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## **Effect of shading on plant growth performance of *Dracaena sanderiana.L.* in Jaffna District**

Student Name : Tharangeney Thiyaharajah

Index No : 493

Lucky bamboo (*Dracaena sanderiana* L.) is a popular indoor house plant grown all over the world. It can be grown in either water or soil. *Dracaena* becomes a famous indoor plant introduced to Jaffna in recent past. The major difficulty observed in cultivation of *Dracaena sanderiana* in Jaffna (dryzone) is the sensitive to light intensity. Previous studies also confirmed that the growth and development of *Dracaena* influenced by light intensity. Therefore an experiment was conducted to determine the effects of four levels of shade on growth and development of three varieties of *Dracaena* in Jaffna, Sri Lanka. 'Gold', 'Victory' and 'White' varieties were grown under 0 %, 50 %, 70 % and 85 % shade levels. The experiment was conducted in randomized complete design with three replicates. *Dracaena* varieties exhibited morphological plasticity in growth and development at different shade levels. Significant differences were observed between varieties of *Dracaena* and the shade levels on plant height, leaf number, inter-node length and visual quality. The plants grown at 50% and 70% shade levels shown high plant height increment, leaf number and inter-node length. Visual quality was evaluated by sensory evaluation and the plants grown under 70 % scored the highest scores followed by 50 % shaded plants. Less root mass developed in plants grown in 85% shade level. There were no significant difference observed in root mass development between plants grown under 50 % and 70 % shade level. From this study it can be concluded that 70% shade level is ideal for growing *dracaena* varieties followed by 50 % shade level in Jaffna (dry zone) Sri Lanka.

**Keywords:** Lucky bamboo, light intensity, shade levels, Visual quality

**Supervisor:** Dr. (Mrs).S.Sivachandiran

Department of Agronomy, Faculty of Agriculture, University of Jaffna, Sri Lanka

**Effect of planting pattern on growth and yield of cowpea (*vigna unguiculata* L.) intercropped with maize (*zea mays*.L.)**

Student Name : Tharshana Markandu

Index No : 494

The study was conducted at the District Agricultural Training Centre (DATC), Thirunelveli, during the period from January to April 2012 to assess the effect of planting patterns of cowpea intercropped with maize. The experiment was carried out with four treatments in randomized complete block design (RCBD) with three replicates. Maize was planted in single row (120cm x 40cm) and paired rows (60cm × 40cm) systems. In both systems same plant population of maize was maintained. Under these systems one row and two rows of cowpea were intercropped. Growth and yield parameters of maize and cowpea were recorded and analyzed. Plant height, yield of the maize and pod length of cowpea were not significantly differed among treatments. Yield of cowpea was significantly differed among treatments. Significantly higher yield was recorded in double row maize with single row cowpea (treatment T<sub>2</sub>). Land equivalent ratio (LER) was significantly differed among treatments and the highest LER (1.65) and net profit also recorded in T<sub>2</sub>. Considering yield, profit and other quality parameters, double row maize with single row cowpea can be recommended as a better planting pattern for intercropping cowpea with maize.

**Keywords:** Land equivalent ratio, intercropping, Maize, cowpea

**Supervisor :** Dr. (Mrs).S.Sivachandiran

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## **Performance of bell pepper varieties under different fertilizer regime**

Student Name : Sangeetha Kulasingam

Index No : 497

Bell pepper (*Capsicum annuum* L.) is a popular vegetable crop around world and recently it was introduced to Jaffna as a high valued crop. A study was carried out during January to May 2012 to investigate the performance of bell pepper varieties under different fertilizer regimes at District Agricultural Training Centre, Thirunelveli. The experiment was laid out in randomized complete block design with three replicates consist of 12 treatment combinations. Four different varieties (Polaris, Red star, California yellow wonder, Ganga) and three different fertilizer levels (Recommended level of inorganic fertilizer with organic fertilizer, ½ recommended levels of inorganic fertilizer with organic fertilizer and only organic fertilizer) were used in this experiment. Plant growth parameters, yield parameters and fruit quality of bell pepper were recorded and analyzed. Plant height, canopy width and fruit circumference of bell pepper were not differed significantly among varieties. Yield, thickness of the fruit and average fruit weight were significantly differed among fertilizer levels and varieties. But there was no significant difference found in yield parameters between the half recommended and recommended levels of inorganic fertilizer. The highest yield was recorded in variety Red star and Ganga and the lowest yield was recorded in variety Polaris. In different fertilizer levels, the lowest yield was recorded in plants where only organic fertilizer applied. The interaction effects between varieties and fertilizer regimes were not significant. From this study it can be concluded that varieties Red star and Ganga can be cultivated with half recommended level of inorganic fertilizer was the best practise to obtain higher yield.

**Keywords:** Fertilizer, bell pepper, yield parameters, growth parameters

**Supervisor:** Dr. (Mrs).S.Sivachandiran

Department of Agronomy, Faculty of Agriculture, University of Jaffna, Sri Lanka

**Efficiency of different mulching materials on weed abundance, growth and yield of okra (*Hibiscus esculentus*) under drip irrigation**

Student Name : Sarujaa Palanimalainathan

Index No : 498

Field experiment was conducted to assess the weed control efficiency of different mulching materials in okra cultivation under drip irrigation. Further effects of mulching materials on the population of different weed categories, their emergence at different growth stages of okra and influences on the crop growth and development, yield, modification of soil temperature and soil moisture conservation were studied. Two varietal treatments and five mulch treatments were arranged in randomized complete block design with three replicates as ten treatment combinations. There was no significant interaction between varietal treatment and mulch treatments. Mulches were proved their effectiveness in weed control, ameliorating the soil temperature and soil moisture conservation. Due to these impacts, mulches except black polythene improved the crop growing environment and resulted in increment of crop growth and yield. Sedges especially *Cyperus rotandus* emerged highest in numbers and also showed highest weed dry matter, than broad leaves and grasses. The weed emergence was higher in vegetative phase and lower in both reproductive and harvesting stages of okra. The crop growth and yield performance of Haritha was higher than TV8. The usage of organic mulches was economically feasible compared to unmulched and plastic mulched cultivation. Cultivation of Haritha variety under *Gliricidia* leave mulch was performed better than other treatment combinations.

**Keywords:** mulching, okra, drip irrigation, Sedges

**Supervisor:** Dr. (Mrs).S.Sivachandiran

Department of Agronomy, Faculty of Agriculture, University of Jaffna, Sri Lanka

**Influence of plant densities and fertilizer management on nodulation, growth and yield of black gram (*Vigna mungo.L.*)**

Student Name : Justin Singarayar Shanas Nowrogi

Index No : 513

A field experiment was conducted during January to June, 2012 at District Agriculture Training Centre, Thirunelvely to study the influence of plant densities and fertilizer management on nodulation, growth and yield of black gram (*Vigna mungo*). Recommended variety MI 1 planted at four different plant densities (25 cm × 10 cm, 30 cm × 10 cm, 35 cm × 10 cm and 40 cm × 15 cm) with four different levels of fertilizer (organic matter only, organic with basal only, organic with half recommended basal and half top dressing, organic with recommended fertilizer level both basal and top dressing). Inorganic fertilizer application significantly reduced the nodulation in roots but improved the vegetative growth of black gram and it significantly increased plant height and canopy width. Different plant densities had no significance effect on nodulation. The grain yield was not significantly differed among different fertilizer levels. But the highest yield was recorded in plants grown at spacing of 35 cm × 10 cm with only recommended levels of organic fertilizer. From this study it can be recommended that black gram be successfully cultivated at a spacing of 35 cm × 10 cm with organic fertilizers only in Jaffna district with supplementary irrigation.

**Keywords:** supplementary irrigation, black gram, plant densities, Fertilizer levels

**Supervisor:** Dr. (Mrs).S.Sivachandiran

Department of Agronomy, Faculty of Agriculture, University of Jaffna, Sri Lanka

**Growth and yield performance of tomato (*Lycopersicon  
esculentum*) varieties under soil-less culture**

Student Name : Vythekee Sukumaran

Index No : 514

An experiment was conducted during January to June 2012 to study the effect of soil less culture media and nutrient solution treatment on plant growth and yield parameters and the incidence of pest and disease in tomato in two factor factorial complete randomized design with three replicates. The treatment combinations were included two types of growing medias such as soil less and soil growing media and three tomato varieties such as Padma 108, Roma and KC-1. These varieties were grown in soil less media using Albert's solution for fertigation in bags using coir dust and partially burnt paddy husk as medium. All the management practices were performed as per recommendation of the Department of Agriculture. Plant height, root development, number of fruits per plant, number of days taken to maturity, fruit weight, total fruit yield and percentage of marketable yield were significantly differed in varieties and growing media. No effects were recorded on canopy width, cumulative leaf number and days taken for 50 percentages flowering on the tomato plants in both varieties. In tomato, highest main stem height, canopy width, number of cumulative leaves and leaf area were found with the application of nutrient solution in soil less growing media, in Padma 108 tomato variety. Flowering and flower dropping was high in KC-1 variety than Roma and Padma 108. A higher total fruit yield (23.6 t/ha), marketable percentage (81%) and fruit set percentage (71%) were found with the application of nutrient solution in soil less treatment. Incidence of pest, disease was lower in tomato variety Padma 108. According to this study it can be concluded that Padma 108 tomato variety can be recommenced as suitable variety for soil less culture to obtain highest yield with quality fruit.

**Keywords:** soil less culture, Tomato, quality characters, fertigation

**Supervisor:** Dr. (Mrs).S.Sivachandiran

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## **Potential for goat production in the Valikamam area of the Jaffna district**

**Student Name** : Kajani Nagendran

**Index No** : AG 520

This study was carried out in the Sandilipay, Chankanai, Kopay, Uduvil and Tellipalai veterinary divisions of the Jaffna district during the period of November to April 2012. The objective was to study the socio-economic status of the farmers in the study area and the potential for goat production in the study area. The list of goat farmers in the study area was obtained from the respective veterinary divisions. Out of 5000 farmers 500 farmers (10%) were randomly selected for the study using Table of random numbers. Information was collected using a structured questionnaire. Information was collected on socio-economic status of the farmers and various aspects related to goat farming. Data was processed using Microsoft Excel and summarized using SAS. Agriculture was the main occupation of goat farmers in Kopay, Uduvil and Tellipalai veterinary divisions. Around 83.6% of the farmers had meat production as one of the purpose of rearing goat. The average herd size of Sandilipay, Chankanai, Kopay, Uduvil and Tellipalai veterinary divisions were 3.75, 3.02, 3.14, 4.01, 3.11 respectively. The goat breeds found in the study area were Sannen, Jamnapari, Sri Lankan boer, Jaffna Local and their crosses. Nearly 50% of the farmers reared their goats under intensive system of management. The ground housing was found in 82.40% of the goat farms. Women's contribution of goat farming was 37.20%. Among the goat breeds available, Sannen gave the highest milk yield of 1.25L per day. Within the breeds Sannen had highest kidding interval (12.60). Comparatively higher percentage of farmers preferred to service naturally than the artificial insemination (AI). Service by using stud centers was high in all veterinary divisions (50% to 97%). In all veterinary divisions higher percentage of farmers sold their goats to middlemen and whole sale. The cost of feeding was the highest among the variable cost components. Sale of animal is the major source of income.

**Key words:** Goat, cost, income, Veterinary division

**Supervisor:** Dr. (Miss). J. Sinniah

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

## **Adoption of artificial insemination for cattle in the Jaffna district**

**Student Name** : Rohini Paramsothy

**Index No** : AG 512

The present study was carried out in the Kopay and Karaveddy veterinary divisions of the Jaffna district during the period from December 2011 to May 2012. The objective was to study, the socio-economic status of the AI famers in the study area, study the factors influencing the adoption of AI in the study area, determination of conception rate by AI for cattle and to study the factors affecting the conception rate by artificial insemination. The list of farmers adopting AI in the study area was obtained from the respective veterinary divisions. Out of 1300 farmers 130 farmers (10%) were randomly selected for the study using Table of Random numbers. Information was collected on socio-economic status of the farmers and various aspects related to Artificial Insemination. Data was processed using Microsoft Excel and summarized using SAS. Percentages of farmers adopting AI alone at Kopay and Karaveddy veterinary divisions were 72% and 73.33% respectively. About 97% of the farmers had milk as one of the purposes of rearing cattle. Farmers preferred AI over NS due to easiness, low cost, increased milk yield, upgraded cattle, time saving time and reduced disease transmission. Clear mucous discharge, restless, bellowing, mounting other cows, reduction in milk yield, tail turned were considered as signs of heat. In the Kopay and Karaveddy veterinary divisions 82% and 80% of farmers succeeded to make their animals conceived with second insemination. The study showed occupation, land holding size, management system, distance of veterinary office, level of education, source of bull and payment for each insemination all have influenced the adoption of AI. The conception rate by AI for cattle was measured by using pregnancy diagnosis. In Kopay veterinary range conception rate by AI for cattle ranged from 80% to 90.6% in year 2011. But in Karaveddy veterinary range, conception rates by AI for cattle ranged from 60% to 75% .Conception rates by AI for cattle were influenced by a variety of factors such as nutrition, reproductive disorders, heat detection, AI technique, environmental factors, semen quality, bull fertility, age and genetic factors.

**Key words:** Artificial insemination, Cattle, Conception rate

**Supervisor:** Dr. (Miss). J. Sinniah

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## **Feeding strategies on small scale dairy production systems in the Thirunelvely area of Jaffna district**

**Student Name** : Thavalanky Subramaniam

**Index No** : AG 510

The objective of the study was to identify local feeding strategies in small scale dairy production systems in the selected area of Jaffna district and to determine their effects on milk yield, milk composition and economic viability. Out of the 19 centres under the Jaffna District Development Cooperative Society; Thirunelvely centre was selected for this study. Using structured questionnaire information was collected from 65 farmers through personal interview during the period of November 2011 to January 2012. Information was collected on background information, breed information, breeding information, production characteristics, feeding practices, expenditure and returns. Out of 65 farms identified 55% of farms followed semi – intensive management system and 45% of farms followed intensive management system. Extensive system was not practiced. In the study area farms did not have bull at the herd so herd structure was not in agreement with typical herd structure. 85% of farms used artificial insemination and 15% of farms used natural service for breeding. After the questionnaire survey ten farms that had Jersey cross cattle for each management system was selected using table of random numbers and the total number of farms selected were twenty. These twenty dairy farms were monitored by monthly visits recording and sampling of milk and feed from each farm were done. Milk composition and chemical composition of feeds were determined. Eleven feedstuffs and three feeding strategies were identified. Of participating farms, 28.3 % followed strategy 1, 16.98 % followed strategy 2 and 54.71 % followed strategy 3. For these three different feeding strategies, there were no significant difference found to milk protein, total dry matter intake and CP dry matter intake. But there were differences for milk yield, milk fat content and feed cost. Milk yield, milk fat content and profit were high in strategy 2. All feeding strategies produced positive economic returns but, the feeding strategy 2 is the most effective system among all systems studied.

**Key words:** Feeding strategy, Dairy, Milk, Feed.

**Supervisor:** Dr. (Miss). J. Sinniah

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

## **Faunal association and properties against storage pests of *Withania somnifera* Dunal. to promote cultivation as a potential medicinal crop in Jaffna**

**Student Name:** Suvanthini Sanmugaratnam

**Index No** : AG 506

The medicinal plant, *Withania somnifera* (Ashwagandha) is becoming popular among farmers. Due to its importance, farmers are interested to cultivate it in larger extent. This study was aimed to assess the potential of *W. somnifera* to cultivate in Jaffna, identify the associated fauna and investigate the effect of its extracts against storage pests. Different field trials and *in vitro* studies were conducted. For field trials, seeds of *W. somnifera* were water soaked overnight and sown to evaluate the phenology of the plant. Results showed that germination was observed  $5.6 \pm 1.16$  days after sowing in nursery. One month old seedlings were transplanted at 45cm  $\times$  60cm spacing. Phenology of *W. somnifera* revealed that it was flowering continuously. Flowering and fruiting were commenced  $66.17 \pm 3.43$  and  $79.77 \pm 2.07$  days after the transplanting, respectively. Roots reached economic timber value between 6 - 7 months old because at that time root:shoot ratio was optimum ( $0.54 \pm 0.09$  to  $0.65 \pm 0.13$ ). Average seed production rate was 6581.89 seeds/plant. To break down seed dormancy, seeds underwent to hot water soaking at 80°C for two hours and water soaking for overnight. Results registered, germination percentages were  $52.75 \pm 3.50$  % and  $33.75 \pm 2.75$  %, respectively compared with control ( $12.5 \pm 2.08$  %). The arthropod fauna and diseases associated with *W. somnifera* were recorded. Among 39 arthropod fauna, 12 and nine species were defoliators and sucking insects, respectively and the rest of them were beneficial insects. Moreover, root-knot nematode and little leaf disease were recorded as disease. In the *in vitro* studies, Larvae of *S. cerealella* were introduced to healthy fruits of *W. somnifera* to evaluate its damaging capability. The results revealed that larvae damaged the fruits and due to this seeds lost their germinating ability completely. In another study, the shoot extract of *W. somnifera* at the level of 20, 40, 60, 80 and 100% were studied for their insecticidal activity on *S. oryzae*. Mortality was assessed 5 and 10 days after treatment (DAT). Mortality at maximum concentration (100%) were 84.17% and 86.07 % both in 5 days and 10 days, respectively but not significantly on par ( $P < 0.05$ ). Furthermore, leaf, fruit, root and shoot extracts of *W. somnifera* at the above mentioned levels were evaluated against storage pests, *S. oryzae*, *C. chinensis* and *T. castaneum*. Damage percentage of *S. oryzae* and *C. chinensis* were taken at 7 DAT and Grain weight loss (GWL) by *T. castaneum* was taken at 7, 30 and 60 DAT. Minimum GWL by *T. castaneum* was observed in 30 and 60 days after treatment (DAT), of  $0.7 \pm 0.12$  and  $3.17 \pm 0.47$  % respectively. GWL was increased with time. Damage percentage of green gram by *C. chinensis* exhibited an indirect relationship with the concentration. Among different extracts, the sets treated with 100% of extracts recorded lowest damage ( $3.36 \pm 1.31$ %) followed by 80% ( $5.6 \pm 0.98$ %) of



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concentrations. Lower damage by *S. oryzae* was observed leaf extract ( $2.40 \pm 0.68\%$ ) followed by fruit ( $2.47 \pm 0.09\%$ ) and root ( $2.93 \pm 0.76\%$ ) extracts but root extracts reduced the damage percentage from lowest concentration. These studies suggest that the climate and soil prevalent in Jaffna are suitable to multiply this herb with least cost and extracts can be used to protect the grains from storage pests under small scale.

**Key words:** Fauna, Jaffna, *Withania somnifera*, insecticidal, *T. castaneum*

**Supervisors:** Prof. G. Mikunthan and Dr. (Mrs). S. Thurairatnam

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## **Existence of Vesicular arbuscular mycorrhiza in roots of queen palm (*Livistona rotundifolia*) and its growth in different media**

**Student Name:** Varmila Sinnarajah

**Index No** : AG 495

Existence of mycorrhizal association is complementary alternative to reduce the inorganic fertilizer application of *Livistona rotundifolia*. Therefore, as an initial step, the present study was under taken to find the occurrence and distribution of Vesicular Arbuscular Mycorrhiza (VAM) colonization in *L. rotundifolia*. It also studied the effects of different media in their root growth. VAM fungi were isolated from the root cortex cells of *L. rotundifolia* with cotton blue-lactic acid stain. Also the *Glomus* and *Acaulospora* spores were isolated from the rhizosphere of *L. rotundifolia* by wet sieving and sucrose centrifugation technique. Plant qualities were depending on the degree of mycorrhizal colonization in three months and one year old potted plants. VAM fungal propagules were poorly distributed varying in number from 18 to 288 spores/100 g soil in potted plants and 8 to 40 spores/100 g soil in ground plants rhizosphere soil. Percent root infection in potted plants ranged from 0.2 to 1.8 however, in ground plant it was 1.77% to 2.55%. VAM fungi spore count was high in potted plants but the root colonization was high in ground plants. Negative correlation was found between root colonization and mean spore density of both the potted and ground plants indicating that low levels of spore density are associated with high root colonization. Quantity of VAM propagules was increased with the age of the ground plants. *Trichoderma* spp, *Nomuraea rileyii*, *Metarhizium anisopliae*, vermicompost and cowdung were inoculated with both basic media, mushroom compost and Ca (NO<sub>3</sub>)<sub>2</sub> treated coir, to evaluate the shoot and root growth. The results revealed that the media inoculated with *Trichoderma* spp was significantly ( $P \leq 0.05$ ) increased the root growth. Although the results showed that the mushroom compost base media was better than Ca (NO<sub>3</sub>)<sub>2</sub> treated base media for root and shoot growth of *L. rotundifolia*. There was no correlation was observed in between different growing media and the root mycorrhizal colonization with six months after transplanting. These findings suggest that the inoculation of mycorrhiza to *L. rotundifolia* plant may act as a bio fertilizer.

**Key words:** VAM, *T. Castaneum*, rhizosphere, mycorrhiza, colonization

**Supervisors:** Prof. G. Mikunthan and Mr. E. Arne Svinningen

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## **Isolation and host range determination of entomopathogenic fungi, *Fusarium* spp**

**Student Name:** Subajini Balakrisnan

**Index No** : AG 492

Investigations were carried out for isolation, host range determination of an entomopathogenic fungi, *Fusarium* sp and also determined the colony growth of isolated fungi in different growing media. From soil sampling and dead cadavers, two *Fusarium* sp were isolated. Test insects either reared in laboratory or obtained from field were topically applied with spore suspension of both isolated fungi. Isolate 01 caused death of coleopteran beetle 3 days after the spore application (DASA). Mycosis was found 5 DASA. In red flour beetle grub external mycosis was found a DASA. Isolate 02 caused mycosis on *Aphis gossypii* (Aphid), *Dysdercus koenigii* (Red cotton Bug) and *Nezara viridula* (Southern Green Stink Bug). In those pests, external mycosis was found 4DASA. Excellent growth of the isolate 01 and 02 was observed on SMAY medium 9.0cm. Isolate 02 in PDA medium also 9cm growth was observed 15 days after inoculation (DAI). Lesser colony growth of both isolates of 01 and 02 were observed in YEA medium 15 DAI 6.8cm and 4.6cm, respectively. Isolate 02 and *Trichoderma harzianum* showed mutual intermingling interaction. Isolate 02 and *Trichoderma viride* showed partial intermingling interaction.

**Key words:** *Fusarium* sp, isolate, fungi, *Trichoderma harzianum*, colony growth

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

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## **Evaluation of banana cultivars against *Odoiporus longicollis* infestation and effect of biorational towards the management of this pest**

**Student Name:** Sobana Muthukumaraswamy

**Index No** : AG 509

Prime income giving fruit crop is being damaged by various pests and diseases in Jaffna. Among the insect pest of banana, Banana pseudostem weevil, *Odoiporus longicollis* is an important one and causing severe threat to banana growers. A field experimental attempt and *in-vitro* studies were carried out to understand the field symptoms of *O. longicollis* on banana. Symptoms were observed on the injured plants and pseudostem left in the fields after harvesting. In an *in-vitro* study, host selection, attraction and preference towards the distinct cultivars, such as *Sevvazhai*, *Colombo itharai*, *Jaffna itharai*, *pulikkathali*, *seenikkathali*, *Ash monthan*, *Abisheka monthan* and *Kappal* were observed. Results showed that *Sevvazhai* had high attraction effect than others. Following *Sevvazhai*, *Colombo itharai* has shown next highest number of weevils attracted in all three days followed by *Jaffna itharai*, *pullikkathali* and *Kappal* did not attract the weevils significantly whereas other cultivars such as *Seenikkathali*, *Ashmonthan*, *Abisheka monthan* failed to attract them at all. In another experiment, repellency bioassay was estimated on *Itharai* by using 10cm x 4cm pieces of pseudostems treated with various bio-rationals such as, *Azardiracta indica*, *Tephrosia pupurae*, *Ricinus communis*, *Nicotiana tobacum* at 20% concentration with control. Results revealed that number of weevils repelled by *A. indica*, *N. tobacum* and *R. communis* was statistically on par compared to *T. pupurae* and control. But *A. indica* was the best bio-rational followed by *N. tobacum* and *R. communis* among the significant. In another experiment, repellency bioassay was estimated on filter paper and on feeding material for the 5%, 10% plant extract of *Allium cepa*, *Acarus calamus*, *Piper nigrum*, *Curcuma aromatic* and *Curcuma longa*. All five extracts such as *A. calamus*, *A. cepa*, *P. nigrum*, *C. aromatica*, *C. longa* showed repellent effect against the *O. longicollis*. Percentage repellency values are not appeared to be proportional to the concentration to the extract. *A. calamus*, *A. cepa*, *P. nigrum* are shown higher repellency values compare to *C. aromatica*, *C. longa*. So, early removal of harvested pseudostem in the field will reduce the pest buildup in the field. It is better to avoid to plant the cultivars those highly attract the weevils. And apply the neem paste on the cut ends of pseudostems.

**Key words:** Banana, Jaffna, pseudostems, weevils, biorational

**Supervisors:** Prof. G. Mikunthan and Mr. K. Pakeerathan

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

## **The analytical study of Sesame (*Sesamum indicum* L.) population available in Jaffna peninsula**

**Student Name:** Sethurajah Vasanthakumar  
**Index No** : AG 515

Success of genetic improvement in many economically valuable crops, like sesame, is solely dependent on available genetic variability. A great deal of genetic variability in sesame (*Sesamum indicum*) has been observed in farmer's fields in Jaffna district. Therefore genetic diversification based on morphological attributes in sesame grown in Jaffna district was critically examined in this study. According to the "Descriptors for sesame" released by IPGRI and NBPGR, total of thirteen qualitative characters were studied in sesame populations found in fields in Jaffna district. Moreover, an attempt was made to determine capsule length and width, seed number, and thousand seed weight influence on yield of the sesame as well as to decide the ideal carpel type for sesame to select and for breeding purpose. Thirty six data were collected for each capsule type and one hundred and eighty data were collected for each character of sesame capsule and were analyzed separately. To measure the yield performance the experiments were conducted using RCBD with four replicates. Pearson correlation analysis was performed for six capsule characters such as capsule length, capsule width, seed number, single seed weight, seeds filling percentage and seeds per locule number. The results show that, seed number is positively correlated with number of carpel in sesame capsule. Higher seed number was obtained in four carpel (82.06) and five carpel (84.94) types, however two carpel capsules contain very low seed number (63.13) and significantly vary from all other types. Even though only two carpel varieties are recommended in Sri Lanka for cultivation. Two carpel capsules have very short width (0.78cm) and long length (2.71cm) and significantly differ from all other carpel types. Four carpel (8 locules) and five carpel (10 locules) sesames are ideal parent stock for varietal improvement. Multilocules and multicapsules of the sesame are the major attributes to increase the yield. Very high positive correlation is found between the capsule length and seeds per locule (0.93082), seeds per locules and single seed weight (0.99988) and capsule length and single seed weight (0.93131). High positive correlation was found between the capsule length and seed filling percentage (0.84107) and width of capsules and seed number (0.78335). Seed filling percentage is highly correlated (0.76346) with seeds per locule and single seed weight (0.76105). Negative moderate correlation (-0.66616) was observed between capsule length and seed number. High negative correlation was observed between length and width of capsules (-0.85620), width of capsule and seed filling percentage (-0.88402), width of capsules and seeds per locules (-0.80109) and width of capsules and single seed weight (-0.79810). Seed number was negatively moderately correlated with seed filling percentage (-0.61559) seeds per locule (-0.58318) and single seed weight (-0.58035). Bicarpillate capsule had seed filling rate of 100% because this type of capsule contain seeds in all four

locules. But tricarpyllate, quadricarpyllate, five carpel and six carpel capsules had seed filling rate such as 97.91%, 77.08%, 75%, 63.31%, respectively. However, 10 L cultivar and 12 L cultivar are not recommended yet in India or Sri Lanka, but our promising line (V1type) have 8, 10 and 12 as a mixer but still segregating. In the breeding program further selection is need to be carried out to stabilize for high locule numbers that would be suitable for high productivity. To develop high yielding sesame cultivars specific desirable characters are identified from this study to serve the purpose.

**Key words:** *Sesamum indicum*, locule, carpel, yield, cultivar

**Supervisors:** Dr. G. Thirukkumaran<sup>1</sup> and Prof. V. Arulnandhy<sup>2</sup>

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**Effect of vermicompost, vermicompost tea, vermiwash and body fluid against root mealy bug (*Rhizoecus hibisci*) on queen palm(*Livistona rotundifolia*) and pink hibiscus mealy bug (*Maconellicoccus hirsutus*) on croton**

**Student Name:** Mary Antonet Morais Pathinathan

**Index No** : AG 515

The potential of vermicompost to protect plants against various pests either by suppressing or repelling them or by inducing biological resistance in plants to fight them or by killing them through pesticidal action. The present investigations were focused on the efficacy of vermicompost, vermicompost tea, vermiwash and body fluid of *Eisenia fetida* on *Rhizoecus hibisci* (root mealy bug) and *Maconellicoccus hirsutus* (Pink hibiscus mealy bug) control. The efficacy of vermiwash against *R. hibisci* was compared with field water as control and also the impact of body fluid of *E. fetida* was evaluated against the *R. hibisci* and *M. hirsutus* under *in-vitro* condition. In the field trials it was studied that the efficacy of vermicompost as a potting media of 2 years old *Livistona rotundifolia* (Queen Palm) against *R. hibisci*. These pot plants were treated with vermicompost from buffalo dung with foliage waste (1:1) (T1), vermicompost from foliage waste (T2) vermicompost from buffalo dung (T3) and coir dust (T4). These treatments were repeated for vermicompost tea with drench application. All treatments were replicated five times and data was statistically analyzed. The chemical parameters such as pH and EC of vermiwash were evaluated by using two different vermicompost obtained from foliage waste and buffalo dung. Among treatments, the drenching application of body fluid of *E. fetida* (EC of 0.75mS/cm, pH of 6.0) was caused higher percent reduction of *R. hibisci* population (81.58%) than field water (25%) while the *M. hirsutus* was controlled successfully under *in-vitro* conditions. The waxy coat of *M. hirsutus* was disappeared after the second top application of vermiwash contains EC of 9 mS/cm, pH of 6.5. The application of buffalo dung vermicompost and foliage waste vermicompost was registered significantly ( $p < 0.05$ ) higher percentage population reduction of *R. hibisci*, being at par with the standard check at 30 days after treatment. The slightly significant of population reduction was observed in vermicompost of buffalo dung with foliage waste. The percentage population reduction of *R. hibisci* in the buffalo dung vermicompost, foliage waste vermicompost and vermicompost of buffalo dung with foliage waste were 41.47%, 30.08%, 21.18% respectively. From 50 days after initial treatment, the vermicompost tea prepared by using the foliage waste effectively reduced the population of *R. hibisci* (60.50%) than prepared by using foliage waste with buffalo dung (45.21%) and buffalo dung (32.50%). The positive relationship was observed between the EC value and percent reductions of root mealy bug population. The pH value of vermiwash from foliage waste vermicompost was 6.53 - 7.45 and from

buffalo dung vermicompost was 6.75 - 7.85. The EC value of vermiwash from foliage waste vermicompost was 8.53 - 9.95 and from buffalo dung vermicompost was 4.2 - 4.55.

**Key words:** Vermicompost, *R. Hibisci*, *E. fetida*, foliage waste, body fluid

**Supervisors:** Prof. G. Mikunthan and Mr. E. Arne Svinningen

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## **Effect of three types of charred biomass on yield of *Capsicum annum* and important soil properties**

**Student Name:** Nilushiny Aloysius Manoharan

**Index No:** AG 501

An experiment was conducted to find the response of *Capsicum annum* for three types of charred biomass namely coconut char (CC), palmyrah char (PC), and paddy husk char (PHC) in combination with organic and inorganic fertilizers and to find the effect of these charred biomass on important soil properties. The field experiment was carried out at the Regional Agriculture Research Station, Thirunelvely. At the end of the experiment important soil properties were determined at the Department of Agricultural Chemistry, University of Jaffna. Randomized Complete Block design was used with three blocks and eight treatments. The treatments were, department recommended fertilizer (DRF), farmers' practice fertilizer (FPF) and each three types of charred biomass with either DRF or FPF. Application of charred biomass with fertilizer has improved *Capsicum* yield and available nutrients (N, P and K) compared to fertilizer application alone. About 21.74% and 41.47% yield increase was observed in T<sub>1</sub> (DRF + CC) and T<sub>2</sub> (DRF + PC) respectively compared to T<sub>4</sub> (DRF). However, T<sub>3</sub> (DRF + PHC) did not show significant difference in yield compared to T<sub>4</sub> (DRF). Similarly, about 34.95%, 46.18% and 65.86% increase was found in T<sub>5</sub> (FPF + CC), T<sub>6</sub> (FPF + PC) and T<sub>7</sub> (FPF + PHC) respectively compared to T<sub>8</sub> (FPF). PC has improved important soil properties followed by CC and PHC when apply with DRF. In T<sub>2</sub> (DRF + PC), availability of N, P and K and CEC were increased by 66%, 41.7%, 52.2% and 84.9% respectively compared to T<sub>4</sub> (DRF). Likewise PHC has improved important soil properties followed by PC and CC when apply with FPF. In T<sub>7</sub> (FPF + PHC), availability of N, P and K were increased by 45.5%, 100% and 28.6% respectively compared to T<sub>8</sub> (FPF). However, T<sub>3</sub> (DRF + PHC) did not show significant difference in available P, EC and CEC compared to T<sub>4</sub> (DRF). T<sub>1</sub> (DRF + CC) has increased N, P and K availability and CEC by 45.3%, 8.3%, 16.7% and 75.6% respectively compared to T<sub>4</sub> (DRF). Similarly, in T<sub>5</sub> (FPF + CC) above same properties increased by 34.8%, 21.4%, 5.6%, 12.97% and 50.8% respectively compared to T<sub>8</sub> (FPF). PC has increased the N, P and K availability when apply with FPF also. About 39.4%, 57.1%, 18.4% and 61.6% increase of available N, P and K and CEC respectively were recorded in T<sub>6</sub> (FPF + PC) compared to T<sub>8</sub> (FPF). Compare to T<sub>0</sub> (Control), reduced soil pH in treatments related to FPF and increased soil pH in treatments related to DRF was recorded even in same charred biomass applied treatments. All treatments have increased organic matter content except the treatments without charred biomass applied treatments compared to T<sub>0</sub> (Control). Therefore PC has higher potential to increase yield and improve soil properties when apply with DRF while paddy husk char

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performs best when applied with farmer practice fertilizer. Moreover, paddy husk char did not have any effect on yield when applied with DRF. However, coconut char and palm char has the potential to increase yield and improve soil properties with both DRF and FPF.

**Keywords:** Charred biomass, available nutrients, Cation Exchange Capacity, Carbon, yield

**Supervisor:** Dr. (Mrs). N. Gnanavelraja  
Department of Agricultural Chemistry, Faculty of Agriculture, University of Jaffna, Sri Lanka.

## **Effect of different charred biomass addition on soil properties on selected soil of Jaffna peninsula**

**Student Name:** Priyatharshny Pannerchchelvan

**Index No:** AG 491

This Experiment was carried out at the Department of Agricultural Chemistry, University of Jaffna to find the effect of different charred biomass addition on soil properties on a selected soil of Jaffna peninsula. This is a part of a long term study to investigate the effect of charred biomass on yield of different crops and soil fertility. Treatments were T<sub>1</sub> (coconut char + dried cow dung), T<sub>2</sub> (Palmyra char + dried cow dung), T<sub>3</sub> (Rice husk char + dried cow dung), T<sub>4</sub> (Coconut char + inorganic fertilizers), T<sub>5</sub> (Palmyra char + inorganic fertilizers), T<sub>6</sub> (Rice husk char + inorganic fertilizers), T<sub>7</sub> (Coconut char + inorganic fertilizers +dried cow dung), T<sub>8</sub> (Palmyra char + inorganic fertilizers + dried cow dung), T<sub>9</sub> (Rice husk char + inorganic fertilizers +dried cow dung), T<sub>10</sub> (Inorganic fertilizers + dried cow dung), T<sub>11</sub> (Inorganic fertilizers alone), T<sub>12</sub> (Dried cow dung alone) and T<sub>13</sub> (control). The design was RCBD with three replicates. The soils were analyzed after harvesting the first crop which was onion. Results of the soil analysis of different treatments indicate different charred biomass combine with dried cow dung and NPK fertilizers significantly increased soil pH than NPK fertilizers alone. When NPK fertilizers applied alone soil pH was significantly decreased than control treatment. Selected soil was saline and combine application of different charred biomass, dried cow dung and NPK fertilizers has a tendency to buffer the soil salinity. Different charred biomass and cow dung application significantly increased organic matter percentage than control soil. Coconut char had highest organic matter percentage than other charred biomass. Combine application of charred biomass, dried cow dung and NPK fertilizers significantly increased total nitrogen percentage than NPK fertilizers applied alone. Complementary use of different charred biomass, cow dung and NPK fertilizers significantly increased available nitrogen than control soil. Application of different charred biomass, and dried cow dung combine with NPK fertilizers increased available phosphorus than NPK fertilizers applied alone. Different charred biomass combine with NPK fertilizers and dried cow dung significantly increased soil available potassium than control soil. NPK fertilizers application not significantly increased CEC of soil than control treatment. Charred biomass combination with NPK fertilizers and dried cow dung significantly increased CEC of soil than control treatment and NPK fertilizers alone applied treatments. Different charred biomass combination with dried cow dung and NPK fertilizers significantly increased soil microbial biomass content than control treatment. Combine application of different charred biomass, dried cow dung and NPK fertilizers significantly increased WHC than NPK fertilizers alone and control treatment. Results indicate that application of different charred biomass in combination with dried cow dung and NPK fertilizers to

agricultural soils had the potential to improve soil physical and chemical properties.

**Keywords:** Charred biomass, available nutrients, Cation Exchange Capacity, microbial biomass carbon, water holding capacity

**Supervisor:** Dr. (Mrs).N.Gnanavelraja.N  
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## **Available nutrients in soils under different agricultural land - uses and their links to carbon fractions and soil properties**

**Student Name:** Thavapalan Rosanthan

**Index No:** AG 516

An experiment was carried out to assess the soil nutrient availability of different land uses in Jaffna peninsula and to study the effect of carbon fractions on nutrient availability and aggregate stability of these soils. In this research nine land uses were studied: annual crop- organic fertilizer only, annual crop- inorganic fertilizer only, annual crop- organic, inorganic both, maintained home gardens, abandoned home gardens, agricultural fields of perennial crops, and paddy land with combined use of organic and inorganic fertilizer within the same soil type calcic red yellow latasol and, annual crop with organic fertilizer only, and uncultivated land in sandy regosol. Aggregate stability, texture, availability of N, P, K, Ca, Mg, Fe, Mn, Cu and Zn were determined at two depths of 0-15 and 15-30 cm. The design used was completely randomized design (CRD) in two factor factorial, with three replicates. The study showed that land uses had significant variations in terms of organic carbon stocks, nutrient availability and aggregate stability. Availability of primary macro nutrients namely nitrogen, phosphorous and potassium ranged between 9.92-29.72 ppm, 3.33 - 31 ppm, and 43.67 - 374.15 ppm respectively. Availability of secondary macro nutrients namely calcium and magnesium ranged between 250.47 - 3929.13 ppm and 54.97 - 312.63 ppm respectively. The micro nutrients such as zinc, iron, copper and manganese had availability ranged between 0.25 - 11.15 ppm, 13.29 - 35.37 ppm, 0.46 - 4.06 ppm and 7.12 - 31.61 ppm respectively in different land uses. Aggregate stability value ranged between 0.17 - 4.11 and had positive trend with carbon fractions. The texture of soils varied from sandy loam, loamy sand and sand and it also varied in depth wise in few land uses. For most nutrients, availability had a positive trend with carbon fractions. Aggregate stability also showed positive trend with clay content of soil.

**Keywords:** land-use, macro nutrients, micro nutrients, carbon, aggregate stability, texture

**Supervisors:** Dr.(Mrs).N.Gnanavelraja<sup>1</sup> and Dr.(Mrs).R.Rathnayake<sup>2</sup>

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## **Antioxidant and total phenol contents of commonly used selected fruits and vegetables in Jaffna peninsula**

**Student Name:** Karthiha Karthigesu

**Index No:** AG 507

The role of natural antioxidants, especially phenolic compounds, which may act both by the reducing content of toxic compounds in foods and by supplying the human body with exogenous antioxidants. The total phenolic contents and total antioxidant contents of sixty (thirty five vegetables and twenty five fruits) commonly consumed fruits and vegetables in Jaffna were determined. Total phenolics were measured using the folin cio-calteu reagent with gallic acid as standard. The antioxidant contents of fruits and vegetables using their extract were assayed *invitro* by both phosphomolybdenum assay and reducing power assay. The antioxidant contents and total phenol contents were calculated per 100g dry weight. Among vegetables, high antioxidant content by ascorbic acid equivalent method was showed in garlic (897.3mg/100gDW), big onion (647mg/100gDW), onion (519.9mg/100gDW), long bean (383.8mg/100gDW), ginger (364.5mg/100gDW), white cabbage (332.6mg/100gDW), raddish (307.6mg/100gDW), green peas (259mg/100gDW), snake gourd (273.9mg/100gDW) and carrot (897.3mg/100gDW). Among vegetables, high antioxidant content by BHT equivalent method was showed in red cabbage (271.5mg/100gDW), long bean (253.3mg/100gDW), bell pepper (233.5mg/100gDW), white cabbage (218.7mg/100gDW), bitter gourd (121.9mg/100gDW), raddish (111.4mg/100gDW), 'Vallarai' (108.2mg/100gDW), beetroot (90.7mg/100gDW), curry leaf (89.8mg/100gDW), and leafy cabbage (80.7mg/100gDW). Among vegetables, high total phenol content was found in 'Kurincha' (401.9mg/100gDW), Amaranth (282.5mg/100gDW), red cabbage (151.9mg/100gDW), 'Akatthi' (133.6mg/100gDW), bell pepper (123.8mg/100gDW), 'Vallarai' (108.1mg/100gDW), long bean (105.3mg/100gDW), white cabbage (96.8mg/100gDW), 'Thavasi murungai' (86mg/100gDW) and snake gourd (67mg/100gDW). Among fruits, high antioxidant content by ascorbic acid equivalent method was showed in strawberry (1875.88mg/100gDW), gooseberry (1572.85mg/100gDW), nectarine (1290.15mg/100gDW), papaw (1227.28mg/100gDW) and grapes (1042.65mg/100gDW). Among fruits, high antioxidant content by BHT equivalent method was showed in straw berry (175.16mg/100gDW), gooseberry (169.56mg/100gDW), papaw (80.94mg/100gDW), woodapple (67.01mg/100gDW) and pomegranate (53.79mg/100gDW). Among fruits, high total phenol content was showed in gooseberry (925.29±0.5mg/100gDW), strawberry (126.47mg/100gDW), orange (64.69mg/100gDW), woodapple (340.03mg/100gDW) and papaw (32.01mg/100gDW). The correlation between total phenolics and the antioxidant contents of vegetables by both phosphomolybdenum assay and reducing power

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assay showed positive correlations( $r=0.743$ ,  $r=0.856$ ). The correlation between total phenolics and the antioxidant contents of fruits by both phosphomolybdenum and reducing power assay showed positive correlations ( $r=0.44$ ,  $r=0.67$ ). The high antioxidant foods are better choice patients who are suffering from oxidative stress diseases such as atherosclerosis, diabetes, neurodegenerative diseases, ageing and cancer.

**Key words:** Antioxidant, Total phenol, Ascorbic acid, Gallic acid, BHT

**Supervisors:** Dr.S.Balakumar and Prof.(Ms).V.Arasaratnam  
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## **Resistant starch content of commonly used selected foods in Jaffna peninsula**

**Student Name:** Vinthuja Segar

**Index No:** AG 503

Resistant (RS) is a powerful nutrient to our body and it has several benefits. The aim of this study is evaluate the resistant starch (RS) content of some of the foods commonly consumed in Jaffna. Different varieties of legumes like green gram (*Vigna radiata* (L.)), black gram (*Vigna mungo* (L.)), cowpea (*Vigna unguiculata*) and chickpea (*Cicer arietinum*) different varieties of rice (*Oryza sativa*) ['Samba', white rice, brown rice ('Sivapupachchai'), parboiled rice ('Mottaikarupan')], Different varieties of plantains ['kathali' ('Embul'), 'kappal' ('Kolikuttu'), 'itharai' ('poo kesel'), 'anai', 'maruththuvavalai' and 'sevvalai' different tubers like potato (*solanum tuberosum*), cassava (*manihot esculenta*), sweet potato (*Ipomoea batatas*), purple yam (*Dioscorea alata*) and jack seed (*Artocarpus heterophyllus* Lam), and different flour samples like wheat flour, 'kurakkan' flour, 'atta' flour, rice flour and 'odial' flour were analysed. The mean RS content of cooked chickpea, green gram, black gram and cowpea were 7.206 ( $\pm 0.167$ ), 4.505 ( $\pm 0.150$ ), 17.570 ( $\pm 0.223$ ) and 5.705 ( $\pm 0.301$ ) g/100g dry sample respectively. The mean RS content of cooked samba, white rice, brown rice and parboiled rice were 4.915 ( $\pm 0.230$ ), 5.461 ( $\pm 0.338$ ), 7.575 ( $\pm 0.209$ ) and 7.501 ( $\pm 0.458$ ) g/100g dry sample respectively. The mean RS content of 'kathali', 'kappal', 'itharai', 'anai', 'maruththuvavalai' and 'sevvalai' varieties of bananas were 4.152 ( $\pm 0.146$ ), 11.505 ( $\pm 0.208$ ), 12.904 ( $\pm 0.175$ ), 7.150 ( $\pm 0.081$ ), 9.309 ( $\pm 0.094$ ) and 4.117 ( $\pm 0.050$ ) g/100g dry sample respectively. The mean RS content of cooked manioc, potato, purple jam, jack seed and sweet potato were 5.814 ( $\pm 0.178$ ), 5.545 ( $\pm 0.224$ ), 12.963 ( $\pm 0.260$ ), 4.940 ( $\pm 0.090$ ) and 4.495 ( $\pm 0.352$ ) g/100g dry sample respectively. The mean RS content of wheat flour 'pittu', 'atta pittu', 'kurakkan pittu', 'odial pittu', and rice flour 'pittu' were 3.716 ( $\pm 0.129$ ), 4.459 ( $\pm 0.113$ ), 3.812 ( $\pm 0.129$ ), 5.091 ( $\pm 0.132$ ) and 3.758 ( $\pm 0.124$ ) g/100g dry sample respectively. Black gram (49.77% of RS out of total starch) had highest RS content within the legume types, same as, cooked parboiled rice (10.96% of RS out of total starch) within the rice types, 'Itharai' and 'kappal' varieties (22.75, 21.43% of RS out of total starch) within the banana varieties, cooked purple yam (20.3% of RS out of total starch) within the starchy vegetables and 'odial pittu' (11.21% of RS out of total starch) within the different flour 'pittu' contain high RS content among the analysed samples. Green gram (10.66% of RS out of total starch) had lowest RS content within the legume types Same as, cooked samba (6.25% of RS out of total starch) within the rice types, 'kathali' and 'sevvalai' varieties (9.66, 11.91% of RS out of total starch) within the banana varieties, cooked sweet potato (8.76% of RS out of total starch) within the starchy



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vegetables and wheat flour 'pittu' (6.07% of RS out of total starch) within the different flour 'pittu' contain low RS content among the analysed samples. High RS content foods are better choices for patients who are suffering from diabetes mellitus and coronary heart diseases while low RS foods are good for athletes.

**Key words:** Resistant starch, total starch, legumes, starchy vegetables, rice types

**Supervisors:** Dr.S.Balakumar and Prof.(Ms).V.Arasaratnam  
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## **COMPARISON OF GROUND WATER USE EFFICIENCY IN AGRICULTURE IN JAFFNA DISTRICT**

Student Name: Aunkumar Pathmanathan

Index No : AG 489

Besides being used for drinking, a large portion of fresh water is exhausted by way of irrigation. By adopting modern technology in irrigation the squandering of fresh water in agriculture could be greatly minimized. Considering the peninsula Jaffna unlike the rest of the dry zone. It is sole dependent on ground water and rain which recharges the ground water and helps out with cultivation. The traditional irrigation methods carried out in the peninsula involve a great loss of water. Hence this research was carried out with the intention of assessing the economics of sprinkler as against traditional basin irrigation for chilli in Jaffna peninsula. Primary data were collected by a questionnaire survey within the framework of purposive random sampling technique. The sample consisted a total of 150 despondence and half of it belongs to traditional basin and the other half belongs to sprinkler. A stochastic frontier analysis was performed to obtain the technical efficiency of both irrigation systems. In addition allocative efficiency and irrigation efficiency were also estimated. The mean technical efficiency of the basin and sprinkler irrigation systems are 62 percent and 99 percent respectively. But for both system mean allocative efficiency found to be less than one that is 0.145 and 0.386 respectively. Finally a higher a higher mean. Irrigation efficiency of 4.3 percent was estimated to the sprinkler and only 1.3 percent was estimated for the basin. From this fact researchers recommend the use of sprinkler be extended to as many farmers as possible. It is strongly recommended that unbiased, impartial and objective distribution of the improved technical equipment should reach one and all of the farmers of the region. The frontier analysis indicates that sprinkler irrigation is far more effective, advantages and efficient than basin irrigation in all aspects and at all times. In comparison that technical efficiency of the sprinkler is 99 percent as against basin at 62 percent. Allocative efficiency is 0.386 sprinkler and 0.145 basin further irrigation efficiency would be 4.3 percent sprinkler and 1.3 percent basin.

**Key words:** Frontier analysis, Technical efficiency, Allocative efficiency, Irrigation efficiency, Sprinkler and Basin Irrigation systems

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

**INFLUENCE OF FARMING BACKGROUND ON THE  
NUTRITIONAL STATUS OF PRESCHOOL CHILDREN OF  
THE JAFFNA DISTRICT**

Student Name: Gowsala Thiyagalingam

Index No : AG 518

This research has taken effort to identify the influence of farming background on the nutritional status of preschool children of the Jaffna district. Understanding the determinants of poor nutritional attainment can provide better idea to reduce the child malnutrition in farming areas. Nutritional status is used to measure social development. Food intake is not only a critical factor responsible for malnutrition particularly in the case of children under five years of age. Percapita expenditure, residence, quality of drinking water and sanitation, sex of child, and household head's education are some of the important factors which have been identified from nutritional researches. Anthropometric measurements of pre-school children and infants have been used as measures for nutritional status in nutritional surveys. The primary data were collected by administrating a pretested structured questionnaire. A purposive random sampling technique was used to collect the data. The sample constituted a total of 300 respondents. The collected data were analyzed within a frame work of multivariate regression analyses by using the statistical software STATA 10. Our analysis indicates that household percapita expenditure is a leading determinant on nutritional status of preschoolers in farming area of Jaffna district. Further negative effect of children age and sex were observed for height for age zscore, weight for age zscore and weight for height zscore. Children become more malnourished as they get older. The nutritional status of a child primarily depends on the quality and quantity of the food available at home; purchasing power of the household which would in turn determines the accessibility to food and the distribution of food within the household. Finally this research concludes that percapita expenditure age of child, sex of child, area of residence, and also the parents education are the important components on the nutritional status of preschool children in the farming area.

**Key words:** Nutritional status, malnutrition, farming background, multivariate regression,

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**TECHNICAL EFFICIENCY OF COCONUT PRODUCTION IN THE  
NORTHERN REGION OF SRILANKA**

Student Name: Jeevakumaran Sornalingam

Index No : AG 499

This research has taken effort to estimate the technical efficiency and to identify the important socio economic determinants of the coconut production in the northern region of Sri Lanka. A structured questionnaire was designed and then pretested with selected respondents and having seen it applicable was administered to the sample community. A total of 306 coconut growers were randomly selected from the database managed by the Northern regional coconut cultivation board. The data were analyzed within the frame work of Cobb- Douglas production function and stochastic frontier production function by using the STATA 10 and FRONTIER 4.1. The inefficiency model was estimated by one-step maximum likelihood method using the FROINTER 4.1. The results revealed that the extent of land, inorganic fertilizer, organic fertilizer and family labour are found to be significant and increased the coconut production by 0.556, 0.038, 0.057 and 0.152 percents respectively. Land fragmented or under-utilized cannot produce optimum returns. In order to obtain profitability, the land under cultivation should be of a minimum extent. Initially the information with reference to improved management practices, availability of various incentives for example 'Kapuka' loan, the use of modern machinery and equipment and the application there of should be disseminated to the cultivators. Result of the inefficiency model suggests that grower's experience have a positive and significant impact on the technical efficiency of coconut production. This indicates that the inefficiency increases with experience of the coconut growers. Meanwhile the level of education exerted a negative impact, the negative and significant coefficient of the variable education suggests that the educated farmers are more efficient than others. The mean technical efficiency of coconut production in northern region of Sri Lanka was estimated to be 66 percent. This manifested that the northern coconut cultivators still have room for vast improvements. In order to obtain higher technical efficiency and returns the inputs have to be used optimally.

**Key words:** Technical efficiency, Coconut production, Stochastic production function, Northern region of Sri Lanka

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

## **COST BENEFIT ANALYSIS OF LAND MINE DEMINING IN JAFFNA PENINSULA**

Student Name: Antony Rajendrakumar

Index No : AG 500

Landmines threaten human lives and the welfare of mine-affected countries. They cause an economic burden both by destroying lives and by limiting the valuable use of land. Landmines remain dangerous for decades after they are deployed, killing or injuring civilians and rendering land impassable and unusable. Mines and explosive remnants of war (ERW) result is substantial threat to life and post-war economic development in many countries. More recently, it has become obvious that landmines can interfere with the overall economic development of mine-affected nations including Sri Lanka. There are many ways to reduce the impact of landmines, but the most common practice is demining. Demining is quite dangerous and expensive to implement and involves many complex challenges. It utilizes scarce resources including time, manpower, and money. Partially in the northern region of Sri Lanka landmines are so wide spread and are making no use of high potential agricultural land areas useless and that composes an enormous economic burden on the livelihood of the native peasants of that land. This study attempts to identify the importance of demining in terms of cost benefit analysis and ensure the best use of its scarce resources to guarantee civilian safety and promote economic development in the northern region of that land. According to the result of the project is positive at 8, 10 and 12 percent of the discount rates and the benefit over cost ratio also is greater than one. Even though the on-going demining project is expected to take another decade to accomplish its task. This research concludes that the project is worth in terms of opening up the venue for permanent settlements, boosting agricultural productivity, employment opportunities, uplift the standard of living of thousands of peasants etc. of the northern region of Sri Lanka. To obtain the highest benefit of the demining process this research suggests that the on-going demining process be accelerated. The acceleration of the demining procedure alone will not contribute to the rehabilitation and resettlement of the people successfully. The supply and establishment of the required infrastructure will be essential to motivate the civil societies who bear the burden of working their land and delivering their finished product.

**Key Words:**Benefit Cost Ratio, Cost Benefit Analysis, Demining, Discount Rate, Jaffna District,

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

## **FEMALE HEADED HOUSEHOLDS AND POVERTY: EVIDENCE FROM NORTHERN SRI LANKA**

Student Name: Tharsana Kunarathinam

Index No : AG 502

The objective in this research is to study the variety of weakness in the female headed households as against the male dominated households considering the aspects like vulnerability, poverty, earning capacity and etc. Accordingly a structured questionnaire was designed and then pretested with selected respondents and having seen it is applicable was administered to the sample community. Questionnaire was applied to selective respondents for both female headed and male headed families. The cumulative study involved the participation of 300 families. The collected data went through a gleaning process and analysed within the frame work of ordered probit and probit regression methods by employing the statistical software STATA 10. The results revealed that female headed households are poorer than the male headed ones. The household's age was also significant but exerted a negative impact on the standard of living and wealth index of poverty but positive impact on poverty. Gender was significant and negatively affected on standard of living of household. Household size manifested a negative impact on the standard living of the households. Domestic location also played a crucial role and exhibited a negative impact on the standard of living. Number of years of schooling of the household head correlated negatively with wealth index of poverty and income poverty. The inference obtained from the research exercise will be the female headed household were in general poorer than the male headed ones. The level of education is inversely proportional to the poverty level. Younger the head of the household greater is the opportunity for employment and consequently greater is the earning capacity. The rural dwellers are poorer than urban residence. Finally the research suggest the special training and individual provision be supplied to the aged and handicapped that they may make them selves usefully occupied in light industry being at home. This provision is suggested mainly for members of female headed families. Training in skills which would enable the individual to get involved in cottage industry, self-employmentetc., to supplement their regular wages. Giving self employment oppounity to the female headed household increases earners due to the involvement the house hold members in self employment.

**Key words:**, Poverty, Probit model, Female headed houseold, War widows

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

## **Hydrus – 1D simulation of nitrate-N leaching in calcic red yellow latosol- Alysimeter study with chilli**

**Student Name:** Thsyanthi Sellathurai

**Index No:** AG 496

Lysimeters and mathematical modeling are the adequate experimental tools for obtaining valuable information about the impact of fertilization method on water flow and solute transport and could be used to understand soil hydrology as it is affected by fertilization method. HYDRUS-1D is a numerical model, can be used to simulate the movement of water and solutes in saturated and unsaturated soil conditions that used to understand the transport and transformation in soil. Nitrate - N in water bodies is a serious environmental concern in Jaffna peninsula. High amount of nitrate-N in the water bodies suspected due to the intensification of agricultural activities by adding inorganic fertilizers subjected to quantity and frequency than the recommended level due to the sociological and environmental factors and the Chilli is a major cash and spice crop, cultivated (MI2 variety) around 81 ha of arable land. Hence, the study was carried out to evaluate and simulate the effect of different levels of fertilizer on the leaching loss of nitrate - N and to evaluate the effect on growth and yield parameters during the cultivation of chilli. The experiment was carried out with complete randomized design (CRD) consists two levels of fertilizer application; recommended level (RT) and half of the recommended level (HRT) of fertilizer by Department of Agriculture Sri Lanka, each treatment was set with three replicates. In this research, the effect of fertilizer level on growth parameters and leaching loss were statistically analyzed at 95% confidence level and the leaching was simulated by using HYDRUS-1D in 50 cm soil column. Lysimeter study showed that, there was significant difference found between two treatments in plant height, number of branches and number of pod; and no significant difference was found in number of leaves, plant canopy, number of flowers and fresh weight of pods. Also no significant difference was found in the nitrate - N concentration between two treatments. But, the concentrations in leachate are significantly different with the days after transplanting and climatic condition. The measured nitrogen leaching loss was 13.88% (16.6 kg/ha) and 24.32% (14.54 kg/ha) for RT and HRT respectively and the fertilizer application efficiency for measured RT was 86% and HRT was 75.67%. The HYDRUS-1D simulated nitrate leaching was 46.32% (55.4 kg/ha) for RT and 70.42% (42.1 kg/ha) for HRT. When considering leachate loss, the simulated fertilizer application efficiency was 53.67% and 29.58% for RT and HRT respectively. However, the fertilizer utilization efficiency was high for HRT because of the root solute uptake in the simulation was 21.65% for RT and 23.42%

for HRT. The results suggest that HRT is the better one when considering the optimum level of production and the environment.

**Keywords:** Chilli, HYDRUS-1D, Leaching, Lysimeter, Nitrate-N

**Supervisors:** Srivaratharasan.T<sup>2</sup> and Mikunthan.T<sup>1</sup>

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## **Design and fabrication of rainfall simulator and measurement of soil erosion by simulating rainfall**

**Student Name:** KandasamyThavarupan

**Index No:** AG 508

Soil erosion is the process of mechanical degradation of soil as a result of active and reactive factors. The prediction of erosion by natural rainfall is difficult. Rainfall simulation is a useful tool in the analysis of soil erosion by natural rainfall characters in the experimental plots. It is an important tool for the study of runoff generation and soil loss because it can be used either under laboratory conditions, or in disturbed or natural soil. The objectives of the study were to design and construct rainfall simulator with locally available materials, to estimate the consequence of intensity of rainfall on the erosion process, to explain the effect of different soil texture on soil erosion, to explain the effect of different management practices on soil erosion and measurement of soil loss by simulated rainfall. The experiment was carried out in randomized complete block design with three factors; three levels of soil, three levels of intensity and three levels of management practices. The soil loss was statistically analyzed at the 95% confidence level. The simulated intensity of rainfall were 5.34 mm/min, 8.32 mm/min and 12.57 mm/min for level 1, level 2 and level 3 respectively. Discharge rate varied as 10.2 liters for level 1, 15.76 liters for level 2 and 23.8 liters for level 3. The uniformity of the simulator was 80.76% for all levels of output. The cost of production was nearly equal to Rs 5600 for design. There was a significant difference found in the soil loss for each intensity of rainfall. The simulated rainfall erosivity was 297.14  $\text{Jm}^{-2}$ , 600.10  $\text{Jm}^{-2}$  and 752.45  $\text{Jm}^{-2}$  for level 1, level 2 and level 3 respectively. There was a significant difference found between different management practices and soil erosion. The effect of management practices on soil loss were observed in the order of bare land > crop land > mulch soil. Soil loss reduced in the sandy loam soil under cultivation. The soil loss was affected by type of soil and it varied as sandy loam > loamy sand > sand. Due to the soils was fully covered with the banana leaves, the erosion was more or less equal to each treatments in mulching. There was a significant difference found between the interaction effect of soil type and management practices and the intensity of the rainfall and management practices. Soil loss reduced in the sandy loam soil under cultivation. The correlation between

the estimated soil erosion and measured soil erosion was 0.81. The results showed that mulching and cultivation of crops can help to reduce the erosion by rainwater.

**Keywords:** Design, Fabrication, Rainfall simulator, Soil erosion, simulated rain

**Supervisors:** Alvappillai.P<sup>1</sup> and Srivaratharasan.T<sup>2</sup>

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## **Nutritional composition of paddy soaking water and its productive disposal**

**Student Name:** Kalaichchelvi Navaratnarajh

**Index No:** AG 505

A significant amount of water is used in soaking operation which is then discharged as wastewater. The continuous discharge of this wastewater has become an environmental concern in paddy parboiling industry. In most of the rice mills this effluent is discharged into inland surfaces, paddy field or surrounding water bodies without any treatment. The effluent discharge from rice mills do not contain toxic compounds, but continuous discharge into soil or surrounding water bodies cause affect environment. Hence the main aim of the research was selected as management of paddy soaking water with its composition of nutrients as source for preparation of enriched compost and also is useful for the control of wastewater pollution and safe the environment with effective usage. The important characteristics of the effluent generated from cold soaking were determined with soaking duration of 4 days, prior to use as decomposable agent. The results revealed that an acidic pH of 4.0 with concentration of total nitrogen (98 mg/l), phosphorous (91 mg/l), potassium (98mg/l), and reducing sugar (76mg/l) and high concentration of COD (2600mg/l), total dissolved solid (2800 mg/l), salinity (1.7) and electrical conductivity of 6mS/cm. Wastewater from the paddy soaking was then used as potential source to an anaerobic composting. The digester with organic solid waste of 5 kg was mixed with 30 lit of rice mill effluent other with 30 lit of water as control. The experiment was conducted in complete randomized block design with three replicates. The digestate of nitrogen, phosphorous and potassium were evaluated in every week's interval from 14<sup>th</sup> days after preparation to 42<sup>nd</sup> days. The use of rice mill wastewater significantly increases the available nitrogen, phosphorous and potassium after completion of 42<sup>nd</sup> days. Chemical analysis of digestate revealed that nutrition profile for anaerobic compost making of paddy soak water with waste was better than that of water with waste after 42<sup>nd</sup> day. In case of phosphorous, 199 mg of phosphorous were observed in 100 g digestate in waste treated with paddy soaked water whereas water treated digestate showed 145 mg phosphorous. The results of available nitrogen and potassium showed that 13.72 mg and 206 mg respectively in 100 g of digestate in waste treated with paddy soaked water. But the results of water treated one showed 9.66 mg and 169 mg for available nitrogen and potassium respectively. The ratio of carbon to nitrogen (C/N) also evaluated in both treatment of paddy soak water with waste and water with waste. The C/N ratio decrease with days of composting but the reduction rate

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was high in paddy soak water than the water treated. Therefore, the rice mill waste water is useful for compost making in anaerobic condition with the production of enriched compost.

**Keywords:** Paddy soaked water, compost, waste disposal

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## **Optimizing hydrothermal parameters of parboiling process practiced by local paddy industry in Jaffna**

**Student Name:** Jeyaanantharajah Jeyapriyanthan

**Index No:** AG 519

Parboiling is the hydrothermal treatment applied before milling in order to increase milling recovery by minimizing broken rice percentage at the end of processing. Parboiling process has three stages such as soaking, steaming and drying. Soaking and steaming play a key role in quality of paddy grains by changing physical properties. Therefore, determination of the end product quality is important. Effect of soaking and steaming duration was investigated with respect to head rice yield in parboiling process. Paddy sample was given with different treatments of various degrees of soaking and steaming. Soaking and steaming conditions were kept constant for all treatments. Treatments were replicated three times. Analytical grade de-husking, milling and polishing machines were used to evaluate the head rice yield and broken rice yield percentages. Lab scale detectors were used to count whiteness value, which reflected the appearance of final processed product. Grain moisture levels of 30%, 60% and above 70% were recorded for samples obtained from soaking alone, steaming alone and boiling alone respectively. However, drying rate was fast in paddy grains steamed than that of samples boiled. Results obtained from the treatments, after 72 hours of soaking with steaming for 3 hours duration, yielded higher de-husked head rice recovery and less percentage of broken rice of 85.3% and 14.7% respectively. The results revealed that 3 hours steaming duration produced very less whiteness value of 10.4. There was no significant difference among the treatments in head rice yield and whiteness value at the highest level of processing. The cost analysis of the parboiling processes revealed that all the processes are economically viable; however, the small-boiler was found to be the most attractive and had the shortest payback period and the highest internal rate of return. The energy consumption varied from process to process. It increased with an increase in the treatments time. In this study, the medium scale steamer vessels process gave monetary value of benefit 20100 SLR/tons and the energy consumption in the process was 2530 MJ/tones. The energy consumption and treatment time were found to be higher for the steaming compared to the other process. The local parboiling process can be improved in terms of the energy consumption and the market value of the rice by adopting the boiler process. Therefore, it is concluded that parboiling process has to be optimized to get quality end product in terms of energy and cost of processing of parboiling.

**Keywords:** Parboiling, Soaking, Steaming, Drying, Milling, Boiler.

**Supervisors:**Prabakaran.M<sup>1</sup> and Alvpillai.P<sup>1</sup>

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## **Local technologies for removal of total hardness in groundwater**

**Student Name:** Nisane Kuganeswaran

**Index No:** AG 490

Groundwater is the major natural water resource in Jaffna peninsula and it is used for all purposes. Jaffna peninsula is underlain by a miocene limestone aquifer, due to this available water is comparably hard. Hardness is greater than 150 mg/l defined as hard water. It causes many problems in domestic and industrial usage. Considering the problems of water hardness, its removal is essential to prevent from health hazards and to get softer tasty drinking water. There are various modern techniques for removal of hardness each with its own special advantages and disadvantages. However, most are high cost technology. The local technologies; boiling, aeration, and filtration were selected, and also one of the advanced technology of the electro coagulation (EC) was selected with filtration. Preliminary tests were conducted to select treatments in which five treatments were selected; 30 minutes boiling, four hours aeration, overnight aeration, two hours aeration after ten minutes boiling and EC running time of 20 minutes. Different hardness content groundwater sources were selected. Raw water samples and treated water samples were analysed for pH, electrical conductivity and hardness. Aluminium residue also was checked for electro coagulated water. Raw water hardness was varied from 244 mg/l to 883 mg/l. Average reduction of 36.7% was achieved in EC, which is mostly suitable for high degree of hard water. In four hours aeration 35.7% average reduction was achieved. Out of 20 selected wells, the reduction percentage was greater than 40% to the 80% of the wells in overnight aeration. The maximum percentage reduction of 56.5% was recorded in boiling. Selected areas were grouped in to three which are low, medium and high hard water in which five wells were selected to check the other chemical parameters of pH, electrical conductivity, alkalinity and chloride with the consideration of treatments. Overnight aeration, two hours aeration after 10 minutes boiling and boiling was suitable method for medium hard water. Removal of hardness is not necessary for hardness less than 250 mg/l however boiling is suitable for this water. Removal of hardness affects the electrical conductivity, alkalinity and pH, no any effects to the chloride. Also all tested chemical characters were reduced to all treatments except boiling of Karainagar water for electrical conductivity. But pH of all selected wells was increased slightly. Boiler was designed without loss of evaporation water. The designed technology could be used as domestic treatment to get soft water in low cost for households.

**Keywords:**Hardness, Groundwater, Removal Technology

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## **Estimating field soil loss due in cassava harvesting: Valigamam Jaffna**

**Student Name:** Sumithra Rangunathan

**Index No:** AG 352

Impact of land use and land use changes on soil erosion process have received and still alarming. Land use changes mainly affect water, wind and tillage erosion but other factor is soil loss due to crop harvesting (SLCH) which is a soil erosion process that occurs during the harvest of crops such as Cassava, Sweet potato, Carrot, Beetroot, Radish, Potato, Ginger, Onion, Yams, green-Amaranth, Leek, and Groundnut. Those crops are mostly cultivated in Jaffna peninsula. Cassava is a major food crops for small holder farmers, which is cultivated under low input other than the irrigation. Cassava was cultivated 259 ha in *maha*, 159 ha in *yala* last year and average yield was 25 MT/ha. It planted as mono crop or intercrop at early stage and cultivating throughout the year. It is harvested carefully because of Cyanogenicglucosides and consumed within a day. Easy and un-damageable uprooting of the tuber mainly depends on soil moisture, texture and agronomic practices. This study was focused with the objectives of the assessment of soil loss due to the harvesting of cassava root tubers, and to estimate the amount of plant nutrients loss due to SLCH for cassava and also the observation was made the correlation between the soil loss and physical characters of the tuber, and soil characteristics. A questionnaire baseline survey about pre-harvest, harvest and post-harvest operation related to soil loss was done initially. Then detail study in selected five cassava field was conducted. During long non rainy period in January and February 2012, harvesting of cassava was done following the irrigation as next day morning, evening, day after morning, evening and third day morning. After harvesting tubers were carefully washed and washed soil was dried. Soil loss was calculated from reference equations from dried soil. Average mass specific SLCHspec (0.22 g/g), plant specific SLCHspec/p (80.7 g/root) and crop specific SLCHcrop (7046 kg/ha/harvest loss) were estimated in Valligamam area in Jaffna due to the harvesting of cassava. The percentage of clay had positive correlation and percentage of sand had negative correlation with SLCH parameters. Soil moisture content at harvesting time is significant factor that explained the variations in the soil loss at cassava harvesting. Soil moisture has linear positive relationship ( $R^2 = 0.65$ ) with SLCHspec/p. Harvesting time after irrigation had negative correlation with ( $R^2 = 0.59$ ) with SLCHcrop parameters. Root characteristics were not strongly correlated with SLCH parameters. Soil nutrient loss during cassava harvesting by removal of adhering soil with root tuber was 1.15 kg of N, 1.99 kg of P and 2.91 kg of K for ha/harvest. Soil loss under cassava justifies the need to conduct further investigations on this process of soil erosion



with wide range of soil characteristics, different soil moisture level and agronomic practices.

**Keywords:**Soil loss, Cassava harvesting, Nutrient loss

**Supervisors:**Mikunthan.T<sup>1</sup> and Srivaratharasan.T<sup>2</sup>

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