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Department of Agronomy

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Morphological characterization and germ plasm evaluation of eggplant (*Solanum melongena* L.)

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Index No : 419

Eggplant (*Solanum melongena* L.) is an important vegetable popular among farmers and consumers in Sri Lanka. It can be used in variety of culinary preparation and adds taste and nutrient to our diet. In Sri Lanka, the crop can be grown in areas where having a wide range of soil and climatic condition. The research and development of its important crop is now being carried out by the government and the private sector organization. Evaluation and characterization of genetic resource is the first step of any crop improvement program. Therefore, a field experiment was carried out at university experimental station, Dodangolla, mid country intermediate zone (IM₃), during February to June 2010 to evaluate morphological diversity of 25 accessions of eggplant. Five plants of each accession were planted in a plot with three replications. Data recorded on agronomic traits such as plant height, growth habit, number of branches, number of leaves, leaf length and width, leaf colour, leaf lobbing and tip angle, flower colour, flower position, number of stamens, number of petals and sepals, number of flower/inflorescence, 50% flowering, fruit length and width, fruit weight, fruit shape, fruit curvature and fruit colour were analysed using multi-variate analysis (cluster analysis) by SAS version 6. The results revealed that 25 varieties were grouped into two main clusters and three sub clusters. Main group consists of eighteen varieties. Most of the landraces including all commercial and recommended varieties by the Department of Agriculture were clustered in to one group at the frequency of 9.8 indicating their close genetic relatedness. Three varieties having agronomic traits associated with low productivity, such as late flowering, low average fruit weight, low branch number and low leaf number, clustered in to one group.

Keywords: eggplant, clusters, landraces, agronomic traits

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Yield and growth performance of ground nut under different irrigation systems and seed treatments

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Index No : 432

The study of yield and growth performance of ground nut (Variety Tissa) under different irrigation systems and seed treatments was carried out at the District Agricultural Training Centre (DATC), Thirunelvely, during February to June 2010. The experiment was carried out with six treatment combinations in two factor factorial Randomized complete block design (RCBD) with four replicates. Groundnut was planted at a recommended spacing of 45 cm × 15 cm. In this experiment, three seed treatments such as captan, thiram and no fungicide treatment (control) and two irrigation systems such as basin and sprinkler were selected as treatment combination. Growth and yield parameters of groundnut were recorded and analysed in the significance level of $\alpha = 0.05$. The height of groundnut was significantly differed between irrigation systems, but non-significant between seed treatments. The maximum plant height was recorded in the basin irrigation system. The average number of nodule per plant was significantly influenced by irrigation at the stages of maturity and harvesting but not at pod filling stage. The highest number of nodules was recorded in T₆ treatment (without seed treatment and sprinkler irrigation system). The average number of nodule per plant was not significantly influenced by seed treatment at any stages. Average number of pod per plant was significantly influenced by seed treatment but not irrigation system. The highest number of pods was recorded from T₁ treatment (captan seed treatment with basin irrigation system). The yield of ground nut was significantly influenced by both irrigation and seed treatment. The highest yield (3.08 t/ha) was obtained from T₁ treatment (captan seed treatment with basin irrigation system). Considering the performance of ground nut the captan seed treatment with basin irrigation system can be recommended for suitable for ground nut cultivation.

Keywords: seed treatment, irrigation system, ground nut

Supervisor: Dr. (Mrs).S.Sivachandiran

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Growth and yield response of chilli intercropped with different density of beetroot under different fertilizer regimes

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Index No : 440

Effect of spatial arrangement of beetroot and chilli with different fertilizer regimes on growth and yield in an intercropping system was studied at the District Agricultural Training Centre (DATC), Thirunelvely, during February to June 2010. The treatment combinations consist of two different beetroot spacing (40 cm × 15 cm and 30 cm × 15 cm) and three level of fertilizer regimes (full organic, ½ organic + ½ recommended inorganic, full recommended inorganic) was carried out in a two factor factorial Randomized Complete Block Design (RCBD) with three replicates. The same population of chilli (*Capsicum annuum*) was maintained at the spacing of 120 cm × 45 cm in all treatment combinations. The beetroot variety Crimson Globe and KA₂ chilli variety was selected for this experiment. Beetroot was planted 10 days after planting of chilli. Growth and yield parameters of chilli and beetroot were recorded and analysed at significance level of $\alpha = 0.05$. The plant height and canopy width of chilli significantly differed among beetroot spacing but not in fertilizer regimes. The highest plant height (40.57 cm) and highest canopy width (32.14 cm) were recorded from T₂ treatment (Beetroot spacing 40 cm × 15 cm and ½ organic + ½ recommended inorganic fertilizer regimes). The total yield of chilli significantly differed among beetroot spacing but not in fertilizer regimes. The highest yield (5.29 t/ha) was obtained from T₂ treatment (Beetroot spacing 40 cm × 15 cm and ½ organic + ½ recommended inorganic fertilizer regimes). Other yield parameters of chilli such as average number of pods per plant and average pod weight per plant were also higher in T₂ treatment. The total yield of beetroot significantly differed among both beetroot spacing and fertilizer regimes. The highest yield was obtained from T₆ treatment (beetroot spacing 30 cm × 15 cm and full recommended inorganic fertilizer regimes). Light intensity significantly differed among beetroot spacing treatment. The interception of light was higher in beetroot spacing of 30 cm × 15 cm (T₄, T₅ and T₆). Land equivalent ratio (LER) was significant among treatments and highest was recorded in T₆ (1.21). Total income was higher in the treatment T₆. Considering yield, profit and other quality parameters, beetroot spacing of 30 cm × 15 cm with ½ organic + ½ recommended inorganic fertilizers was the best options for intercropping of beetroot with chilli in calcic red yellow latasol soil.

Keywords: Fertilizer regime, spacing, beet root, chilli

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Effect of Alley Cropping and fertilizer regimes on growth and yield of Capsicum

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Index No : 442

A field experiment was conducted during February 2010 to June 2010 to assess the effect of alley cropping and different fertilizer regimes on growth and yield of capsicum (*Capsicum annuum*) variety Hungarian Yellow Wax at the Department of Agriculture (Extension), Thirunelveli. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replicates with six treatment combinations in two different cropping systems (alley and without alley) and three different fertilizer levels (Recommended level of inorganic fertilizer, half recommended level of inorganic fertilizer with recommended level of organic fertilizer, and organic fertilizer alone). *Gliricidia sepium* was used as hedgerow tree species in the alley field. Capsicum was planted at recommended spacing of 30 cm × 15 cm in the alleys which had an inter hedgerow spacing of 4.2 m and intra hedgerow spacing of 0.5m. All other agronomic practices were adopted based on Department of Agriculture recommendation. The growth parameters and yield parameters were analysed at $\alpha = 0.05$ by using SAS. The height of capsicum plant was significantly higher in the alley plots. The height of plant was non-significant among fertilizer treatments. The number of fruits per plant was not significant between the cropping systems. The average length and weight of the capsicum fruits significantly differed among cropping systems and fertilizer treatments. The maximum were recorded in alley system treated with recommended level of inorganic fertilizer. Yield of capsicum were not significantly differed among all treatments. Leaf curl incidence was significantly lower in the alley cropping system. Considering yield parameters and leaf curl incidence, capsicum cultivation under alley cropping with application of recommended inorganic fertilizers can be recommended as a suitable option for Jaffna farmers.

Keywords: Capsicum, *Gliricidia sepium*, fertilizer levels, Alley cropping

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under different irrigation systems in Jaffna District

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Index No : 454

Chilli (*Capsicum annuum*) is one of the most important cash crop grown in Sri Lanka. It has become an essential ingredient in Sri Lankan meals. Chilli is extensively grown for dry chilli production, but part of the crop is harvested as green pods. Generally Jaffna farmers get low yield (8-10 t/ha) from chilli cultivation, mainly due to pest and diseases incidence. Thus, a study was carried out at the district Agricultural Training Centre (DATC), Thirunelvely during the period of April to August 2011 to study the varietal performance of green chilli under different irrigation systems. The treatments consisted of three varieties (KA₂, MI – green and Cimi F₁ hybrid) and three irrigation systems (basin, sprinkler and drip) in split plot design with three replicates. The plant height and canopy width were statistically significant among varieties but non-significant between irrigation systems. The maximum plant height (64.13 cm) and canopy (58.02 cm) width was obtained in Cimi F₁ hybrid. Incidence of thrips attack was significantly differed among irrigation systems and the sprinkler irrigation system was lowest incidence of thrips attack. The fruit length of chilli was significantly different among the varieties. The pod number/plant and pod weight were non-significant among varieties and irrigation systems. The difference in yield of chilli was statistically significant among varieties and irrigation systems. The higher yield was recorded under sprinkler irrigation system due to the low incidence of pest attack at 2nd harvesting (11.05 t/ha) in Cimi F₁ hybrid. It can be concluded that Cimi F₁ hybrid variety can be cultivated under sprinkler system to get higher yield with low pest and disease incidence.

Keywords: green chilli, irrigation system, thrips attack, yield

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**Cultivar variability on Karuthacolomban mango
(*Mangifera indica* L.) Based on phenotypic characters**

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Index No : 460

Several mango types are cultivated in Jaffna district is affected by several factors. Among them the karuthacolomban types is very promising type and Jaffna karuthacolomban has very high demand among consumers. Anyway due to the unplanned and open supply of planting materials, there is a lot of variation among these cultivars. To identify the different types among the karuthacolomban cultivars based on physiochemical and sensory characteristics a study was carried out in Thenmaradchy division of Jaffna district. The plants were selected from three GN divisions and labeled and data were collected and tabulated. Principle component Analysis (PCA) was carried out to characterize the physiochemical properties. Cluster analysis was conducted to group the plants based on their similarities. From the dendrogram, four clusters are selected based on physical and chemical analysis. Sensory panel score were analyzed by Firdmen's non-parametric ANOVA. Correlation was observed between mean sensory scores and chemical properties of the fruits. Based on the physical analysis variables, cultivars with higher mean for weight of fruit (360.743g, 302.792 g) flesh (266.26 g, 223.669 g), peel (64.280 g, 61.764 g) and stone (34.263 g, 32.853 g), moisture content(86.723 % were grouped into cluster 3 and cluster 4. The non-significance difference was recorded for stone length, fruit diameter and pulp to stone ratio among the clusters. Based on chemical analysis, total soluble solids (TSS) and titrable acidity (TA) significantly high in both cluster 3 (22.0067⁰ Brix, 0.40249 %) and cluster 3(15.605⁰ Brix, 0.43947%) respectively. Total sugar and crude fiber significantly high in both cluster 1(13.5697 g/ 100 g: 4.7117 %) and cluster 2(13.9878 g/100 g, 4.5911 %) respectively. Based on these analyses, plants which are grouped into cluster 1 and 2 in chemical analysis and cluster 3 and cluster 4 in physical analysis have the promising characters. Out of these plants which had high correlation with mean sensory scores, four plants are selected as mother plants. Further molecular level study is needed to see whether these differences are due to the genetic nature or due to the environmental adaptation.

Keywords: cultivars, karuthacolomban, physio chemical, Cluster analysis, dendrogram

Supervisor: Dr. (Mrs).S.Sivachandiran

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Varietal performance of red onion under different irrigation systems in Jaffna District

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Index No : 465

Onion is one of the important cash crop in Jaffna peninsula. A study was conducted to investigate varieties performance of red onion under different irrigation systems at District Agriculture training Centre ,Thirunelvely during April to July 2011. The treatment combination consisted of three varieties of red onion (TVR, Jaffna local and Kalvethalam) and three different irrigation systems (Sprinkler, Drip and Basin) and the experiment was carried out two factor factorial Randomized Complete Block design. Irrigation systems were non-significant on the leaf number of onion varieties. Sprinkler and drip irrigation systems were significantly influence on plant height. The bulb number, circumference and yield of onion were significantly differed in irrigation systems and non-significant among varieties of onion. The drip irrigation system provided significantly higher bulb number (6.32) in TVR variety and bulb circumference (7.7 cm) in Kalvethalam. The highest yield was obtained in TVR variety (14.25 t/ha) in Drip irrigation system. Therefore it can be concluded that TVR onion variety can be cultivated under Drip irrigation to get higher yield with limited water resource.

Keywords: Irrigation system, bulb circumference, Onion

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Performance of different varieties of green gram and sesame inter cropping under paddy fallow system in Jaffna District

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Index No : 472

A field experiment was conducted to study evaluated the performance of different varieties of green gram and sesame inter cropping under paddy fallow system in Jaffna district in *Yala* 2011 at two different locations as Chulipuram and Chempianpattu. The six treatment combinations comprising two varieties of green gram (ARI and local) and sesame (MI-1 and UMA) under different planting methods (broadcasting and row seeding) were checked at two factor factorial randomized complete block design with three replicates. The yield range of the crops were recorded in the Chulipuram and Chempianpattu areas and analysed. The yield of crops was significantly higher in row seeding in both locations. The net return was highest in local green gram and MI-1 in Chulipuram and Chempianpattu location. The LER value also highest in row seeding such as 1.05 and 1.00 in Chulipuram and Chempianpattu location respectively. Therefore it can be concluded that local green gram variety and MI-1 sesame variety are the suitable varieties for inter crop in row seeding in paddy fallow system in the Jaffna District.

Keywords: inter cropping, sesame, green gram, LER

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Phenotypic variation of cultivated *Musa* sp in Jaffna Peninsula

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Index No : 480

The banana (*Musa* sp.) is an important fruit crop among farmers and consumers of Jaffna. The Jaffna is the major banana cultivation district. A total of 23 banana cultivars were identified in Jaffna by department of agriculture. From the 23 cultivars, 12 cultivars are more popular among farmers and consumers so that these 12 cultivars were selected to this study. This paper focuses on morphological and nutritional variation of 12 cultivars of *Musa* sp. collected from District Agricultural Training Centre, Thirunelvely and a selected banana field in Neervely. The Principal Component Analysis (PCA) was carried out to identify the descriptor, i.e. the most important for characterization and classification of 12 cultivars of *Musa* sp. Cluster analysis was conducted to explain the relationship among and within groups in the dendrogram, while Proc GLM procedure (SAS institute 1993) were carried to identify the influence of each individual character on cluster grouping. Four groups were derived from the dendrogram and from mean procedure every cultivars shared the value ≥ 1 indicating that they have distinct differences in their phenotypic characters even though they are of the same cultivar.

Keywords: banana, dendrogram, Cluster analysis, phenotypic characters

Supervisor: Dr. (Mrs).S.Sivachandiran

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The Performance of Nili-Ravi buffaloes and Sahiwal and Sahiwal crosses in the Intermediate zone of Sri Lanka

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Index No : AG 431

The objectives of the study were to evaluate production capacity and reproduction parameters of Nili-Ravi buffaloes, Sahiwal, AFS and AMZ cattle reared at the National Livestock Development Board farm, Nikaweratiya, Sri Lanka. Data on age at first calving, lactation length, dry period, total milk yield, calving interval, gestation length, lactation number, birth weight and calving to service period were collected during the period 1990 – 2010 and analyzed using the statistical package SAS 6.12, Eighth version. With regard to Nili Ravi buffaloes the estimated LS mean value for production traits of lactation milk yield, lactation length, calving interval and birth weight were 1612.54 kg/lactation, 288.46 days, 12.94 months and 30.29 kg, respectively. The least square mean value of age at first calving, calving to service period, gestation period and dry period were 49.27 ± 08.14 months, 138.32 ± 54.46 days, 309.92 ± 25.37 days and 77.97 ± 29.24 days, respectively. For Nili Ravi buffaloes milk yield was significantly influenced by age at first calving, lactation length, birth weight and season of calving. The lactation length was significantly influenced only by lactation number. Calving interval was significantly influenced by season of calving, dry period and lactation length. But birth weight was significantly influenced only by sex of calves. The estimated LS mean value for production traits of lactation milk yield, lactation length, calving interval and birth weight were 1385 kg/lac, 252.13 days, 11.69 months and 21.59 kg for cattle breeds, respectively. The least square mean value of reproductive traits age at first calving, calving to service period, gestation period and dry period for Sahiwal, AFS and AMZ were 43.59 ± 7.05 months, 94.71 ± 36.68 days, 283.42 ± 15.81 days and 86.58 ± 24.59 days; 38.89 ± 8.34 months, 89.50 ± 35.59 days, 286.25 ± 12.09 days and 87.02 ± 20.86 days; 40.65 ± 7.70 months, 76.71 ± 47.96 days, 279.17 ± 37.80 days and 67.25 ± 25.20 days, respectively. For cattle milk yield was significantly influenced by lactation length and breed of the animal for cattle breeds. The lactation length was significantly influenced by sex of the calves and breed. Calving interval was significantly influenced by birth weight and breed. Birth weight was significantly influenced by breed. For Nili Ravi, could be concluded that productive and reproductive parameters could be improved further through proper feeding, health care management and adoption of rigorous culling. For cattle breeds performance of the Sahiwal is the least among the three breeds compared but its crosses performed better. Between AFS and AMZ, AFS performs better than AMZ for most of the traits but the differences were not significant. An economic analysis should be performed to confirm it.

Key words: Nili-Ravi, Sahiwal, AFS and AMZ, Reproduction parameters

Supervisor: Dr. (Miss). J. Sinniah

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Productive and reproductive performance of Holstein Friesian cattle in the hill country of Sri Lanka

Student Name : Gnanapragasam Krishanthan

Index No : AG 438

The objective of the present study was to describe the productive and reproductive performance of Holstein Friesian dairy cows in the Hill country zone of Sri Lanka. Data for the present study was obtained from one of the NLDB farms (Bopathalawa) in the Nuwara-Eliya district, Sri Lanka over a period of eleven years (1999-2010). The overall data comprised of 635 records of 171 animals. The traits recorded included calving interval, age at first calving, calving to service period, number of services per conception, gestation length, lactation length, lactation number, dry period, milk yield, birth weight, sex of calf, year and month of calving, year and month of dry off. Data were analyzed using SAS (Version 8). Results showed that Least Square mean for milk yield was 2704.19 Kg, and it was significantly influenced by age at first calving, birth weight, lactation length, dry period, calving to service period and season of calving. The cows calved during the wet season showed significantly higher total milk yield compared to those calving during the hot and humid seasons. The average least square mean for lactation length was 342.37days and it was significantly influenced by lactation number, dry period, calving to service period and season of calving. The mean birth weight was 26.83Kg and it was significantly affected by sex of the calf and season of calving. The mean of calving interval was 15 ± 4 months and none of the factors influenced the calving interval. The average age at first calving, gestation length, dry period, and calving to service period were 40.6 months, 279 ± 5 days, 78 ± 28 , and 101 ± 52 days, respectively. For the traits of the total milk yield, birth weight, and number of services per conception falls within the average values observed in other tropical countries. However, there is room for improvement of these traits as higher values are also reported in the literature. For the traits such as lactation length, calving interval, calving to service period and age at first calving the values recorded in the hill country were higher than the optimal or normal values expected for these trait to maintain proper calving interval, to get maximum number of calves and maximum milk yield for the lifetime of the cows.

Key words: Holstein Friesian, Hill country zone, Productive and reproductive performance

Supervisor: Dr. (Miss). J. Sinniah

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Development of a palmyrah (*Borassus flabelifer*) fruit pulp flavoured pasteurized milk toned with soy (*Glycine max*) milk

Student Name : Gunaratnam Guberan

Index No : AG 477

A study was conducted to develop a palmyrah fruit pulp (PFP) (*Borassus flabelifer*) flavoured pasteurized milk toned with soy milk (*Glycine max*) using different percentages of PFP and soy milk with 7.5% (w/v) of sugar and 0.05% (w/v) of Cremodan, considering the recommendations of Sri Lanka Standard (SLS) for flavoured pasteurized milk. Initially data were collected using questionnaire to find out the personal preference for fluid milk within the A/L students of 1 AB schools in Municipal Council area of the Jaffna District. Preliminary trials were conducted using 30 member panels to select mostly preferable combination of cow milk, soy milk and PFP for formulating the final product. Self constructed scoring cards were used to collect the information from the respondents. Pasteurized flavoured milk consumption was lower than the UHT milk consumption among the school students. In preliminary trial, Flavoured milks were prepared by adding 2%, 4%, 6%, 8%, and 10% of PFP (v/v) to cow milk. In second trial, flavoured milks were prepared with the flavours of PFP, vanilla, and Chocolate flavours. According to the results of first two trials, third trial was conducted with 10%, 20%, 30%, and 40% of soy milk. Most preferred product from third trial was compared in a fourth trial with vanilla flavoured milk as a control along with pasteurized chocolate flavoured milk commercially manufactured in Jaffna district. 6% of PFP and 10% of soy milk levels were selected as best by sensory panel. This product, and vanilla flavoured pasteurized milk used as control were subjected to proximate analysis. Results revealed significant differences ($P < 0.05$) in chemical composition between two samples. PFP flavoured pasteurized milk toned with soy milk was rich in protein and lower in fat, and the fibre content was big plus, while the (vanilla flavoured pasteurized milk) had none. Microbial assessment was carried out for *coliforms* and the results revealed that none were observed in the most preferred product. The formulated flavoured milk with 6% of PFP and 10% of soy milk concentration was found to be superior in quality and could be stored at $4 \pm 1^\circ\text{C}$ for 12 days without any significant changes in quality. From the results it could be concluded that the PFP flavoured pasteurized milk toned with soy milk compares well with commercial pasteurized flavoured milk sample organoleptically, nutritionally, and it costs much less to manufacture in order to launch a sustainable enterprise.

Key words: *Borassus flabelifer* fruit pulp, Soy milk, Flavoured pasteurized milk

Supervisor: Dr. K.F.S.T. Silva

Department of Animal Science, Faculty of Agriculture, University of Peradeniya,

Sri Lanka

Productive and reproductive performance of Jersey cattle in hill country of Sri Lanka

Student Name : Pathinathan Roney Parathavarman Fernando

Index No : AG 466

A retrospective study was carried out to evaluate the productive and reproductive performance of Jersey cattle in hill country of Sri Lanka. A 10 year (2000-2010) set of dairy records of 131 Jersey cows collected from Dayagama National Livestock Development Board farm situated in Nuwara -Eliya district, Sri Lanka was analyzed. Total number of 556 performance records of 131 Jersey cows, was used for the analysis. The production traits of lactation milk yield, birth weight, lactation length and calving interval and the reproductive traits viz. age at first calving, number of services per conception, calving to service period, days open, gestation length and dry period were analyzed using SAS (Version 8). The overall means of lactation milk yield, lactation length, birth weight and calving interval of the Jersey cattle in the farm were 2235 ± 77 Kg, 323.78 ± 91.02 , 20.97 ± 2.35 , and 447.73 ± 142.88 days, respectively. The overall means of age at first calving, calving to service period, days open, gestation length and dry period in the farm were 41 ± 10 months, 92 ± 66 days, 156 ± 123 days, 276 ± 12 days and 120 ± 122 days respectively while the number of services per conception and incidence of rates of abortion and still birth were 2.1 ± 1.29 , 3.96% and 5.4%, respectively. From the findings it could be concluded that the productive and reproductive traits of Jersey cattle at the Dayagama farm could be improved through improved, feeding, housing, breeding and health care aspects.

Key words: Jersey cattle, Productive and reproductive performance, Hill country

Supervisor: Dr. (Miss). J. Sinniah

Department of Animal Science, Faculty of Agriculture, University of Jaffna, Sri Lanka

Development of a ripened Jack (*Artocarpus heterophyllus*) fruit and Soy (*Glycine max*) milk incorporated set yoghurt

Student Name : Sarmini Navarathnam

Index No : AG 467

In this study, an attempt was made to develop a value added set type fruit yoghurt with the acceptable combination of milk, soy milk (*Glycine max*), and ripened jack fruit (*Artocarpus heterophyllus* Lain). To select the most preferable seasonal fruit available in Jaffna preliminary study was carried out using 30 untrained panellists. Suitable percentages of the jack fruit in small chunks and soy milk were incorporated to yoghurt also determined by organoleptic evaluation. Self constructed scoring cards were used to collect the information for sensory attributes from the respondents. In the first trial, yoghurt was prepared by separately adding mango, jack, pineapple, and grape fruit chunks. Once jack fruit was selected as the most preferred fruit, 3%, 5%, and 7% level of jack fruit chunks were added to yoghurt in order to determine the optimal level of jack fruit. Third trail was conducted with 5%, 10%, 15%, 20%, and 25% of soy milk toned yoghurt without any fruit addition. Subsequently after the optimum level of 5% jack fruit and 10% soy milk were determined, fourth trail was conducted with 5%, 7%, and 9% level of jack fruit chunks added to an optimal level of 10% soy milk toned yoghurt. Most preferred product from all panels (yoghurt with 5% jack chunks, yoghurt with 10% soy milk and yoghurt with 7% jack chunks and 10% soy milk) was compared in the final trail with normal yoghurt being used as control. At the same time, physico-chemical and microbiological analyses were also conducted. The sensory data were analyzed by Friedman non-parametric statistical method using Minitab and the proximate data were evaluated by Proc ANOVA using the SAS. Mean rating for three replicates were done by Duncan statistical method. The soy-jack yoghurt differed significantly ($p < 0.05$) in sensory and nutritional attributes. The control significantly differed ($p < 0.05$) in fat, protein, fiber, sugar, and ash content with others. Soy-jack yoghurt sample had the highest protein % (3.35 ± 0.02), the lowest fat % (4.08 ± 0.02). Presence of fiber is a big plus in the product since the normal yoghurt has none. In addition, the fat content and the absence of *coliforms* satisfied the Sri Lankan Standard. Based on the pH, titratable acidity, syneresis and visual observation revealed that the soy-jack yoghurt was found to be superior in quality and could be stored at refrigerated temperature for 13 days without any significant changes in quality. According to the results it could be concluded that soy-jack yoghurt was superior to normal yoghurt, jack incorporated yoghurt, and soy toned yoghurt sample organoleptically and nutritionally. It could be manufactured for a sustainable market with a low cost of production.

Key words: *Artocarpus heterophyllus* Lain, Soy milk, Set type fruit yoghurt

Supervisor: Dr. K.F.S.T. Silva

Department of Animal Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka

Effect of partial replacement of fish meal with Cassava leaf meal on the performance of Broilers

Student Name : Jency Sinthuja Mariathas

Index No : AG 483

Ice cream is one of the most popular frozen desserts available all over the world. Sri Lanka as a tropical country entertains a great demand for chilled or frozen products. Among these, ice cream has reached the top as it is very delicious and having high quality food value. Palmyrah is seasonal fruit variety, which has a higher nutritional value. Preliminary study was carried out to find out the best % of palmyrah fruit pulp. Five treatments comprising palmyrah fruit pulp (at 3 %, 6 %, 9 %, 12 % and 15 % w/v) was prepared and sensory evaluation which was carried out by 30 panelists to find the best treatment. The statistical analysis of this sensory evaluation was carried out by using “FRIEDMAN” non parametric test. Based on first sensory evaluation results, the 3 % palmyrah fruit pulp ice cream was selected as the best combination. Then, second study was carried out to find out the best palmyrah-soymilk incorporated ice cream mix with 3 treatments of soymilk % (10 %, 20% and 30% w/v) along with 3 % of palmyrah fruit pulp level in all 3 treatments which was selected from first sensory evaluation. Based on second sensory evaluation the 3 % palmyrah fruit pulp with 20 % soy milk was selected as the best treatment combination. Proximate analysis was done for above these 3 samples. Statistical analysis was carried out by using SAS ANOVA. There were significant differences observed among the treatments. However, the best selected treatment was 3 % palmyrah fruit pulp with 20 % soy milk having 14 % fat, 2.4 % protein, 16% sugar, 18 % milk solid non fat, 0.8 % fiber and 32 % total solids with an overrun of 47 % and a melting rate of 0.8 min /1 g.

Key words: Palmyrah fruit pulp, Soy milk, Ice cream

Supervisor: Dr. K.F.S.T. Silva

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Sri Lanka

Small scale production of selected bio agents using kitchen waste, industrial waste and low cost materials

Student Name: Kalyani Nagendrarajah

Index No : AG 441

Investigations were carried out during January to June 2010 at the department of Agricultural Biology, University of Jaffna to evaluate the substrates for mass production of *Nomuraea rileyi* in different techniques, comparing the growth rate of *N. rileyi* with different media, pathogenicity of *N. rileyi* against insect pests and multiplication of effective microorganisms (EM) by using Distillery spent wash (DSW). Six types of sterilization techniques were investigated. Among the six techniques tested, the autoclaved sterilization yielded a maximum of 8.72×10^9 spores/g of at 28 days after inoculation (DAI) and pressure cooker + 6% v/v H₂O₂ technique yielded the next best of 8.66×10^9 spores/g at 28 DAI. These results clearly indicate pressure cooker + 6% v/v H₂O₂ technique is economical for mass production of *N. rileyi* compare to autoclave sterilization. The household waste evaluated was found to be the best for the growth of the *N. rileyi*. Among the household waste tested, kitchen waste supported maximum spore yield 9.2×10^9 spore/g at 21 DAI. The growing medium of king yam recorded the maximum radial growth of 9cm followed by elephant foot yam medium (8.925cm) on 4th day. The least radial growth was observed in SMAY medium (8.75cm) on 4th day. Coconut scraping after milk extract was supported the spore load and can be suitable to develop in to formulation. *N. rileyi* proved pathogenic to larvae of *Papilio demoleus*, *Leucinodes orbonalis* and *Plutella xylostella*. Mortality of *P. demoleus*, *L. orbonalis* and *P. xylostella* was found at 48 hours after application of *N. rileyi* under the laboratory condition ($25 \pm 2^\circ\text{C}$ temperature and $80 \pm 5\%$ relative humidity). EM was multiplied best in the DSW, which is an industrial waste that can be used as locally available cost effective best media.

Key words: Distillery spent wash, *N. rileyi*, waste, sterilization, radial growth

Supervisors: Dr. G. Mikunthan

Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Sri Lanka

Effect of vermiwash on the productivity of *L. rotundifolia* and mass production of vermiwash

Student Name: Ahalya Sundaralingam

Index No : AG 426

A pot culture experiment was conducted during January to May 2010 to know the impact of vermiwash on the growth parameters of *Livistona rotundifolia* seedlings along with regular foliar fertilizer at Green Farms Ltd, Marawilla. Observation on growth parameters was taken. The results revealed that vermiwash spray enhanced growth parameters of number of leaves/plant, plant biomass and leaf color. From these result it could be effectively exploited for the increasing the production of ornamentals like *L. rotundifolia*. Application of vermiwash without dilution at one month interval has more pronounced effect. The experiment was carried out to identify the correct time for the collection of vermiwash using EC and pH as indicator. Result revealed 20-30 days after the introduction of earthworm was the ideal time for the vermiwash collection. Investigation was carried out to study the suitable substrate for the production for the vermicomposting and vermiwash production using *Dracaena sanderiana*, *Dracaena purple compacta*, *Dypsis lutescens* and mixed with cow dung. Results revealed for the multiplication of the *Eisenia fetida*, *Dypsis lutescens*, for the body weight gain *Dracaena puple compacta* and for the good quality of vermiwash mixed substrate were suitable media. In the study of effect of light in the multiplication of *E. fetida* revealed the *E. fetida* shows highest multiplication in the shaded condition. Effect of vermiwash on the germination percentage and vigour index was carried out in the *L. rotundifolia* seeds. The results indicated vermiwash don't enhance the germination percentage and the vigour index. To evaluate the beneficial fungal growth in vermiwash *Trichoderma* culture was used. *Trichoderma* didn't grow in the vermiwash medium. Pot culture experiment was carried out to study the effect of microbes in the vermiwash to increase the availability of granular fertilizer. Results showed the plant have quick response to the granular fertilizer with vermiwash than they alone.

Key words: vermiwash, *Livistona rotundifolia*, *E. fetida*, *Trichoderma*, fungal growth

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Potential of biorationals in managing pests of queen palm and composition of growing media

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Index No : AG 407

Applications of biorationals is given prime concern to manage pests in an environment friendly way. This study was carried out to compare the efficacy of different biorationals on the management of *Tetranychus urticae* on queen palm, evaluate the growth impacts on Queen Palm and determine suitable combination with coir dust growing media to enhance *Trichoderma* establishment. Biorationals evaluated were; Adhatoda, Neem Seed Kernel Extract (NSKE), Ginger, Vermi wash, *Metarhizium anisopliae*, *Nerium* (Family: Apocynaceae) extract (130g/l), *Nerium* extract (80g/l). Among them more than 90% mortality of *T. urticae* was recorded in the application of *Nerium* extract. NSKE responded next best causing 72% mortality when comparing with other biorationals. Grass hopper damage was comparatively low in *Adhatoda* treated seedlings. Biomass of biorational treated plants had significant increase than chemical treated. Success of field application of *Trichoderma* depends on the rate of establishment on growing media like coir dust. Growth of *Trichoderma* was the best and comparable in cow dung mixed coir dust, which pH and EC values were nearer to the preferable range of Green Farm Ltd standards.

Key words: Queen palm, biorationals, *Nerium* extract, NSKE, *Trichoderma*

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Effect of *Parthenium hysterophorus* and its' management through different methods

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Index No : AG 408

Effect of *Parthenium hysterophorus* (L.) and its' management through different methods carried out by study the biology of *P. hysterophorus* and manage using botanicals and assess the allelopathy property of *P. hysterophorus* and apply the vermitechnology to manage the *P. hysterophorus*. *P. hysterophorus* is a hazardous herb causing economical loss in crop cultivation and animal husbandry. In this study concluded *P. hysterophorus* has shown in road side of the Jaffna districts (Palaly road, KKS road, Pointpedro road etc). Mainly Kopay area has high intensity of *P. hysterophorus* (72%). In vermicomposting, using *P. hysterophorus* alone as substrate have negative effect on worms (*Eisenia foetida*) due to the mortality. Worm activity was increase when *P. hysterophorus* treated with cow dung or other plant residues. Using the uprooted *P. hysterophorus* in vermicomposting, which eight times reduce the spreading of seeds than dried *P. hysterophorus*. The allelopathic effect of *P. hysterophorus* will reduce the overall germination of tomato seeds. The Allelo chemical effect increases with increasing decaying period of *P. hysterophorus* root in composting. *Azadirachta indica* and *Capsicum* extract reduces the germination percentage of *P. hysterophorus* by 24 and 27, respectively. Cross pollinated and phytoplasma infected *P. hysterophorus* cannot produce the seeds. Cross pollinated plant produces yellow colour inflorescences.

Key words: *P. hysterophorus*, vermicomposting, allelopathic effect, germination percentage, Jaffna

Supervisors: Dr. G. Mikunthan

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Present status of *Parthenium hysterophorus*: Effect of its leaf extract cow urine on vermicomposting in northern Sri Lanka

Student Name: Sivakurunathan Kavinthan

Index No : AG 450

The present status of the noxious weed, *Parthenium hysterophorus* in Sri Lanka is unknown and this information is essential to continue the implementation of management methods effectively locally by the state sector and to monitor its effects on environment, spread and control globally through the International *Parthenium* Net work. An investigation conducted throughout Sri Lanka revealed that *Parthenium* was confined to two districts of Northern region only. Therefore a study was conducted to obtain data on distribution and density of *P. hysterophorus* throughout the districts of Jaffna and Vavuniya. Geographical Positioning System was used to locate the sampling places and all selected points were mapped out. Quadrata sampling was done in these districts to estimate densities and frequencies of dicot and monocot plants associated with *P. hysterophorus* and dead plants due to mealy bug infestation. High intensity of *P. hysterophorus* population was observed in Valigamum region in Jaffna and Vavuniya South. Nallur, Valikamam East, Uduvil, and Thellipalai DS divisions were mapped as dense areas of Jaffna District. Vavuniya Town North DS division had dense growth of *P. hysterophorus*. Mealy bug infested *P. hysterophorus* was comparatively higher in Jaffna than Vavuniya district. Two weeks fermented cow urine had influenced earthworm numbers favourably and hence different volumes of fermented cow urine of 50ml, 100ml, 150ml and 200ml, were tested to rear *Eudrillus eugineae* with the substrate of cow dung and jack leaves. Fermented cow urine of 50ml had significant increase of growth and reproduction of *E. eugineae*. Number and live weight of *E. eugineae* hatchling were increased substantially. In another experiment extract of the weed used with cow urine, cow dung and jack leaves was revealed that live weight of *P. hysterophorus* hatchling was significantly increased. Both the fermented cow urine and leaf extract of *P. hysterophorus* were found effective to *E. eugineae*. This information of effective method of control would assist to destroy *P. hysterophorus* successfully through vermiculture in Jaffna and Vavuniya districts.

Key words: *Parthenium hysterophorus*, Geographical Positioning System, quadrata sampling, intensity, Vavuniya

Supervisors: Prof. G. Mikunthan and Dr. G. Thirukkumaran

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Occurrence of *Marasmiellus inoderma* stem rot on banana in Jaffna and the potential of biorationals on its management

Student Name: Nagarathnam Thiruchchelvan

Index No : AG 455

Stem rot of banana is caused by a Basidiomycetes fungus *Marasmiellus inoderma* Berk (Agaricales: Tricholomataceae), and this is the first report in banana (*Musa* sp.) fields in Jaffna, Sri Lanka. Since it is new to this region, this study is carried out to understand its disease cycle, symptoms, host range, prevalence and intensity of disease. The fungus produced cottony white colony, later turned to cream and branched mycelium observed under light microscope. Fruiting body was white, pileus diameter 1-5 cm, strip length 2-5 cm but small in size under adverse conditions. Disease symptoms were identified as rotted patches on rhizome and pseudo stem, gradual wilting of leaves from lower area to upper part, stunted growth, abnormal leaves and bunches, toppling of crown, fruiting body adhere on pseudo stem. Prevalence of stem rot was confined to Valikamam division of Jaffna peninsula. A banana field at Thirunelvely has recorded 44.44% disease incidence with 51% rotting at bottom region of pseudostem. The disease severity was 96.3% in remaining portion of pseudostem, which yielded bunch already, 62.63% mature plants and 23.02% suckers. Arecanut was also found infected with *M. inoderma*. Among major banana cultivars grown in Jaffna; *Kathali*, *Itharai* and *Monthan* had exhibited stem rot except *Kappal*. *M. inoderma* was studied under *in-vitro* condition with different substrates. King Yam and Elephant Foot Yam were found as good substrate for *M. inoderma* and the fungus was grown well and substituted the potato glucose agar (PGA) for growing pure culture. The antagonistic fungus, *Trichoderma* sp showed suppressive effect on *M. inoderma* grown on PGA. Different combinations of pathogen and parasite were tested and the results showed that *M. inoderma*: *T. harzianum* (1:4) yielded 80.6% of growth inhibition than other tested ratios. *M. inoderma*: *T. viride* (1:2 and 1:4) combination was given 92% of growth inhibition. Food poison method tested under *in-vitro* condition revealed that maximum inhibition was observed with 30% *Azadirachta indica* (79.19%) and 30% *Ocimum sanctum* (59.96%) than *Lantana camara*, *Zingiber officinale* and *Curcuma longa*. Among the five fungicides tested at two concentrations *in-vitro* condition, recommended level of Ridoaxyl (Metalaxyl 8 % [w/w] +Mancozeb 64% [w/w] WP) and Max (Chlorothalonil 75% [w/w] WP) had higher growth inhibition 86.76% and 64.09%, respectively than Pomarsol forte WP 80% (thiram 80%[w/w]) and Captan (Captan 50% [w/w] WP), but Coblite (Copper 50% [w/w] WP as copper oxychloride) failed to inhibit the growth of *M. inoderma*. The information obtained from this investigation creates awareness among extension workers and growers about the infection of *M. inoderma* which caused stem rot disease on banana in Jaffna peninsula and it is also a guide to

control its spread further to other growing areas through infected suckers and other means.

Keywords: *Marasmiellus inoderma*, banana, Captan, pileus diameter, pseudostem

Supervisors: Prof. G. Mikunthan and Dr. G. Thirukkumaran

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Parasitic potential and host range of *Cuscuta campestris* and its impact on *Allium cepa* L. towards its management

Student Name: Amirthaveni Varothayan

Index No : AG 458

Cuscuta spp. is known as a medicinal plant for many years in Jaffna. But it has been found parasitizing cultivated crops like onion and chilli. Thus, this study was planned to find out suitable control measures by understanding the growth habit and parasitic nature of *Cuscuta*. It was collected from the parasitized plants and its basic morphological characters, growth behavior, host range and parasitic potential were studied. Vegetable crops and medicinal plants grown in Jaffna were selected and the host– parasitic interaction of *Cuscuta campestris* on different host plants were qualitatively assessed. Treatments were set up to measure the parasitic potential of *C. campestris* on different age of *Allium cepa* L. by measuring the growth parameters to the different levels of parasitism. Two levels of parasitism of *C. campestris* were made at two weeks old and four weeks old onion plants with six replicates for each treatment. The parasitic effect of *C. campestris* was compared with the onion which was not parasitized by *C. campestris*. The morphological characters and growth behavior confirmed that this parasitic plant was *Cuscuta campestris*. *C. campestris* has great potential of parasitism by means of stem pieces and seeds. Even 5cm stem pieces of *C. campestris* have the capability to make infestation. Stem pieces of *C. campestris* have the potential to infest the adjacent crop even at a distance of 60 cm. The germination percentage of *C. campestris* seeds was seven. Infested onion's of bulbs and leaves showed significant reduction in the dry weight due to the parasitism. Plant height and root length of parasitized onion showed variation but number of bulbs were not affected by the infestation. Infestation of *C. campestris* did not depend on the age of the onion. Crop rotation with incompatible crops such as cow pea, kidney bean, maize and millets could be grown to avoid multiplication of the parasite. *Brassica oleraceae* and *Raphanus sativus* can be cultivated with onion to reduce the spreading of *C. campestris*. Growing of incompatible crops in the *Cuscuta* seed contamination field is another best tactic to reduce the seed multiplication of the parasite. Weed management is essential to protect any kind of crop. Spacing between the crops should be considered in planning cropping system. Intercropping with incompatible crops of *Cuscuta* is the best practices to suppress the parasite in the cultivable fields.

Key words: *Cuscuta* spp, *Allium cepa*, parasitism, onion, bulbs

Supervisors: Prof. G. Mikunthan and Dr. G. Thirukkumaran

Department of Agricultural Biology, Faculty of Agriculture, University of Jaffna, Sri Lanka

Prevalence of *Erwinia* soft rot disease in cut foliage, *Dracaena sanderiana* and its management

Student Name: Thiyo Desiya Kayalvily Thayapararajah

Index No : AG 470

The study was carried out under net house conditions at Green Farms Ltd, Marawila from March 2011 to June 2011, to find out the occurrence and severity of *Erwinia* soft rot disease in *Dracaena sanderiana* plants and to formulate the possible control measures. Pathogen isolated from the infected leaves and stems of *D. sanderiana* was confirmed as *Erwinia* spp by Koch's postulate method. It was observed that *Erwinia* spp severely affected the *D. sanderiana* plants in selected field. The disease severity assessed on White, Gold and Victory cultivars 95%, 90% and 80%, respectively. Field and *in-vitro* experiments were carried out to manage the soft rot disease in *D. sanderiana* plants. Three different soil treatments with vermicompost, cow dung, poultry manure and control plots were prepared and percentage of disease incidence, disease reduction and growth parameters were recorded and data were statistically analyzed. Higher percentage of disease reduction was observed with vermicompost (80%) compared to cow dung (60%) and poultry manure induced the soft rot disease in stems and spread the disease to whole plant. Moreover, plant height, shoot and root biomass, number of leaves per plant and length and width of leaf were significantly high in vermicompost media. Among the different water management practices tested to reduce the disease severity of *Erwinia* soft rot disease in *D. sanderiana* plants, water irrigated through the horse pipe was more effective compare to sprinkler application. Cultural practices, weeding and fertilizer application were practiced as recommended and soft rot affected leaves and stems were removed aseptically twice a week. Cultural practices adapted in two experiments, were effective to reduce spreading of *Erwinia* soft rot in *D. sanderiana*. *In-vitro* experiment conducted to manage the *Erwinia* soft rot disease by using bio-agent, *Pseudomonas fluorescens* was found effective to reduce the growth of *Erwinia* under *in-vitro* conditions. Initiation and spreading of *Erwinia* soft rot *D. sanderiana* can be controlled by the eliminating of sprinkler irrigation and continuous sanitation practices.

Key words: *D. Sanderiana*, *Erwinia* soft rot, vermicompost, cultural practices, bio-agent

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Snails and slugs damaging cut foliage *Cordyline fruticosa* and their management

Student Name: Sinnarajah Karthiga

Index No : AG 481

Snails and slugs became a serious molluscan pests and damaging leaves of purple compacta, *Cordyline fruticosa* at Green Farm Ltd in Sri Lanka. The export quality of *C. fruticosa* is devalued due to the damage and this incurred great loss to the industry. Since, snails and slugs are new pests; there is no information available to develop management practices. Therefore this study was carried out to investigate their biology, alternate host, damage, breeding potentials of snails and slugs and to develop possible management practices. *Achatina fulica*, *Opeas pyrgula*, *Helix aspersa* were the snails and garden slugs were identified in this field. The eggs of snails and slugs were creamy white with 1 ± 0.5 mm diameter and transparent, 1 ± 0.2 mm diameter respectively and incubation period of slugs egg was 14 ± 2 days and also the depth of eggs laid in the soil surface was 12 ± 3 cm. Snails and slugs damaged mainly in fresh leaves of *C. fruticosa*. The severity of damage was 44.5% in infested field based on the visual rating method. Leaves of Cassava, Sting bean, Okra, Cucumber, Passion, Papaya, *Glyricidia*; and shoe flower were identified as alternate hosts and Neem leaves, *Ixora* flower and *Draceana* spp were not host. Among the plant materials tested for their repellency against the snails and slugs revealed that neem seed powder was an irritant; neem leaves, mint leaves and lantana leaves were acted as antifeedant and salt as chemical repellent. Among the barrier and bait experiments Bordeaux mixture acted a significant barrier effect against horizontal movement. Baits made out of Metaldehyde bait, vegetables bait and jaggery had a strong effect in repelling the snails and slugs. Mulching with *Madhuca longifolia* punnac was best to reduce the snails and slugs population compared to with *M. longifolia* seed kernel powder and oil from *M. longifolia* failed to reduce their population. Hence the results revealed that saponin containing *M. longifolia* punnac was helped to eliminate the damage from snails and slugs when used as a mulch. Baits using Metaldehyde, vegetable and jaggery also useful to suppress them further. Hence combination of these methods will help to chase out snails and slugs from damaging *C. fruticosa*. This ultimately solved the problem and benefits to the cut foliage industry to regain in exporting.

Key words: Purple compacta, neem leaves, snails, slugs, *M. longifolia*

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Extraction and characterization of yellow passion fruit (*Passiflora edulis f. flavicarpa* L) endocarp peel pectin and its utilization as stabilizer in ice cream

Student Name: Simmakya Sarvanandan

Index No: AG 424

Present commercial sources of pectin are citrus peel and apple pomaces. Passion fruit peel represents about half of the fruit mass. It is a major waste that possesses the problem of disposal with causing environmental pollution. The conversion of passion fruit waste into a valuable by product such as pectin offers great scope for utilization. The objectives of this study were to extract and isolate pectin found in passion peel, a waste product in food industry and to study the physical and chemical properties of passion pectin and to compare these properties with that of commercial pectin. Also the suitability of using these pectins in the production of ice cream instead of using commercial stabilizer was evaluated. Pectin was extracted and isolated from passion fruit endocarp after pre-processing, at pH 1.34 (using 0.5HCl) and at 65°C for 2 hours and filtered. The pectin was isolated by precipitating with 96% ethanol filtering, washing with acidified ethanol and absolute ethanol and air drying at 40-45°C. The yield of passion endocarp pectin was 29% on dry weight basis. High methoxyl content (9.88%±0.03) was obtained for passion pectin than that of commercial pectin (8.16%±0.03) while the degree of esterification of passion endocarp pectin (71.44%±0.67) was lower than that of commercial pectin (76.41%±0.72). Both pectins were found to be high methoxyl (>7% methoxyl content and >50% DE) and rapid set (<25min) pectins. The acetyl value of passion pectin (1.86%±0.03) was slightly higher than that of commercial pectin (1.53%±0.02). Equivalent weight of passion pectin and commercial pectin were 810.85±7.63 and 1271±18.4 respectively. Purity of passion endocarp pectin (89.62%±0.16) was higher in terms of AUA content than that of commercial pectin (76.19%±0.33). The gel-forming property of passion pectin at 110 gel grade was of good quality when compared with commercial pectin at 150 gel grade. Overrun of both commercial and passion fruit pectin ice creams (67.8 and 70% respectively) were higher than that of commercial ice cream (59.5%) prepared using commercial ice cream stabilizer. At 60rpm the viscosity of ice cream mix of commercial and passion fruit pectin ice creams (158 and 153cp respectively) were lower than that of commercial stabilizer ice cream (320cp). Melting rates of commercial and passion fruit pectin ice creams were higher than that of commercial stabilizer ice cream, while the passion fruit pectin ice cream showed lower melting rate than that of commercial pectin ice cream. Sensory evaluation revealed that both commercial and passion pectin gave good texture to ice cream as given by the commercial stabilizer and replaced the mouth feel and body given by fat. According to the physical and sensory evaluation passion fruit endocarp pectin gave better

stabilization to ice cream and therefore can be used instead of commercial stabilizer.

Keywords : Passion fruit, Pectin, Passion endocarp pectin, Ice cream

Supervisor: Dr.(Ms).Jaanaki.G

Food technology division, Industrial Technology Institute, Colombo, Sri Lanka.

Development of Ready-To-Serve (RTS) grape drink, with local *Vitis vinifera* without added sugar

Student Name: Janani Jerome

Index No: AG 418

Vitis vinifera known as grapes is proven for health beneficial properties. Ready-to-serve drink processing which is suitable for small scale farmers is not considered in the Northern region of Sri Lanka, where it is cultivated. Low calorie functional foods with health benefits are rare in Sri Lankan market. Therefore, a RTS type grape drink was formulated without sugar and storage study was carried out. An experiment was carried out to select a best pre-treatment within 9 different treatments. Fruits were subjected to blanching at combinations of 55, 60, 63, 70°C temperatures for 2, 4 minutes. The product development was carried out in two stages. First stage involved in the development of RTS grape drink with imported grapes and second stage was to develop a RTS grape drink with Jaffna grapes, in cooperated with an artificial sweetener. First step involved in the selection of best level of grape juice among 5%, 10%, 12%, 15% and 20% and the best sugar content was selected among 14.6%, 9.6%, 19.6%. The best drink was selected in this stage between cordial and RTS processed with grapes. The best level of sucralose was also selected among 140ppm, 150ppm, 160ppm and 170ppm. At the second stage of development, the best level of Jaffna grape juice in drink was selected between 10% and 15%. The final product acceptability was tested and the storage study was conducted. Selections were based on ranking on preference tests and results were analyzed by Friedman test available in SAS. The storage study was carried out with samples stored at 31°C±2, 10 °C±2 and 42 °C±2. The microbiological sensory and chemical properties were analyzed at one week interval for four weeks storage. Blanching in hot water at 55°C for 4 minutes was the best pre-treatment for local grapes, resulting in significantly higher juice yield, TSS, pH and ascorbic acid content ($p < 0.05$). The initial drink was not accepted by sensory panellists ($p < 0.05$), indicating the need of improvement of the formula. In the preliminary study, 15% grape juice, 14.6% sugar and 150ppm of sucralose were selected based on the significance of sensory results and economic considerations. RTS was preferred than the cordial by panellists. The formula was confirmed during the second stage as 15% Jaffna grape juice and 150ppm sucralose. The final product was accepted by the sensory panellists without significant difference among the panellists on acceptance. It indicated 3.03 ± 0.03 pH, $4.2^\circ \text{Brix} \pm 0.06$ TSS, $0.47\% \pm 0.02$ titrable acidity and $112 \text{ppm} \pm 0.10$ benzoic acid. The product was free of aerobic spoilage bacteria, yeasts and molds and coliforms. Process flow chart was developed for grape RTS. Shelf life at 31°C is 270 days. TSS and pH did not change significantly during one month study period.

Keywords : Grapes, Ready-to-serve drink, Sugar, Pre-treatments

Supervisor: Ms.B.Udayani

Food technology division, Industrial Technology Institute, Colombo, Sri Lanka.

Screening of nitrogen fixing and phosphorus solubilizing bacteria to enhance growth of tomato and onion plants

Student Name: Alexander Alexregan

Index No: AG 413

Inoculation of phosphorus solubilizing bacteria and N fixing bacteria to soil, seeds or plants is known to increase P and N uptake of various crops. This study was undertaken to isolate plant growth promoting bacteria (PGPR) from the rhizosphere of tomato and onion and to assess their impact on P availability and growth of tomato and onion. Nine bacterial strains having the ability to fix N, secrete Indole-Acetic Acid (IAA) and solubilize $\text{Ca}_3(\text{PO}_4)_2$ under *in vitro* condition were isolated from tomato and onion rhizosphere soils. The best performed four bacterial strains were inoculated on to tomato seeds (O_A , and T_A) and onion bulbs (O_A , O_D , O_E) and grown either added with recommended fertilizer, cow dung or without any source of nutrient (control). Plant growth on 6th week and three months after planting for both tomato and onion plants growth were recorded. In addition, tomato plant samples were assessed for tissue P contents and roots were assessed for the mycorrhizal infection. Combined treatments of inoculants and recommended fertilizer resulted in the highest growth of tomato. In comparison to non-inoculated control (10mg/kg), treatment with O_A and T_A showed high plant P 21 and 18 mg/kg respectively. Accumulation of P was higher in inoculated and fertilized treatments as well for inoculated and cow dung treatments than non-fertilized and non-inoculated treatments. In addition, O_A and T_A had enhanced mycorrhizal colonization demonstrating their synergistic behaviour with added inoculants. Thus O_A and T_A enhanced growth of tomato plants by increasing nutrient availability and their acquisition. Among the inoculants introduced to onion, O_A and O_D have enhanced the growth and yield of onion plants substantially than the control. In general, results provided evidence that growth of tomato and growth and yield of onion could be enhanced by added biofertilizer under greenhouse conditions. However, field experiments are necessary in order to assess the potential of their commercialization.

Keywords : Phosphorus solubilizing bacteria, N fixing bacteria, Bacterial strains, Mycorrhizal infection

Supervisor: Prof. R.M.C.P.Rajapaksha

Department of Soil science, Faculty of Agriculture, University of Peradeniya, Sri Lanka

Potential of selected aquatic plants on phytoremediation of water treated with Nitrogen and Phosphorus

Student Name: Sundaralingam Thulasi

Index No: AG 425

Experiments were carried out to assess the phytoremediation potential of four different aquatic plants for nitrate N and phosphorus from treated water. The selected plants were moss (Division Bryophyta), water lettuce (*Pistia stratiotes*), water hyacinth (*Eichhornia crassipes*), and water spinach (*Ipomoea aquatica*). Ground water was used in all experiments. The water used in the experiments had a pH of 6.8-6.9, nitrate N of 4-8.5mg/l and available phosphorus 0.4mg/l. Open plastic bottles and buckets were used to grow the plants. A total of twelve treatment combinations including four levels of nitrate N (0, 20, 40 and 60mg/l) and three levels of P (0, 20 and 40mg/l) were treated for the total volume of 3, 1 and 20 liters of water for moss, *P.stratiotes* and *E.crassipes* respectively. In the experiment using *I.aquatica* ten treatment combinations with five levels of nitrate N (0, 10, 20, 40 and 50mg/l) and two levels of P (0 and 5mg/l) were treated to 3 liters of water. The design used was a two factor factorial with three replicates. Water was analyzed at weekly interval for nitrate N and P. At the end of the experiment nutrient analysis of plants was carried out. Moss had the potential to remove nitrate N between 29-90%. In addition moss removed 90-99.6% of P from water during the period of 4 weeks. Total nitrogen and total phosphorus content of moss were varied between 1.5-2.7% and 1.6-2.2% respectively. *P.stratiotes* showed a percentage removal of nitrate N between 61.5-91.8% at the end of six weeks. The percentage reduction of P by *P.stratiotes* was varied between 90-99% under different P concentration at the same period. Total N and total P content of *P.stratiotes* were recorded as 2.3-4.2% and 0.4-1.3% respectively. At the end of third week, the percentage nitrate N and P removal by *E.crassipes* was varied in the range 40-63.5% and 75-97.2% respectively. While the total N and total P content of *E.crassipes* varied between 1.3-1.7% and 0.84-2.05% respectively. *I.aquatica* recorded 29.3-75% reduction of nitrate N in water in different treatments. Better P removal performance was also observed in *I.aquatica* and it was 75% and 83.3% in the concentration of 0.4mg/l and 5.4mg/l respectively. Total N and total P of *I.aquatica* at the end of experiment were 1.2-2.2% and 0.19-0.22% respectively. Total nitrogen and total phosphorus content in plant shows an increasing trend with increasing concentration in water in all tested plants. Total N and total P content of moss, *P.stratiotes* and *E.crassipes* used for phytoremediation shows that these

plants have a comparable amount of nitrogen and phosphorus with locally available green manures and organic materials. Therefore the phytoremediated plants could be used as a source of nutrients for crops. The nitrate N content of *Ipomoea* (26.3mg/Kg) shows it could be used as a vegetable after remediation even for infants without any health risk.

Keywords: Aquatic plants, Phytoremediation, Nitrate N, Phosphorus

Supervisor: Dr.(Mrs).N.Gnanavelrajah

Department of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna, Sri Lanka

Nutritional analysis of different brands of soy meat (Textured Vegetable Protein or Textured Soy Protein) available in Jaffna peninsula

Student Name: Jesuthasan Mervin Roshan Roche

Index No: AG 421

Soy meat or Textured Vegetable Protein (TVP) or Textured Soy Protein (TSP) is introduced to consumer market of Sri Lanka in 1980. It is made from defatted soy flour by extrusion technology. Most of the vegetarians prefer to consume soy meat in their balanced food. People who avoid non vegetarian foods for religious concepts prefer soy meat because it gives meat like texture. Soy meat producing companies have been increasing since 1980 and they are producing variety of soy meat products. These products can be categorized according to weight of packs, shape of granules and flavors. However the question is whether nutrient contents of these products set to be the values given by Sri Lankan Standard Institute (SLSI). This study was conducted to analyse the nutrient contents of the different soy meat products of different brands available in Jaffna market. Thirty different products of eight brands are available in Jaffna peninsula and they were selected to analyse the Carbohydrate, Protein, Fat, Crude Fiber, Ash, Iron, and Calcium contents. Carbohydrate contents of the products varied from 26.42(± 0.04) to 29.74(± 0.016) g/100g. Carbohydrate contents of all the products were below the value (30% of weight) set by SLS. SLS denoted Protein and Fat are the major nutrients that determine the product quality. The protein contents of the products varied from 42.81(± 0.24) to 50.84(± 0.09) g/100g. The protein contents of samples should be above 48% of its weight. About 70% of products contained protein that closely related to the Sri Lankan standard. The products should contain fat lower than 1% of its weight. But fat content of the products varied from 1.1 to 3.2g/100g. The fat contents of all products were higher than 1% of its weight. However the crude fiber contents of the products varied from 2.67(± 0.28) to 4.71(± 0.67) g/100g and almost 95% of the products contained crude fiber closer to standard value (3.5 g/100g) given by the SLS. Ash content of the products also did not highly deviate. More than 70% of products contained the ash content that is closer to SLS value (7.5%). Iron content of soy meat samples varied from 8.68(± 0.34) to 14.66(± 0.15) mg/100g. Calcium contents of the samples varied significantly among the products. It varied from 124.12 (± 0.90) to 255.67(± 1.12) mg/100g. All the products contained low moisture content compared with standard value (10% of its weight). Nutritional comparison of the products from bulk and retail packs was done. There were not significant deviations in the nutrient contents of the products from bulk and retail packs of the same brand were observed. Nutritional comparison of the same brand of different flavors of products was also carried out and no significant differences were observed among the soy meat products with different flavors. Finally the result was concluded, the products of brands B and C were better than

products of other brands available in Jaffna peninsula. Because protein and fat contents of products of these brands are closer to standard values that set by SLSI.

Keywords : Textured Vegetable Protein, Nutritional analysis, SLS standard

Supervisors: Prof.(Ms).V. Arasaratnam and Dr.S.Balakumar
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Soil carbon stock assessment of various land uses in Jaffna district

Student Name: Thiruvartchelvam. Kugendren

Index No: AG 452

Land use and management practices affect carbon sequestration in soils. By comparing soil carbon of various land uses we could surmise which type of land uses increase productivity through the enhancement of carbon sequestration. Agriculture land uses cultivating annual crops with organic fertilizer only, inorganic fertilizers only and combination of organic and inorganic fertilizers, perennial agriculture crop fields and abandoned or maintaining home gardens were selected as the various land uses in this study. The properties were studied at two depths of 0 – 15 cm and 15 – 30 cm. The design used was a two factor factorial with three replicates. Soil microbial biomass carbon, total organic carbon (TOC), KMnO₄ oxidizable carbon, and water labile carbon were analyzed. Litter dry weight, C/N ratio, litter quality were also analyzed and compared. This study showed that within the agricultural land use patterns, application of organic fertilizer only and the undisturbed abandoned home gardens caused substantially higher total soil carbon content than other land use patterns. Microbial biomass carbon fraction was also high in the only organic fertilizer applied land uses, which was not significantly different with abandoned home gardens. Microbial biomass carbon was significantly less in only inorganic fertilizer applied land uses. KMnO₄ oxidizable carbon was significantly higher in maintaining home gardens. Significantly higher water labile carbon was observed in maintaining home gardens, abandoned home gardens and perennial land uses. Litter accumulation was the highest in abandoned home gardens. In each land uses the top most layer (0-15cm) had significantly higher amount of carbon than deeper layer (15-30cm). The potential stable carbon was substantially higher in abandoned home gardens and organic annual cropping land use.

Keywords : Carbon sequestration, Land use pattern, Stable carbon

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Selection of starch hydrolysing enzymes by the fungal strains isolated from contaminated raw and dried Palmyrah root (*odiyal*)

Student Name: Desitha Mahendrarajah

Index No: AG 459

Amylolytic properties of the enzymes produced by the fungi isolated from '*odiyal*' were investigated. '*Odiyala*' is a product of raw dried palmyrah tuber. *Aspergillus* spp., *Rhizopus* spp., *Mucor* spp. and *Fusarium* spp. were the four fungi isolated from contaminated '*odiyal*'. The *Aspergillus* spp. and *Rhizopus* spp. were selected as good α -amylase producers, and the *Rhizopus* spp. and *Mucor* spp. as good glucoamylase producers. Highest α -amylase activities obtained from *Aspergillus* spp. and *Rhizopus* spp. were 4284 and 3762 UmL⁻¹ respectively on the 7th day of incubation. Highest glucoamylase activities obtained from *Rhizopus* spp. and *Mucor* spp. were 1854 and 1800 UmL⁻¹ respectively on the 6th day of incubation. The α -amylases from *Aspergillus* spp. and *Rhizopus* spp showed zero order kinetics for 6 and 8 minutes respectively. The glucoamylases from *Rhizopus* spp. and *Mucor* spp. showed zero order kinetics for 14 and 10 minutes respectively, and the reaction time was fixed as 5 min. The optimum pH for the activity of α -amylases from both *Aspergillus* spp. and *Rhizopus* spp. was 6.5, and for the activities of glucoamylases from both *Rhizopus* spp. and *Mucor* spp. was 3.5. The optimum temperatures for the activity of α -amylase from *Aspergillus* spp. and *Rhizopus* spp. were 55 and 65^oC respectively at pH 6.5. The optimum temperatures for the activity of glucoamylase from *Rhizopus* spp. and *Mucor* spp. were 55 and 70^oC respectively at pH 3.5. Among the different combinations of α -amylase and glucoamylase from different organisms, the combination of α -amylase from *Aspergillus* spp. and glucoamylase from *Mucor* spp. hydrolysed the *odiyal* flour more effectively and the percentage of starch hydrolysed after 3 hours of incubation was 11.7%. The *plukodiyal* flour was more effectively hydrolysed by the combination of α -amylase from *Aspergillus* spp. and glucoamylase from *Rhizopus* spp. and 22.5% of the starch was hydrolysed. At 9.65% sugar concentration, alcohol production in the sterilized *odiyal* flour hydrolysate where the added enzymes had been inactivated was 2.95 % in 72 hours on fermentation with yeast, while the non-sterilized *odiyal* flour hydrolysate with 7.9% sugar concentration yielded 3.12 % of ethanol in 72 hours.

Keywords : Palmyrah root, Fungal strains, α -amylase producers, glucoamylase producers

Supervisors: Prof.(Ms).V.Arasaratnam and Dr.S.Balakumar

Department of Biochemistry, Faculty of Medicine, University of Jaffna, Sri Lanka.

Alternative sources of nutrients for selected crops in Jaffna district

Student Name: Selvarajan Shayanthan

Index No:

Experiments were carried out to study the possibility of alternative sources of nutrients for different crops. A laboratory incubation study was conducted to find out the effect of Palmyrah distillery spent wash (PDSW) on soil nutrients, changes in microbial population pH and EC in Calcic red yellow latosols. Treatments were T₁ (¼ recommended fertilizer with PDSW), T₂ (control soil), T₃ (PDSW 100 m³/ha), T₄ (sterilized PDSW), and T₅ (weekly added PDSW). A pot experiment with *Oryza sativa* was carried out to quantify the nutrient intake, growth parameters and yield of rice in different treatments. Treatments used in pot experiment were T₁ (control), T₂ (recommended fertilizer), T₃ (PDSW 100m³/ha), T₄ (¼ recommended fertilizer with PDSW 100m³/ha) and T₅ (PDSW 500 m³/ha). A field experiment with onion and tomato were also carried out to study the effect of inoculation with pre-isolated microbial strains OA, OE and TA. For both incubation experiment and pot experiment complete randomized design (CRD) was used with three replicates and field experiments were arranged with randomized complete block design (RCBD) with two factors. Results of incubation experiment with different treatments indicated that Palmyrah distillery spent wash increase the N, P and K content in soil without any significant pH and EC changes except in the weekly adding spent wash. PDSW increased the soil microbial population. The sudden microbial increment was observed on the account of PDSW than the sterilized PDSW on soil. PDSW contains 3.97mg available N, 25mg available P and 1604 mg available K in one liter. High concentration (500m³/ha) of PDSW caused the poor seed germination and stunted growth in rice. PDSW (100m³/ha) application significantly increased the rice plant height, number of leaves, average leaf area, number of tillers, root length, root volume, dry matter production and grain yield compare to control. PDSW application resulted in significantly high uptake of N (155%), P (166%) and K (118%) in rice plant parts compared to control soil. Results of onion field study indicated that OA and OE bio fertilizer strains gave positive results on bulb circumference, number of bulb per cluster, bulb yield and bulb dry weight compared to inorganic fertilizer. OE strain gave more interaction effect with either inorganic or organic fertilizers than organic or inorganic alone in onion. TA strain gave better dry matter production on tomato plant compared to inorganic fertilizer. Further, T_A also gave good interaction with inorganic or organic fertilizers. OA strain only gave good result in tomato, when it interacts with either organic or inorganic fertilizers.

Keywords : Palmyrah distillery spent wash, Microbial strains, Onion, Tomato

Supervisors: Dr. (Mrs).N.Gnanavelrajah and Prof.(Ms). R.M.C.P.Rajapaksha.

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Characterization and mapping of Karst plain soil series in Jaffna peninsula.

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Index No: AG 471

The Characterization of the major physical and chemical properties of the agriculturally important soil series and mapping out the characteristics are important for planning of sustainable agricultural land-uses. It will enable us to make multi-purpose interpretations, evaluations and management recommendations for various land uses. The two great soil groups of Calcic red-yellow latosols and Soils on recent marine calcareous sediments and the series of agriculturally important karst plain (E Series) were selected to do the characterization and mapping. The random soil sample collections were carried. The number of samples was decided according to the total area represented by each series. Sampling points were marked out using the GPS and the mapping was performed by GIS software. The physical properties of soil colour, soil texture, bulk density, particle density and chemical properties such as pH, EC, CEC, organic matter, total nitrogen and available nitrogen, available phosphorous, available potassium and available sulfur were analyzed. The physical properties were significantly varied among the treatments. In the Calcic red yellow latosol the most of the chemical characteristics namely the pH, EC, CEC, organic matter, total nitrogen, available sulfur and available potassium were highest for the Chankanai rocky phase series. The common texture of sandy loam and loamy sand were observed among the series. The colour of the soil ranged from light olive brown to dark red in the calcic red yellow latosol. The colour of the soil ranged from light brownish grey to dark grey in the soils on recent marine calcareous sediments. The chemical properties of pH, CEC, available nitrogen, available phosphorous were highest in the Saravanai series and the organic matter, total nitrogen, available potassium and available sulfur were highest in the Velanai series. The colour of the soil was ranged from light brownish grey to dark grey. The soil characters were mapped out in the GIS environment using ILWIS software.

Keywords : Karst plain, Characterization, Mapping, GIS

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Effect of biochar on selected soil properties of three soil series in Jaffna peninsula and yield of beetroot (*Beta vulgaris*)

Student Name: Sivagnanam Ambihai

Index No: AG 474

Experiments were carried out at the Department of Agricultural Chemistry, University of Jaffna to find the effect of biochar addition on selected soil properties and yield of beet root (*Beta vulgaris*). A laboratory incubation study was conducted to find out the effect of application of biochar alone and in combination with inorganic fertilizers on selected properties of three different soils of Jaffna peninsula namely Inuvil series, Chemmani series and Regosols. Treatments were T₀ (control), T₁ (biochar), T₂ (NPK fertilizer), and T₃ (½ biochar + ½ NPK fertilizer). A pot experiment with beet root was also carried out in Inuvil series to quantify NO₃⁻ and NH₄⁺ leaching loss and yield of beet root for different treatments. Treatments used in pot experiment were T₀ (control), T₁ (compost), T₂ (biochar), T₃ (NPK fertilizer), T₄ (½ biochar + ½ compost), and T₅ (½ biochar + ½ NPK fertilizer). Complete randomized design was used with three replicates for incubation experiment and four replicates for pot trial. Results of incubation experiment with different treatments indicated that pH of soil significantly increased in T₁ (biochar) and decreased in T₂ (NPK fertilizer) in three soils. Available N was significantly higher in T₂ (NPK fertilizer) followed by T₁ (biochar) in Inuvil series. In Regosols available N was significantly higher in T₃ (½ biochar + ½ NPK fertilizer) followed by T₂ (NPK fertilizer) and available N slightly increased in biochar with time. In Chemmani series during 2nd and 4th weeks available N was higher in T₃ (½ biochar + ½ NPK fertilizers) and available N was significantly increased in biochar during 6th and 8th weeks. In Inuvil series Available P was significantly increased in T₁ (biochar) followed by T₂ (NPK fertilizer). Available P was significantly increased in T₂ (NPK fertilizer) followed by T₁ (biochar) in Chemmani series and Regosols. Available K was significantly increased in T₁ (biochar) followed by T₃ (½ biochar + ½ NPK fertilizer) in three soils. EC was significantly increased in NPK fertilizer followed by T₃ (½ biochar + ½ NPK fertilizer) and reduced in T₁ (biochar). Cation exchange capacity of three soils was significantly increased with T₁ (biochar). By adding biochar (T₁) microbial biomass carbon was significantly increased by 40.65%, 45.91% and 36.36% in Inuvil series, Regosols and Chemmani series respectively, compared to control. About 11.7%, 11.06% and 3.85% increase in water holding capacity was achieved in Inuvil series, Regosols and Chemmani series respectively by T₁ (biochar) compared to control. Results of pot experiment showed that leaching loss was lowest in biochar treated pots. The yield of beet root was increased by 112.31%, 152.31%, 50.73%, 56.81%, and 122.85% in T₁ (compost), T₂ (biochar), T₃ (NPK fertilizer), T₄ (½ biochar + ½ compost), and T₅ (½ biochar + ½ NPK

fertilizer) respectively compared to control. Results therefore indicate that biochar has potential to enhance the soil fertility parameters such as nutrient availability, water holding capacity, cation exchange capacity and microbial biomass in the three tested soils of Jaffna Peninsula. In addition, in Inuvil series application of biochar increased the yield of beet root through improving soil properties and reducing leaching losses of both nitrate and ammonium.

Keywords : Biochar, Physico-chemical properties, Microbial biomass, Beetroot

Supervisor: Dr.(Mrs).N.Gnanavelrajah

Department of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna, Sri Lanka

Physical, chemical and microbial analysis of bottled drinking water available in Jaffna peninsula

Student Name: Sabaratnam Sasikaran

Index No: AG 475

There is more than thousands of bottled drinking water supplied in Jaffna peninsula. People rely on it quality of the bottled drinking water especially they are free of microbial contamination. The greatest risk from microbes in bottled drinking is associated with consumption of bottled drinking water that is contaminated with human and animal excreta, although other sources and route of exposure may also be significant. In this study attempts were made to evaluate the quality of sold bottled drinking water by physical, chemical and microbial analysis. Bottled drinking water of 22 brands were selected which include one brand produced in Jaffna and others are brought from out of Jaffna. The entire bottled drinking water brands which are sold in Jaffna has very low electrical conductivity compared with SLS (750 $\mu\text{S}/\text{cm}$) and varied from 19 to 253 $\mu\text{S}/\text{cm}$ with the mean of 80.53 (± 60.92) $\mu\text{S}/\text{cm}$. The pH values of the bottled drinking water brands varied from 4.11 to 7.58. Only 9.09% of the bottled drinking water brands contained the pH value above the minimum permitted level (6.5) by Sri Lankan standard. The Total Dissolved Solid content of the bottled drinking water brands were very low and varied from 9 to 123.67 mg/L with the mean of 39.5 (± 30.23) mg/L. The calcium content of the bottled drinking water brands were low and varied from 6.48 to 83.77 mg/L with the mean of 49.9 (± 25.09) mg/L. The nitrate content of the bottled drinking water brands were low and varied from 0.21 to 4.19 mg/L with the mean of 1.26 (± 1.08) mg/L. When the different bottled drinking water brands were analyzed for microorganisms, aerobic bacterial count varied from 0 to 800 colony forming unit per mL (cfu/mL). Approximately 63.63% of the bottled drinking water brands contained high amount of aerobic bacterial count than the minimum acceptable standard level (100 cfu/mL) by the Sri Lankan standard institution. Among it 22 brands 13.6% of bottled drinking water brands showed the fungal contamination and 9.09% of the analyzed bottled drinking water brands contaminated with coliform bacteria. Out of a total of 22 bottled drinking water brands, two (9.09%) contained faecal contamination. This was confirmed by analyzing the bottled drinking water brands for *Escherichia coli* and *Klebsiella*. Therefore all the bottled drinking water samples supplied in Jaffna peninsula are not free from microbes. The RDH should consider the monitoring of the drinking water samples supplied in Jaffna.

Keywords : Bottled drinking water, Microbial contamination, Microbial analysis

Supervisors: Prof.(Ms).V.Arasaratnam and Dr.S.Balakumar

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Preparation of rice bread using premix

Student Name: Mahalingam Prarthana

Index No: AG 484

The aim of this study was to find out the feasibility of preparing rice bread with better nutritional and sensory characters using premix (rice flour, wheat flour, yeast and bread improver) stored over a period of time and to evaluate the storage period of premixes without change in quality. For this purpose wheat bread, wheat-rice bread and premix breads prepared using premix flour stored for 3 weeks, 4 weeks, 6 weeks and 8 weeks were compared for the morphological, sensorial and nutritional qualities. Based on the determination of gluten percentage of different combinations of rice-wheat flour mixes, flour mix with 20% rice and 80% wheat was selected to prepare premixes. Moisture content of wheat flour was significantly lower ($p < 0.05$) than that of rice-wheat flour and premix flours. With increasing storage period the microbial count was increased. Moisture content of wheat bread was significantly lower ($p < 0.05$) than that of the rice-wheat bread and premix breads. The total sugar and total protein content of rice-wheat bread and premix breads did not differ significantly ($p < 0.05$) among them but total sugar content was significantly higher ($p < 0.05$) than that of wheat bread while total protein content was significantly lower ($p > 0.05$) than that of wheat bread. There was no significant difference ($p > 0.05$) in fat, ash and crude fiber content of all types of breads. There were no significant differences in specific gravity and the sensory qualities among rice-wheat bread and premix breads, but specific gravity of wheat bread was higher than that of rice-wheat bread and premix breads and there were no significant differences in the sensory qualities except crumb colour and crust colour of wheat bread and rice-wheat bread and premix breads. Even though the breads prepared using fresh rice-wheat flour and premix flours differ significantly in some qualities with wheat bread, they did not differ significantly in qualities among them. Therefore from this study it can be concluded that rice breads can be prepared using premixes stored up to two months with the qualities consistent with that of bread prepared using fresh rice-wheat flour mix and thus the use of this premix formulation in households and bakeries will make convenient use of ingredients for bread making.

Keywords : wheat flour, Yeast, Wheat-rice bread, Premix bread

Supervisor: Mr.S.Ekanayake

Food Research Unit, Gannoruwa, Sri Lanka

CONSUMER PREFERENCE TOWARDS FRESH MILK AND SPRAYED DRIED MILK POWDER IN JAFFNA DISTRICT

Student Name: Nimalini Nadarajah

Index No : AG 411

Milk is a complete food because of its great biological value as it contains a number of nutrients and these nutrients in milk help to make it one of the nature's perfect foods. At present national production meets only about 20% of the total demand and 80% of the Sri Lanka's population has been consuming the imported milk powder. The Government of Sri Lanka is taking all possible measures to boost the national fresh milk production. However, the statistics manifests an increased annual spending of foreign exchange on imported spray dried milk powder. Hence it is important to know the factors that have been influencing the consumer preference towards fresh milk consumption. This is critical in order to bridge the demand and supply decisions. Therefore, this research has taken effort to determine the factors that have been influencing consumers' decision in consuming fresh milk as well as the spray dried milk powder. Due to the restricted time frame this research had confined its scope of study within the Valikamam area of the Jaffna District. Random sampling technique was used to select the respondents. Structured questionnaire was prepared and pretested prior to the data collection. Total sample size was 300. The compiled data were analyzed within the frame work of Logit regression model by using the econometric software STATA version 10. The results revealed that age of household-head, presents of children (age ≤ 16 years) in the family and residential location (Valikamam East) found to be significantly influencing the fresh milk consumption. Among these age of household-head and presents of children in the family were exhibited a negative correlation with the fresh milk consumption decision of the Jaffna consumers. On the other hand the factors like age of the household-head, years of education of the household head, availability of the electricity to the household and the residential location manifested statistically significant results in the consumption decision of the milk powder. Based on the results the researchers suggest undertaking an effective extension program mainly targeting the educated working group to increase their awareness towards the nutritive value of fresh milk. More over establishing more outlets particularly in Valikamam west area and introducing the home step delivery of pasteurized milk may increase the consumption of fresh milk. Introducing the reconstituted different fat percentage pasteurized milk in a very user friendly packs may also expect to attract all the people indifferent of their ages.

Keywords: Fresh milk, Spray dried milk, logit model, Jaffna district.

Supervisor: Mr.K.Umashankar, Department of Agricultural Economics, Faculty of Agriculture, University of Jaffna, Sri Lanka

EFFECT OF FORMAL CREDIT ON WELFARE OF CASH CROP FARMERS: A CASE STUDY CONDUCTED IN VALIKAMAM AREA

Student Name: Vanitha Navaratnarajah

Index No : AG 434

Agriculture remains the mainstay of economic activity in rural Sri Lanka; it has a considerable influence on the lifestyle of the rural households. But unfortunately majority of the rural Sri Lanka population is experiencing a chronic poverty. Sri Lankan Government support for farmers in several forms including the provision of credit. Agricultural credit said to play a vital role in improving the welfare and reducing poverty of the farmers. This research has taken effort to study the welfare effect of agricultural credit on farmers. Due to the time constraints this research has confined its scope of study with the red onion producers residing valikamam area of the Northern region of Sri Lanka. Stratified random sampling technique was used to collect the data, A questionnaire survey was conducted and the collected sample consisted hundred and fifty red onion producers around 20 percentage of the total red onion producers. The multiple log-log regression model and logit model were employed to analyze the data. The results revealed no evidence for that the credit is improving the welfare of the farmers. The education and household size were found to be positively correlated with the welfare of the farmers at 5 percent and 1 percent respectively. The production model revealed that years of experience, extent of onion cultivated, and gender of the household head and decision of borrowing formal credit significantly influenced the red onion production. Finally the logit model revealed that the farmers decision to borrow the credit significantly influenced only by the extent of red onion cultivation rather than others.

Key words: Cash crop, Formal credit, Farmers welfare, Valikamam area, Logit regression

Supervisor: Mr.K.Umashankar, Department of Agricultural Economics, Faculty of Agriculture, University of Jaffna, Sri Lanka

Influence of farming background on the educational performance of ordinary level students in Jaffna district, Sri Lanka

Student Name: Jena Selvaratnam

Index No : AG 449

This research has taken attempt to quantify the effect of the farming background on the educational performance of ordinary level students belongs to the rural farming community in Jaffna district situated in the northern part of Sri Lanka. Purposive random sampling technique was used to pick the sample. The sample constituted a total of 287 respondents. A pretested structured questionnaire was administered to elicit the information from the respondents. After performing the regression diagnostic tests the collected data were analyzed within a frame work of multiple regression analyses by employing the statistical software STATA 10. The results revealed that individual studying hours positively contributed in increasing the average marks of all the subjects at the significant level of 1%. This implies that when the students' individual average studying time increases by one hour the marks scored in Mathematics, Science, Tamil, English, and Cumulative average increased by 6.69, 4.53, 4.24, 3.96, 4.59 respectively. The student's age was also significant at 5% level and exerted a negative impact on the outcome of Mathematics. This implies that one year increase in the age of student decreases the average marks of Mathematics by 6.76. The paternal age factor also demands the increased labor contribution from the children. When the students' fathers' age increase by one year that reduces the student's overall performance by 4.74 at 10% significant level. More over the researchers found that if the progeny of the farming community is a male the performance in English reduces by 6.61 at 5% significant level and the cumulative performance lessens by 3.54 points at 10% significant level. Finally this research concludes that increasing the student individual studying hours and providing adequate facilities at home are more critical in improving the weighted average marks of the students. Where ever this lack in facilities seen the provision of necessary facilities as far as possible should be supplied by the government or non-governmental agencies or philanthropists. More over the parent also has to take more concern and should be more cooperative in terms of not expecting the children to participate in the farming activities.

Key words: Farming Community, Educational Performance, Multiple Regression, Jaffna district

Supervisor: Mr.K.Umashankar, Department of Agricultural Economics, Faculty of Agriculture, University of Jaffna, Sri Lanka

Economic analysis on the market participation decision of fishermen in Jaffna district, Sri Lanka

Student Name: Pirasath Sanmuganathan

Index No : AG464

This research has taken effort to identify the personal, socio economic characteristic and infrastructure facilities of the fish markets in Jaffna district which have been pausing constraints on the market participation decision of the fishermen of the Jaffna district, Sri Lanka. A primary data survey was conducted by administrating a structured questionnaire. The total sample size estimated to be 278 and the samples were selected randomly from the list obtained from the SLFC. Collected data were compiled and analyzed within the frame work of multinomial logit model by using the statistical software STATA 10. The results revealed that the harvesting per month and access to the market information are found to be significant at 10%, and 1% levels respectively and increased the local market participation through the middleman by 0.1422, 17.36 respectively. The investment to the future manifested a significant negative impact at 10% level and decreases the local market participation rate by 1.8317. Knowing the market price and termination of business relation with buyer are found to be significant at 10%, 5% respectively and increased the participation to the southern market through middleman by 0.8199, 1.601 respectively. Having own mobile manifested a significant negative impact at 10% level and decreased the participation in the southern market by 1.395.

Key Words: Fish marketing; Multinomial logit, Market participation decision, Jaffna district

Supervisor: Mr.K.Umashankar, Department of Agricultural Economics, Faculty of Agriculture, University of Jaffna, Sri Lanka

Economic analysis on the market participation decision of commercial red onion producers in Jaffna district, Sri Lanka.

Student Name: Shylanthi Thangarajah

Index No : AG 469

Marketing plays a vital role in determining the profitability of the producers. Availability of market information and the right choice of a marketing channel is crucial in deciding the producer margins. Hence it is important to identify the factors which have been influencing the farmers decision in choosing the marketing channels. Therefore this research has taken effort to identify the demographic and socioeconomic characteristics of the red onion farmers influencing the choice of marketing channel in Jaffna district, Sri Lanka. A purposive random sampling technique was used to select the samples from the population. Structured questionnaire was prepared and pretested prior to the data collection. Total sample size was 200, which representing 10 percent of the total commercial red onion producers in the district. The compiled data were analyzed within the frame work of multinomial logit regression model by using the econometric software STATA version 10. The results revealed that the investment in future season and knowing the market price were found to significantly increase the log ratio of participation in the wholesale market through middleman based on the participation in the direct retailing market by 3.148, 3.532 respectively. The investment in last year and membership in a producer group manifested a significant negative impact and decrease the log ratio of choice of performing direct transporting based on the participation in the direct retailing by 19.438, 1.985 respectively. The investment in last year manifested a significant negative impact and decreases the log ratio of choice of participation in the wholesale market through middleman based on the participation in the direct retailing by 14.058. From this the research concludes that the availability of market information vastly decided the choice of the marketing channels. Hence it is important to both government and non government sectors to take effort in disseminating the market information using current electronic media like mobile phones, radio, internet, and television to the red onion farmers. This is expected to increase the farmers share via choosing the most profitable channel. Government organizations or any other non-governmental organization can take effort to connect the buyer and producer through media. Moreover if any of the non-profit organizations could come forward to perform the transport function on behalf of the farmers it is expected to increase the farmers share tremendously. Organizing the red onion farmer societies or organizations is expected to increase the bargaining power collectively on behalf of the individual farmers. And this will in turn expect to help the farmers to choose the most suitable and profitable marketing channel.

Key words: Red onion, Multinomial logit model, Choice of a marketing channel, Jaffna district

Supervisor: Mr.K.Umashankar, Department of Agricultural Economics, Faculty of Agriculture, University of Jaffna, Sri Lanka

Study of particle size of spices and condiments in the development of pungency during processing and storage of canned mushroom

Student Name : Abirame Kirupakaran

Index No: AG430

Mushroom is an important protein rich food item. Demand for the edible mushroom is increasing in all over the world. Mushroom is highly perishable one. It causes the producer to process and preserve for a long time to make it available for the whole year. The western type of canned mushroom curry was already made. This study was conducted to prepare an eastern type of canned curry in the proper sterilization condition. The oyster mushroom was chosen as the suitable one from other mushrooms such as button and abalone by analyzing the cost (Rs.50-60) and the blanching loss (15.9%). The blanching time of 2 minutes in 100 °C was determined by determining the phenolase enzyme activity and over-cooking. Several trials were conducted to find out the correct mixing of ingredients in a mushroom curry. The ingredients are mushroom (100 g), salt (2.2 g), coconut milk powder (6 g), vegetable oil (5.1 g), pepper (0.5 g), onion (108 g), ginger (4.2g), garlic (8.4g), coriandar leaves (0.81 g), water (135g) and mixed spices (3.66 g). The mixed spices were prepared with the following ingredients, red dried chilli (100 g), coriander (100 g), fennel seed (10 g), cumin (10 g), pepper (10 g) and curry leaves (5 g). The three sizes (300 µm, 300 µm -850 µm, 850 µm- 1.18mm) of mixed spices were prepared to find out which particle size of mixed spice gives tastiest and high pungency curry. All the canning operations were conducted for canning the curry. The sterilization time and temperature combination (retort come up time -13 min, process time- 50 min and cooling time-41 min at 130°C) was calculated by an equation by having the temperatures of retort and the trial cans at the particular time interval (1 min). The sterilized cans were incubated at two distinct temperatures, 30°C and 42°C. Three sensory evaluations were conducted after microbiology test to find out the pungency development after thermal sterilization, and in the storage time. The study revealed that there is no difference in pungency development after thermal sterilization, and the lowest particle size of spice mixed gives high pungency at higher temperature of storage.

Keywords: Particle size, Spices, Condiments, Pungency, Mushroom

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Packed king coconut water (*cocosnuciferavaraurantiaca*) in flexible packaging

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Index No: AG427

King coconut water (*Cocosnuciferavaraurantiaca*) is renowned as a refreshing, highly nourishing drink with a delicate aroma and flavor. It is rich in sugars, minerals, vitamins and amino acids. It has a great potential as a competitor in the beverage market, if it could be presented in portable and easy to use manner. Once exposed to air, king coconut water begins to ferment and rapidly lose most of its organoleptic and nutritional characteristics. To eliminate the risk of bacterial growth, commercial bottlers are forced to sterilize the product. This study aims to develop a technology appropriate for small and medium-sized agro-industries that allow to produce coconut water in flexible pouches. The suitability of different packaging materials and some processing conditions were studied. During the study, three types of packaging materials were tested. The packaging materials used for the study are PET-CPP (Polyethylene terephthalate-castpolypropylene). Laminate with 100 μm thickness, PET-CPP laminate with 37 μm thickness and BOPP/BOPP (bi-axially oriented polypropylene) laminate with 40 μm . Hygienically extracted king coconut water was divided into two and one portion of the king coconut water used for the experiment was passed through a filter with 0.45 μm pore size and the other portion was used un-filtered. Then, they were filled into pouches of all three types and sealed. The produced pouches were divided into two sets so that each set gets filtered and unfiltered. All three types of pouches and the two sets were subjected to two different pasteurization conditions, one at 85°C for 20 minutes and the other at 100 °C for 10 minutes followed by cooling stage. Then the packs were examined for their sealed strength at pasteurization temperatures. Then, the packs were divided into three sets and kept at three different storage conditions, one at elevated temperature (42 °C), another at ambient temperature (28 °C) and the third set at refrigerated temperature (7 °C). The observation was made at an interval of one week up to one month. The king coconut water samples were evaluated with respect to microbial population (total plates counts and yeast and molds), chemical properties (pH, titrable acidity and total soluble solutes) and sensory properties (colour, odor, flavour, sweetness, astringency and overall acceptability). King coconut water samples were presented to a trained panel for sensory evaluation and results were analyzed by a non-parametric Friedman's test and paired preference test. Results revealed that the filtered king coconut water samples packed in PET/CPP (100 μm) and pasteurized at 100 °C for 10 minutes and kept under refrigerated temperatures can retain their

natural flavour and odour for more than one month and highly acceptable for consumers.

Keywords: Packing, King coconut water, Flexible

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Fabrication and evaluation of a low-cost bioreactor for high energy food waste

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Index No: AG 436

Biomass energy is a renewable source of energy and one of the viable options for the sustainable solution of the World's energy crisis. Bio-methanation is a natural and eco-friendly method of recovering energy from biomass such as biodegradable waste material. Anaerobic digestion is an efficient energy farming method from biodegradable waste. This process was earlier used to produce biogas from low caloric materials using big reactors, but current attention is paid to recover energy from high caloric value food stuff using compost reactors. Fabrications of an odor free, affordable and compact, biogas reactor is an important need for the urban households where lots of high energy food wastes were disposed in an improper way that creates national and global problems. A 200 litre low-cost bioreactor was made with locally available materials and tested for its performance with waste rice starch. Hourly variation of gas yield for different feeding rates and the pH variation with the feeding rates were measured. The results shows the potential biogas production form 1 kg of dry matter of waste rice starch is about 656 litre/kg/ day (dry matter) and the emission rate mainly depends on the temperature and the pH of reactor. By using this bio reactor and waste rice starch, nearly 10% of the money can be saved than using LP gas while promoting the sustainable energy used in the country.

Keywords: Fabrication, Evaluation, Bio-reactor, Food waste

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Start – up of an up – flow anaerobic digester for enhancing stabilization of kitchen waste

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Index No:AG433

Several AD systems have been developed throughout the world. However, there are some challenges still remaining in start-up and continuous operations. This study was focused to overcome the problems in start-up of an up-flow anaerobic reactor. Interventions were made to enhance the start-up conditions of the reactor such as pH adjustment, influence on microbial activities by practicing daily feeding, adding Ca(OH)₂ and cow dung, applying blended wild sunflower leaves extract and landfill leachate, removal of sludge and feeding with seven day old kitchen waste. Performance of the reactor was assessed via measuring quality parameters such as TS, VS, TSS, pH, TDS, conductivity, salinity, NO₃⁻, NH₄⁺ and PO₄³⁻ concentration, permeate and gas volume. A kinetic study was undertaken to determine the microbial dynamics. The intervention of Ca(OH)₂ and addition of cow dung gave positive result for short durations. An increasing trend of pH was observed after addition of wild sunflower and it leads to ignition of gas. It reveals that wild sunflower is a good source of nitrogen and it enhances the activity of methanogen via increasing ammonium concentration of elute. Landfill leachate is an excellent source of methanogens, which is specific to solid waste. The concentration of NO₃⁻, NH₄⁺ and PO₄³⁻ in permeate showed lower values. For the reason that a bio-film has been developed on liner system and it has absorbed NO₃⁻ and PO₄³⁻ ions in the elute and controls the toxic effect of inorganic ions on microorganisms. Permeate sample TDS shows decreasing trend. This indicates that the liner system is functioning well as expected. The kinetic study showed definite microbial life cycles, immaterial of substrate levels, although the populations differed. All of the results and experiences can be used to redesign a new reactor incorporating a hydrolysis/acidogenic phase reactor. A gas tight container/tank will reduce leakages and enhance gas removals.

Keywords: Start – up, Bio-reactor, Stabilization, Kitchen waste

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Toddy distillery spent wash as a source for compost making from the decomposable organic waste

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Index No: AG462

The present waste disposal methods in Jaffna peninsula are a major impediment to the public health and environmental quality by re-utilizing the waste materials. Therefore, a concept was developed to mix the Solid Waste (SW) with the Toddy Distillery Spent Wash (TDSW) produced from Thikkam and Navaly distilleries. Composting of both wastes is one of the eco-friendly waste management systems. In this study, composition of the fresh TDSW was analyzed. SW was collected randomly and the manual separation was practiced. The experiment was conducted for anaerobic process. Five kilogram of solid waste was mixed with 30 L of TDSW and control treatment was carried out with water instead of TDSW. For aerobic process, same amount of solid waste was mixed with 30 L TDSW at two days interval for 15 times and control was carried with water in similar pattern. The experiment was conducted in Completely Randomized Design (CRD). In addition, centrally aerated aerobic and anaerobic digesters were designed. pH, Ec, TDS, TS, TSS, VS, VSS Total nitrogen, available nitrogen, phosphorous, potassium and calcium were analyzed by standard methods. pH, TDS, Ec increases with time. But, the significance was higher in aerobic than anaerobic process. TS and VS were decreased by the methanogenic activity. TSS and VSS were increased by the microbial activity. Moisture content was kept above 80% in anaerobic and 60% in aerobic process. Quick composting, due to the higher decomposition rate, within 28 days was recorded for anaerobic process and greater than 35 days recorded for aerobic process. There was a significant difference in available nitrogen, phosphorous, potassium for anaerobic and aerobic samples obtained at the maturity time. Favourable C/N ratio of 30 was obtained for anaerobic process with distillery spent wash. Therefore mixing of solid waste with TDSW is the suitable sustainable waste disposal system for the production of nutrient rich compost. Solid waste and TDSW management are advisable to keep our city clean by minimizing the hazardous effects due to the improper disposal of both solid waste and TDSW.

Keywords: Toddy distillery spent wash, Compost making, Organic waste

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Design, fabrication and evaluation of pilot scale hand operated upland seeder

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Index No:AG457

Agriculture plays a key role to the cross domestic production of Sri Lanka. Northern part of Sri Lanka has a huge potential for Agriculture. Poor farming community experiences many hardships as they had already lost their farming equipment because of the war. Sowing cost contributes considerable fraction to the total cost of production. Advance seeders available in markets are costly as such poor farmers struggle to purchase it. Hence, an attempt has been made to cut down that fraction by developing a mechanical device, a low cost two row hand operated seeder. This pilot scale seeder was developed with an advance cup mechanism to eject seeds at the correct spacing. It has seed hopper, rigid handle, internal cup-wheel arrangement, mechanical agitator, furrow opener and covering device. Fabrication was investigated in terms of seed placement efficiency and seed damage of placed seeds. Green gram seeds were sown on levelled land with its recommended spacing by the fabricated pilot scale seeder. Number of correctly placed seeds and damage seeds was counted to justify the efficiency of seeder fabricated. Placement efficiency and damage percentage were 88.6 % and 5.2 % respectively. Therefore, it is clear that this pilot scale seeder does not disturb germination of seed as it places seeds almost in an accurate way and it cuts down sowing cost considerably. This pilot scale invention can be developed commercially to be attached on heavy four wheel tractor with tine for large extend cultivation. Therefore, developed hand operated eject type seeder is very useful to sow seeds mechanically since its fabrication and evaluation is satisfactory in the field investigation done.

Keywords: Design, Evaluation. Hand-operated, Upland seeder

Supervisors:Alvappillai.P¹ and Prabharan.¹

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Design, fabrication and evaluation of multi-grading machine

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Index No:AG456

The lime size grader is very important for regulation of size to have better marketing. Intensive manual size grading procedure has created more time utility that insisted on severe managerial failure. To justify the concept, a multi size grader was designed at the Department of Agricultural Engineering, Faculty of Agriculture University of Jaffna. The multi size grader can be operated mechanically with the help of an electric motor. The machine was fabricated, tested and then evaluated. The electric motor of 0.25 hp and 120 rpm was used to supply power through chain power transmission alignment to the per-wheel which mounted on crank shaft. One-side mounted pre-wheel was used to increase the speed of rotating mechanism. Materials used for fabrication of machine had shown no structural weakness or mechanical failure during operation. Here, the upper container sieve has 42 mm in diameter holes, which are equal in diameters and also the lower container sieve has 38 mm in diameter holes, each holes are equal in size. These flat plastic (PVC) perforated sieves were suitable to separate the limes from ungraded lime stock. These PVC sieve can prevent the rust, avoid bruise effect and reduce frictional damage to the fruit skin. Among the several angles tested, angle 0° gave better performance in grading efficiency and also suitable speed of 90 rpm showed better performance in grading. The lime size grader appeared to be a low cost machine for lime grading. The capacity of the lime size grader was found to be comparatively high as 120 Kg/hr. Furthermore, the overall grading efficiency was 91 % at the optimum operating conditions. From the results of the experiment, it was concluded that lime size grader can be recommended for farmer's concern. By changing the sieves and their holes sizes, the machine could be utilized for other fruit crop grading.

Keywords: Design, Evaluation, Multi-grading machine

Supervisors:Alvappillai.P¹ and Prabharan.M¹

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The influence of drying of agricultural perishables on their whiteness value as a reflective index

Student Name : Umakanthan Thirukumaran.

Index No:AG463

Drying is defined as mass transfer of water molecules from higher gradient to lower gradient as of the raise in temperature due to the release of heat energy from heat source. It plays key role in determining the shelf-life of agricultural perishables. Moisture is a medium for microbes to proliferate faster and to activate biological processes. Therefore, an attempt was developed to remove as maximum water as possible to control microbial proliferation and to deactivate enzymes. Heated air circulatory dryer was fabricated and evaluated in terms of moisture reduction rate, whiteness value of samples (reflective index), and psychrometric properties of heated air. The performance of drying was further compared with standard heated air oven. Drying operation was performed for three different groups of perishables, high moisture vegetables (>80% wb), medium moisture vegetables (70% - 80% wb), and low moisture vegetables (below 60% wb), based on their initial moisture content. Uniform sample slices were taken and the changes in their moisture and whiteness values, and psychrometric properties were measured with drying time up to 90 minutes at 15 minutes interval. The pattern of moisture removal of three groups of vegetables behaves differently. Medium moisture vegetables followed continuous falling nature, where as other two groups first followed constant nature and then falling nature. The moisture removal rate was 0.026 g/min, 0.232 g/min, and 0.52g/min for low moisture vegetables, medium moisture vegetables, and high moisture vegetables respectively. The quick drying was observed in heated air circulatory dryer, which seems six folds faster than that of heated air oven since it has an exhaust vent which is absent in an oven. The blanching did not give any positive differences in whiteness values of blanched samples compared to un-blanched samples. Whiteness value of samples diminishes with drying time, and it is based on reflective properties of sample slices. Reflective properties are dependent on solid constituents and water content of sample slices. Dry bulb temperature and wet bulb temperature were measured to fit psychrometric model to both an exhaust air and inlet air to check the efficiency of dryer in terms of its moisture removal rate and changes in enthalpy. Eventually, moisture content of exhaust air augments with drying time as the moisture removed from samples is added to an exhaust air. The overall dryer efficiency was calculated around $0.7 \pm 0.1(\%)$, which supports pilot scale dryer fabricated scientifically could be scaled up to suit small scale industries.

Keywords: Influence, Drying, Perishables, Whiteness value

Supervisors:Alvappillai.P¹ and Prabharan.M¹

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Design, fabrication and evaluation of filter for organic fertilizers in micro-irrigation

Student Name:PireethaLoganathan

Index No:AG463

Drip is, an advanced method of water application, widely used all over the world and it plays a vital role in the national agricultural economy and exploits the limited water resources efficiently and profitably. Adaptation of drip irrigation is important especially for Jaffna peninsula because there are no rivers and tanks available to supply water. A limited amount of groundwater is the only source accessible for all purposes such as drinking, industrial, public utility and irrigation. At present, cultivation technology is motivating towards organic farming. Also keeping a drip system free of debris is critical because most clogs will disturb system. Available filters in drip irrigation are not designed for extracted organic fertilizers. Hence, an experiment was carried out with the objective of design, fabrication and evaluation of primary, secondary filters and sand filter with the locally made cheap materials. The design filters were fabricated in a model forms which were used to filter the extracted organic fertilizers such as five leaves solution, gliricidia solution, and cow dung solution. The system performances were evaluated with uniformity of emitters. The sand filter's efficiency was measured before and after fixing of filter with drip irrigation from the design parameters. Filter efficiencies were calculated in wet weight basis by weight losses after each filtration through both filters. Flow rate of the fertilizer tank and drip system was measured to estimate the dilution factor and to control the flow rate. Primary and secondary filters were successfully designed. The "U" shape sand filter was selected to activate the filtering because the solids passing out due upward movement in the out let arm was negligible due to the gravity force of the particles. All the measured values were less than the recommended value results revealed that there was no significant variation in the uniformity before and after installation of sand filter in the system. The calculated emission uniformity were 60.05% for water, 56.43% for five leaves solution, 53.02% for gliricidia, 53.87% for cow dung solution. The dilution factor was 8.38. It is possible to control the fertilizer dilution by fixing of gate value between fertilizer tank and supply line. Finally, the conclusion was made that there was no any significant changes in the uniformity due to the installation of sand filters and applying the organic fertilizer solution. Also it indicates that there was no any clogging in the field due to application of

organic fertilizer solution. It is possible to control the fertilizer dilution by fixing of gate value between fertilizer tank and supply line.

Keywords: Design, Evaluation, Filter, Organic fertilizer, Micro-irrigation

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