embryo at the eighth week of culture. Therefore, there is a possibility to produce mass amount of sandalwood plantlets.

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