PROCEEDINGS

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2000

VOLUME : 8 NUMBER : 1

ABSTRACTS

EIGHTH ANNUAL SESSIONS

HELD ON
APRIL 05, 06 & 07, 2000
AT
UNIVERSITY OF JAFFNA
JAFFNA, SRI LANKA

JAFFNA, SRI LANKA
2000

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This volume is a record of the Proceedings of Eighth Annual Sessions of the Jaffna Science Association. It contains the Abstracts of Papers accepted for presentation at the Eight Annual Sessions of the Association to be held form 05 to 07 April 2000 at University of Jaffna:

Four(4) abstracts in Pure Science, Thirty Three(33) Abstracts in Applied Science and Technology, Two(2) Abstracts in Medical Science and Three(3) Abstracts in Social Science.

I wish to thank the General Secretary, JSA and Chairmen of all Sections for their assistance in getting these abstracts refereed in time for presentation at this Annual Session.

I also express my sincere thanks to Prof. P.Balasundarampillai, Vice chancellor, University of Jaffna; Dr. S.Kanaganathan, Head, Department. Of Computer Science, University of Jaffna; Prof.K.Sinnathamby, Mr. G.Mikunthan and Mr.S.Kannan for their kind assistance. I am extremely grateful to the sectional editors Mr.K.Kesavan (section B) and Ms. M. Sivarajah (section C) for their support in bring out this publication.

Dr. N.Sivayogan
chief Editor

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April 03, 2000

SPECIAL NOTE

This year the Executive Committee of the Jaffna Science Association decided to introduce **Volume Number** to the Publications of the Proceedings. Volume Number will be the number of the respective Annual Sessions. Each Volume will be divided into two:

The publication containing the Abstracts will be **Number 1** and the Publication containing Presidential Address, Chairmen's Addresses and Review Lectures, **Number 2**.

Volume Number of a previous Publication of the Proceedings may be taken according to the number of the Annual Sessions in which it was presented.

Dr. N. Sivayogan
Chief Editor

Contents

Section A **Page**

Section C

Section D

EFFECT OF CALCIUM CHLORIDE PREHARVEST SPRAY ON KEEPING QUALITY OF *KARTHACOLOMBAN* MANGOES (*Mangifera indica* L.)

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The postharvest physiology of mango under ambient tropical condition is characterised by a rapid rate of ripening and senescence. Control of these processes is essential for extending the storage life.

The Role of preharvest calcium spray can directly affect the mechanism of fruit ripening and resistance to infection. Spraying of $CaCl_2$ at 10,000 ppm with 0.1% teepol on to the fruits and leaves close to the fruit bunches showed a significant difference ($p = 0.01$) in the loss of weight and volume. It was shown that the parameters of pulp to skin & stone ratio, moisture content, total soluble solids and titratable acidity were not significantly different from the control.

Pulp to skin & stone ratio, moisture content and titratable acidity decreased with increasing storage days. The decreasing rate of pulp to skin & stone ratio was rapid in control compared to the calcium sprayed fruits. Loss of weight and volume and total soluble solids increased with increasing storage days. Low weight loss and volume loss were observed in calcium treated fruits. Firmness of calcium sprayed fruits was high, but colour development was slightly less compared to the control. There was no difference in taste and acceptability between control and treatment. The storage life of calcium treated fruits was extended by 4 days. Therefore, $CaCl_2$ preharvest spray is effective in extending storage life without affecting taste and acceptability.

Key words: Mango, Preharvest Calcium spray life and acceptability.

A2

DETERMINATION OF AMINO ACID COMPOSITION OF SOY PRODUCTS

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On the basis of amino acid analysis, soybean protein is of high nutritional quality. The amino acid distribution is close to FAO recommendations for amino acid pattern, hence quality is very good (Orthoefer, 1978). The importance of soy protein in nutrition lies in its high content of essential amino acids, particularly lysine, leucine and isoleucine. Sulfur containing amino acids, cystine and methionine are low in soybean indicating that methionine is the first limiting amino acid to be recognized when using soy products in a diet.

The objective is to determine the amino acid composition of soy products and to assess the protein quality by using the chemical scores and amino acid scores.
The samples of soy products were analyzed by High Pressure Liquid Chromatography for amino acid composition (Tsugita and Scheffler, 1982). The chemical scores and amino acid scores of soy products were determined based on the amino acid content (Orthoefer, 1978).
The amino acids aspartic acid and glutamic acid were found in highest amounts in all soy products . The sulfur containing amino acids, methionine and cystine were in least amounts in these soy products. Soy cutlet had the highest chemical score of 30% whereas tempeh and soy ice cream had the score of 14%. The amino acid composition of soy cutlet resembled that of soy flour.

Regarding amino acid scores, all the soy products supply threonine at 100% or more of the requirement for adults. Lysine is supplied by soy flour at 100% or more of the requirement for adults. The sulfur amino acid requirement of pre-school children, school-age children and adults is poorly satisfied by all the soy products.

Both chemical scores and amino acid scores were low in soy products. It is suggested that the processing conditions must be reviewed to improve the protein

quality of these products. Fortification with amino acids such as methionine and lysine can be done for the soy products where loss of methionine and lysine occurs due to heat treatment.

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A3

A STUDY ON THE EFFECT OF AQUEOUS NEEM SEED KERNEL EXTRACT ON POST EMBRYONIC DEVELOPMENT OF TIGER MOSQUITO, *AEDES AEGYPTI* (DIPTERA: CULICIDAE)

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This study was carried out to evaluate the effect of aqueous neem seed kernel extract on post embryonic development of, *A. aegypti*. The neem kernel extract was prepared as follows: sun dried seeds (10 gm) was ground into powder. Tap water (100 ml) was added into it. After 24 hr, 1 ml of 3% (w/v) "Sun light" soap solution was added and filtered. The larval rearing medium was prepared by adding 5 gm of dried cowdung to 1000 ml of tap water. 0.25 ml, 0.5 ml, 1.0 ml of extract and 0.1 ml of 3 % (w/v) soap solution were added to 10 ml portions of rearing media. Ten freshly laid eggs were introduced into each of concentrations and the percentage hatchability was determined at 24h, 48h and 72h intervals. 0.5 ml, 1.0 ml, 2.5 ml and 5.0 ml of extract and 1 ml of 3% (w/v) soap solution were added to 100 ml of rearing media. Ten first instar larvae were added to each concentration and the percentage mortality was determined. Similarly, effect on second, third and fourth instar larvae and pupae were also determined. All treatments were replicated ten times along with the control.

The eggs treated with neem kernel extract except 0.25 ml extract, showed significant difference in hatchability when compared with that of the controlled ($P < 0.05$). First and second instar stages showed significant mortality with all the concentrations at 48h, and 72h ($P < 0.05$). The second instar larvae did not show significant difference with 0.5 ml in 24h exposure ($P > 0.05$). In both stages mortality was the highest (96 %) with 5.0 ml neem extract after 72 h of exposure. Third and fourth instars showed significant mortality with all the treated concentrations at 72 h exposure ($P < 0.05$) and third and fourth instars showed 72% and 70% mortality respectively with 5.0 ml neem extract after 72 h of exposure. In the pupal stage there was no significant difference between the treatments ($P > 0.05$). The treated larvae died at different stages showing incomplete ecdysis, improper pupation and adult could not shed the pupal skin completely.

In the egg stage the neem extract would have penetrated the exochorion and caused mortality of the embryo thus reduced the hatchability. The first, and second instar stages exhibited significant percentage mortality indicating that the thin cuticle would have allowed the penetration of neem extract. Although the third and fourth instar larval stage showed a significant percentage mortality, the values were lesser than that of the first and second instar stages, probably due to the development of a thick cuticle which reduces the penetration of extract. In the pupa the effect of extract was not significant probably due to hard cuticle.

This study shows that aqueous extract of neem kernel causes mortality of egg and larval stages of *A. aegypti* depending on the quantity and duration of exposure of extract.

A SEARCH FOR THE DIGESTIVE ENZYMES IN GUT FLUID OF *HOLOTHURIA SCABRA* JAEGER, *1833* *(Echinordermata : Holothuroidea)*

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A monthly survey of sampling on *Holothuria scabra* in Jaffna lagoon, Sri Lanka, from June 1998 to June 1999 was made to evaluate the digestive enzymes in its gut fluid. The gut fluid collected from eviscerated alimentary canal contained enzymes to hydrolyze starch, casein and oil. The mean volumes of fluid in fore gut and mid gut were 1.2 (± 0.638) ml and 6.0 (±0.233) ml respectively. The mean pH value of mid gut fluid was 6.1 (± 0.24). The mean carbohydrase, protease and lipase activities, in one milliliter of mid gut fluid were 35.11 (±12.41) U, 12.32 (±3.41) U and 3.59 (±0.61) $x10^{-3}$ U respectively. The mean amount of reducing sugars, free amino acid & peptides and free fatty acids were 0. 54 (± 0.20) g/l, 0.07 (± 0.03) g/l and 48.12 (± 10.0) g/l respectively. The results showed that this animal seems to have higher carbohydrase activity than protease and lipase activities, even though it is a sediment feeder's animal. When the activities of the digestive enzymes in gut fluid was studied in different periods of an year, the activities were least in the month of April. But in April gonadal development of *Holothuria scabra* is maximum. The observation suggests that the organism contains least digestive enzymes during its reproductive period.

PERFORMANCE OF PALMYRAH TODDY MIXED CULTURE ON ALCOHOL PRODUCTION USING DISTILLERY SPENT WASH AND PALMYRAH BASED CARBON SOURCES

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Palmyrah toddy mixed culture has been used for the alcohol production from palmyrah fruit pulp and bakers yeast was used a control. This work was carried out as a preliminary research with the view of spent wash (a waste produced during distillation of toddy in distilleries) utilization, replacing bakers yeast by toddy mixed culture and the possibility of palmyrah fruit pulp as a carbon source in industrial scale production of alcohol. Palmyrah toddy (10h old) was kept in a reciprocal shaker water bath (150rpm) at 36°C after the addition of penicillin antibiotic ($0.1gl^{-1}$). Cells were separated by centrifugation after 24h and used for inoculation. Bakers yeast (Fermipan) 0.5g was grown in PYN medium which consisted of (gl^{-1}) peptone, 3.5; yeast extract, 3.0; KH_2PO_4, 2.0; $(NH_4)_2SO_4$, 1.0; $MgSO_4.7H_2O$, 1.0 and glucose, 100 for 18h. Under all conditions palmyrah toddy mixed culture or bakers yeast was used as the inoculum (cell number $2x10^7$ cells ml^{-1}) and the incubation was carried out at 36°C in a reciprocal shaker (150rpm) . Palmyrah fruit pulp (PFP, 50ml) was diluted to 100ml with either distilled water or spent wash; spent wash (50ml), PFP (50ml) & sucrose (5g); spent wash (50ml) & sucrose (10g) and depectinized PFP (DPFP, 50ml) & sucrose (6g, to make up the total sugar equivalent to that of PFP 50ml and sucrose 5g) were taken and the final volume of all media were made upto 100ml with distilled water. Molasses fermentation was carried out using molasses (60 Brix) diluted with spent wash to make the sugar concentration to $100gl^{-1}$. Spent wash supplemented with sucrose ($100gl^{-1}$) gave maximum ethanol production of 43 and $38gl^{-1}$ with palmyrah toddy mixed culture and bakers yeast respectively. When approximately half of the sucrose ($50gl^{-1}$) was replaced with PFP, a slight drop in alcohol production ($38gl^{-1}$) was observed. When the PFP was replaced

with DPFP, ethanol production efficiencies were almost same 75 and 66.5% with palmyrah toddy mixed culture and bakers yeast respectively. Palmyrah toddy mixed culture and bakers yeast showed 75.0 and 69.0% ethanol production efficiency (Amount of ethanol that could be produced / Theoretical amount of ethanol that could be produced from the added amount of glucose x 100) with molasses diluted with spent wash medium. The results indicated that the toddy culture was superior to bakers yeast and among the media considered for the studies, spent wash suplemented with sucrose ($100gl^{-1}$) was the best. Hence the wasted spent wash can be enriched and used for ethanol production. Further addition of palmyrah fruit pulp to spent wash is a good substitute for commercial sucrose as it gave 78.4 and 65.9% ethanol production efficiency with palmyrah toddy mixed culture and bakers yeast respectively.

B2

CHANGES IN MACROMOLECULES OF RICE DURING MALTING

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Cereal malts are rich in enzymes and soluble materials, which could be used in the food industry. Several studies were made by others on malting of rice, wheat, barley, corn, oat, and millet. This paper presents the changes in moisture, reducing sugar, total soluble sugar, total carbohydrate, total protein, soluble protein contents and endogenous amylase and protease activities, during malting of rice. Unpolished rice grains ("Mottaikarupan" variety) were steeped in distilled water containing 0.1gl^{-1} $Na_2S_2O_5$ for 12h, then drained the steeped water and allowed the grains to germinate in a moistened bag wetted with 0.15 gl^{-1} $Na_2S_2O_5$ and kept in dark at 35°C for 6 days. Each day, the moisture, reducing sugar, total soluble sugar, total carbohydrate, total protein and soluble protein contents and enzyme (malt amylase and protease) activities, in the germinated grains were estimated with respect to their dry weight. Moisture content of about 39% was sufficient to initiate germination. Apart from the decrease occurred immediately upon steeping, an appreciable drop in total carbohydrate was observed from the third day. Reducing and soluble sugar contents were decreased up to 12h and then increased steadily, while soluble protein content was increased from the second day of germination. The DE of malt powder was increased from 0.63 (0 h) to 2.76 (6th day), during germination. Appreciable increase in malt enzyme activities were observed from the second day of germination. Steep water analysis revealed, the increase in the release of the soluble materials with steeping time.

B3

APPLICATION OF DIFFERENT STRATEGIES TO IMPROVE THE THERMOTOLERANCE OF A YEAST STRAIN

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Thermotolerant yeast strains were found in distillery environment and cowdung samples. The spent wash disposal pit in the distillery was subjected to thermoadaptation cycles as the spent wash was disposed into the pit intermitently with high temperature. Further this was left to cool overnight. Hence the strain isolated from this environment showed highest thermotolerance of retaining 100% viability for 5h at 45°C. This strain was then subjected to regular thermal adaptation cycles to 50°C for 3h and the colony developed after 48h on the plate was further cultured and the cycle was repeated for 15 times. Due to the regular thermal adaptation programme thermotolerance was improved from 5 to 8h (for the retention of 100% viability) at 45°C. Thermo adapted strain showed rapid death rate after 30min incubation at 55°C, however retained 100% viability for 68h at 40°C. Mutation with UV radiation and ethylmethane sulphonate has improved thermotolerance (of 100% retention of viability) from 68 to 72h at 40°C. The viability of the strain has dropped to 50% of the initial viable cells by 120h due to the exposure to 40°C, while supplementation with oleic acid or soy flour has enhanced the thermotolerance to 58 and 64% respectively.

B 4

OPTIMIZATION OF FERMENTATION CONDITIONS FOR α-AMYLASE PRODUCTION FROM *ASPERGILLUS ORYZAE*-B_{12}

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In baking and food processing industries fungal α-amylase is preferred due to its compatibility, which has led to FDA to approve its use in food processing industries. For the industrial production of enzymes, it is important to improve the cultural conditions to obtain better production of enzymes. Optimization of age of the spore inoculum was carried out with 4, 6, 9, 11, 13 and 27 days old spores (5×10^7 spores g medium^{-1}) in the medium containing soy flour (30 g), rice bran, 5.0 g and mineral solution (30 ml, H_2O; $MgSO_4$, 0.062 gl^{-1} and 0.01gl^{-1}, $CuSO_4$ $5H_2O$). Four days old spores gave highest α-amylase activity (901.3 U g DMM^{-1}) than the older spores at 96h. Then with 4 days old spore inoculum optimum number of the spores in the inoculum was also determined by taking the number of spores from 4.5×10^5 to 4.5×10^9 spores g medium^{-1} at 10 difference and 4.5×10^8 spores g medium^{-1} gave highest production (1439.0 U g DMM^{-1}) of α- amylase at 96h. When soy flour and rice bran were used in different ratios of 5:1, 4:1, 3:2, 1:4 and 0:5, maximum α- amylase activitiy was obtained 1448.5, 1517.8, 1920.9, 2220.0 and 236.6 U g DMM^{-1} respectively at 96h. The substitution of rice bran with wheat bran (soy flour to wheat bran ratios of 5:1, 4:1, 3:2, 1:4 and 0:5), led to a reduction in time from 96 to 48h and activities obtained respectively were 1522.4, 1650.3, 1893.8, 217.8 and 1240.3 U g DMM^{-1}. The total sugar and protein were assayed for all the media used and carbohydrate / protein ratio was maintained at the same level by adding purified starch for all the medium used in both the above experiments.

B5

FERMENTATION CHARECTERISTICS OF A THERMOTOLERANT YEAST STRAIN

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Finding the optimal conditions for the ethanol fermentation is important to improve the ethanol production efficiency. This report presents the effects of pH, temperature, agitation, inoculum size and the method of inoculum development on ethanol fermentation of a thermotolerant yeast strain. The yeast cells were grown in sterile PYN medium, which consisted of (gl^{-1}) peptone, 3.5; yeast extract, 3.0; KH_2PO_4, 2.0; $(NH_4)_2SO_4$, 1.0 and $MgSO_4.7H_20$, 1.0 with glucose 100. The fermentation at 36 and 40°C showed complete utilization of glucose and produced $40gl^{-1}$ alcohol at 24h. Optimum temperature for growth was 36°C, however 98% viability (number of viable cells /total cells x 100) was observed at 36 and 40°C. At 45 and 50°C, alcohol, residual sugar and viability were 20 & $10gl^{-1}$, 50 &$70gl^{-1}$ and 85 & 60% respectively. The fermentation profiles with different pH value revealed that pH 4.5 and 5.0 were most suitable for growth and fermentation. The inoculum size of 10^7 cells ml^{-1} showed 6.8% increase in alcohol production than 10^8 cells ml^{-1}. However the alcohol production rates were 1.46 and 1.83 $g.h^{-1}l^{-1}$ with 10^7 and 10^8 cells ml^{-1} respectively. The ethanol produced with 10^4, 10^5 and 10^6 cells ml^{-1} were 48, 47.5 and $47.3gl^{-1}$ at 48h fermentation respectively. The method of inoculum preparation suggested that, if the inoculum is prepared in the same type of the medium, the fermentation proceeds rapidly. Agitation of the medium has improved the rate of ethanol production and viability of cells.

B6

IN SITU EXTRACTION DURING LACTIC ACID PRODUCTION USING ION-EXCHANGE RESIN

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Food and biochemical industries use lactic acid in numerous ways; but its production is limited by end-product-inhibition. To avoid such inhibition, integrated approach of extractive fermentation technique was carried out. Fermentation set up for extractive fermentation contained a jacketed column reactor packed with 2 gl^{-1} polyethyleneimine (PEI) coated foam glass, Poraver beads (2-4 mm mean diameter beads) to which *Lactobacillus casei* cells were immobilized and the column was connected to a jacketed stirred tank fermentor containing the fermentation medium. The stirred tank fermentor was connected to a resin packed column (Amberlite IRA-400, 400 g weight) via pH controller. In control experiment (recycle batch fermentation), the pH was controlled by titrating with 6M NH_4OH throughout the experiment. Fermentation medium (pH 6.0) contained (gl^{-1}) glucose, 95; lactose, 5; yeast extract, 10; K_2HPO_4, 0.5; KH_2PO_4, 0.5; sodium citrate, 1.0; $MgSO_4.7H_2O$, 0.05; $MnSO_4.H_2O$, 0.0031; $FeSO_4.7H_2O$, 0.002 and ascorbic acid, 0.005. When the total sugar concentration in the medium was $50gl^{-1}$ (glucose : lactose = 19 : 1) the productivities obtained in control and extractive fermentation were 3.0 and $4.1gl^{-1}h^{-1}$ respectively. Whereas when the total sugar concentration was increased to $100gl^{-1}$ the productivities obtained were 2.2 and $3.1gl^{-1}h^{-1}$ in recycle batch and extractive fermentations respectively. Thus there is a 1.4 fold increase in overall lactic acid productivity when recycle fermentation was converted to extractive fermentation. The lactic acid production efficiencies were almost similar in both cases (96%). These results indicated the advantage of extractive fermentation.

B7

α - AMYLASE EXTRACTION FROM MOULDY MEDIUM AND ITS CHARACTERIZATION

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Aspergillus oryzae from different sources were collected and pure colonies were isolated from different samples. Isolated strains were grown in PDA plates and potent α-amylase producer which produced bigger diameter of the halos and highest α-amylase activity [9mm diameter and 417.9 U g DMM^{-1} (Dry Mouldy Medium) activity] was selected for further studies . The selected strain (*A. oryzae* B_{12}) was cultivated in solid and submerged media containing soy flour (30 g), rice bran, 5.0 g and mineral solution (30 ml, H_2O; $MgSO_4$, 0.062 gl^{-1} and 0.01gl^{-1}, $CuSO_4$. $5H_2O$). Maximum α- amylase production by *A. oryzae* B_{12} under solid and submerged conditions were 417.9 U g DMM^{-1} and 57.5 U ml $medium^{-1}$ at 96 and 114h respectively. The effect of time on α- amylase extraction from mouldy bran (mouldy bran to extractant ratio = 1:5) was studied with citrate phosphate buffer (0.01M, pH 5.0) and the enzyme extraction was increased up to 30 min and thereafter no significant increase in enzyme extraction. Effect of different extractants such as distilled water, tap water, glycerol (1%, v/v) , NaCl (1%, w/v) and citrate-phosphate buffer (0.01M , pH 5.0) and different mouldy medium to extractant ratio were studied. Finally under the optimized conditions, the pH of the best optimum extractant was determined. Enzyme was best extracted in citrate-phosphate buffer (pH 5.1) at the buffer to bran ratio of 1:8 and the optimum pH for the extraction of the enzyme was 4.5. The α- amylase activity produced was measured with time and the reaction time was fixed as 5 min. Optimum pH and optimum temperature of the α- amylase were 5.1 (at 30°C) and 55°C (at pH 5.1) respectively.

B8

CHARECTERIZATION OF OSMO TOLERANCE AND ETHANOL TOLERANCE ABILITY OF A THERMOTOLERENT YEAST

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A combination of high temperature, ethanol and osmo (sugar) tolerances are clearly desirable characteristics in fermentation processes. A relationship between these tolerances has often being suggested while never being well defined. This paper reports on the ethanol and osmo (sugar) tolerances and the effect of heat shock on enhancing these tolerances of a thermotolerant yeast strain isolated from the distillery environment and developed in this laboratory. The yeast cells were grown in sterile PYN medium, which consisted of (gl^{-1}) peptone, 35; yeast extract, 30; KH_2PO_4, 20; $(NH_4)_2SO_4$, 10; and $MgSO_4.7H_2O$, 10; with glucose 50gl^{-1} at 36°C with reciprocal shaking (150rpm) for 18h for inoculum preparation. The ethanol tolerance of yeast was determined at different concentrations of ethanol (0-200gl^{-1}) added to the PYN and soy flour 3.5gl^{-1} supplemented PYN media separately and incubated at 40°C with shaking (150rpm). Viable count and ethanol were determined. The viability was reduced with the increase of the added ethanol concentration. Complete cell death was observed at 48h with 150gl^{-1} added ethanol. Soy flour supplemented PYN medium was conducive for better ethanol tolerance. At 100gl^{-1} added ethanol level the viability was improved from 70 to 75% with soy flour supplementation at 48h. At 150gl^{-1} added ethanol level complete cell death and 20% viability were found in PYN and soy flour supplemented PYN medium respectively at 48h. Soy flour supplementation was ineffective at 200gl^{-1} added ethanol level. The osmo tolerance was determined at different concentrations of sorbitol (50 - 400gl^{-1}) added to the PYN and soy flour supplemented PYN media separetely. The osmotic effect caused by the non metabolizable sugar was well tolerated by yeasts in soy flour supplemented medium than unsupplemented medium. Combined effect of added ethanol and osmotic effect were studied in PYN and soy flour

supplemented PYN media separately having sorbitol 200gl^{-1} and 0 - 200gl^{-1}ethanol. The combined effects of osmotic stress and ethanol stress were more pronounced than their individual effects. However the soy flour supplementation has protected the yeast cells from the combined stress. At 100 and 150gl^{-1} added ethanol levels total cell death was observed in PYN medium whereas in supplemented medium 10 and 5% viability was observed respectively. Effect of heat shock along with soy flour supplementation was also studied. Results showed that heat shock further enhanced the ethanol tolerance. Inoculum (18h) was subjected to heat shock at 45°C for 15 min and was added to soy flour supplemented PYN medium having 200gl^{-1} ethanol and incubated at 40°C. Cultures grown in PYN medium at 36°C showed 93% viability at 50h. When the inoculum grown in PYN medium at 36°C was transferred to PYN medium having 200gl^{-1} alcohol and incubated at 40°C, 60, 20 and 0% viabilities were observed at 10, 20 and 30h respectively. When the inoculum grown at 36°C was subjected to heat shock at 45°C for 15min and was transferred to PYN medium having 200gl^{-1} alcohol and incubated at 40°C, 70, 40, 32, 18 and 10% viabilities were observed at 10, 20, 30, 40 and 50h respectively.

B9

EXTRACTION AND KINETIC STUDIES OF THE PROTEASE FROM MALTED RICE

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The existence of proteolytic enzymes in wheat and barley flours has been recognized since early in the century. The present study deals with the extraction and kinetic studies carried-out with rice malt protease obtained from "Mottaikarupan" variety of rice. Germination of rice grains was carried out by soaking the grains in distilled water containing 0.10gl^{-1} $Na_2S_2O_5$ for 12 h, then drained the steeped water and allowed the grains to germinate in a moistened bag and kept in dark at 35°C for four days. The germination was arrested on the fourth day, by drying the malted rice at 40°C for 2 days and powdered. The protease from rice malt powder (1.0g) was extracted by suspending it in 5.0 ml of different extractants such as distilled water, phosphate buffer (0.01M, pH 7.0), phosphate buffer (0.01M, pH 7.2), 10gl^{-1} NaCl, and 1% v/v, Glycerol. High activity of protease was extracted with 0.03M phosphate buffer at pH 7.0. Then the optimum pH and concentration of the phosphate buffer were determined. The kinetic properties of the rice malt protease was studied. The optimum pH and temperature for the activity of malt protease were 7.2 (at 50°C) and 50°C (at pH 7.2) respectively. At the optimized conditions, the malt protease activity showed zero order kinetics for 60 min. The Km and Vmax of the malt protease were 1.646 gl^{-1} casein and 0.0773 U respectively. The temperature and pH stability of the protease were also determined.

B10

COMPARISON OF LACTIC ACID PURIFICATION BY PRECIPITATION AND ION-EXCHANGE CHROMATOGRAPHY

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Some of the major economic hurdles and process cost centers on conventional carbohydrate fermentation process are in the complex separation steps which are needed to recover and purify the products from the crude fermentation broth. Hence an attempt was made to purify lactic acid by conventional precipitation methods as calcium lactate, and ion-exchange chromatography using Amberlite IRA-400 resin as ion-exchanger. In batch fermentation, $CaCO_3$ was used as neutralizing agent, hence lactic acid was precipitated as calcium lactate. The cells were removed by filtration and the fermentation broth was decolourised using activated charcoal (10 gl^{-1}). The decolourised filtrate was concentrated from 150 to 400 gl^{-1} and left at room temperature for 18h. The crystals formed were removed by filtration. When calcium lactate was concentrated to 250 gl^{-1}, maximum (90%) calcium lactate was crystalised. The calcium lactate crystals were treated with sulphuric acid and the lactic acid was concentrated to 800 gl^{-1} by flash evaporation. The concentrated lactic acid contained (gl^{-1}) 1.6, total sugar; 1.0, reducing sugar and 0.9, protein as impurities. Hence as an alternative ion-exchange chromatography was tried. The adsorption capacities for lactic acid of Amberlite-IRA 400 and –401 were 186 and 99 g kg resin $^{-1}$. Amberlite-IRA 400 was selected for purification studies at pH 6.0. Lactic acid purification was carried out in batch wise and packed column. Packed column method was selected as the lactic acid was concentrated by 1.6 fold while it was eluted from the column using 2N HCl. The eluate was concentrated to 800 gl^{-1} by flash evaporation. HPLC analysis showed the absence of sugar and protein impurities. Further the resin could be used for more than 25 cycles without loss in adsorption capacity. These results showed that lactic acid can be purified using Amberlite-IRA 400 resin efficiently.

B11

ETHANOL PRODUCTION BY A THERMOTOLERANT YEAST AT HIGH GLUCOSE CONCENTRATIONS IN BATCH AND CELL RECYCLE OPERATIONS

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The potential economic benefits in ethanol production could be realized by conducting fermentation at 40°C and above. In this study a thermotolerant yeast isolated and developed in our laboratory was used. Sterile PYN medium, which consisted (gl^{-1}) peptone, 3.5; yeast extract, 3.0; KH_2PO_4, 2.0; $(NH_4)_2SO_4$, 1.0; and $MgSO_4.7H_2O$, 1.0 and glucose 100 was used for inoculum preparation. When PYN medium with 150, 200, 300 and 400gl^{-1} glucose was inoculated with the yeast strain and incubated at 40°C by reciprocal shaking (150rpm), 150gl^{-1} glucose was completely utilized at 36h and 68gl^{-1} ethanol was produced. With 200, 300 and 400gl^{-1} glucose in PYN medium 72, 70 and 68 gl^{-1} ethanol was respectively produced. When the medium composition was doubled (2 x PYN) except glucose, alcohol production was increased to 88, 92 and 90gl^{-1} with 200, 300 and 400gl^{-1} glucose containing 2 x PYN media respectively. When different supplementation (gl^{-1}) such as $MgSO_4.7H_2O$ (5.0) and KH_2PO_4 (5.0) or yeast extract (20), or peptone (14.68), or soy flour (34.5) or oleic acid ($1ml^{-1}$) were made to 2 x PYN media having 300 and 400gl^{-1} glucose, ethanol production was 120 & 130, 130 & 135, 120 & 125, 140 &145 and 98 & 100 respectively. Soy flour was the best among the supplements and produced 140 and 145gl^{-1} ethanol at 300 and 400gl^{-1} glucose respectively. Efficiency of glucose utilization with soy flour supplementation was 93.3 and 85% respectively of the initial 300 and 400gl^{-1}glucose added. Alcohol production efficiency with soy flour supplementation was improved from 60 to 91.5 and 44.0 to 71.0 with 300 and

400gl^{-1} glucose when compared with unsupplemented 2 x PYN medium. In the cell recycle operations the first batch fermentation took 36h to exhaust glucose and produced 140gl^{-1} alcohol. In five batches of subsequent cell recycles 135, 110, 101, 80 and 45gl^{-1} alcohol was produced. Stuck fermentation was observed with advancing cycles with increasing residual sugar. No fermentation was observed after 6th batch of cell recycle operation.

SACHHARIFICATION OF THE LIQUEFIED STARCH BY IMMOBILIZED ENZYME IN BATCH PROCESS

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Glucoamylase and pullulanase have been immobilized to several carriers such as porous silica, alumina, controlled porosity glasses and ceramics. The attachment of biologically active molecules to porous glass beads is attractive due to their chemical stabilities which carry regeneration properties. Dextrozyme is mixture of glucoamylase and pullulanase and hence enzyme mixture can hydrolyze α-1,4- and 1,6- links in liquefied starch. Stability of the Dextrozyme was determined at 60, 55 and 50°C and the free enzyme respectively lost 30, 10, and 0% of its liquefying ability at 24h. Whereas only 4% of the enzyme activity was lost in 8 days at 50°C. Hence it was decided to carry out the saccharification process at 50°C. Dried starch suspended in distilled water (100 gl^{-1}) was gelatinized at 105°C for 5 min, cooled to 95°C and amylase (0.5µl g^{-1} starch) was added to liquefy for 1h with constant stirring (200 rpm) at 95°C. This liquefied starch was used for saccharification. Control pore glass (CPG, 5g) beads were coated with aqueous solution of Polyethyleneimine (PEI, 20 gl^{-1}, 10 ml, pH 7.0), by mixing for 1h, and washing with acetate buffer (pH 4.5, 0.01M) and drying at room temperature. PEI coated CPG (1.0g) beads were mixed with 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDAC, 10 mg) dissolved in sodium acetate buffer (5ml, 0.01M, pH 4.5), and different amount of Dextrozyme (100 and 200µl) for 20h at 50°C. Unbound enzyme was removed from the CPG by washing with the same buffer; 16.6 and 26.3 mg protein, 5.3 and 8.0 units of pullulanase (PUN) and 13.16 and 21.5 units of glucoamylase (AGU) were immobilized respectively to 100 and 200µl Dextrozyme added CPG beads. In batch studies to the immobilized Dextrozyme preparation, liquefied starch (1.0g CPG in 100 gl^{-1} liquefied starch) was added and incubated at 50°C while mixing at 100 rpm. With free and immobilized enzyme preparation complete saccharification was obtained at 8h

and the immobilized enzyme was used for 10 saccharification batches. Hence the volume of Dextrozyme used to immobilize CPG was decreased to (1g CPG 20, 50 and 100µl) and used to saccharify the liquefied starch (10 ml, 100 gl^{-1}) at 95°C. Complete saccharification was obtained with 50 and 100µl immobilized CPG at 8h. But for 20µl immobilized CPG it took 22h. When increased volume of liquefied starch (100gl^{-1}, 100ml), was saccharified at 50°C with 50 and 100µl immobilized CPG, the time taken for complete saccharification was 22h and 10 h respectively. The 300 gl^{-1} liquefied starch (100ml) was incompletely saccharified with 50µl immobilized CPG while it was completely saccharified by 100µl immobilized CPG at 54h. From the results obtained, 100µl immobilized CPG could be used for saccharification of the liquefied starch.

B13

IMMOBILIZED DEXTROZYME IN FLUIDIZED BED REACTOR FOR THE SACHHARIFICATION OF LIQUEFIED STARCH

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Immobilzing glucoamylase to porous glass beads offers the dextrose and High Fructose Syrup (HFS) manufacturer a potential reduction in both enzyme and fixed capital costs while providing stability and resistance to microbial attack. Fluidized bed reactor (FBR) offers great advantage over other reactors such as packed bed reactor for immobilized systems when small particles are used and when reactants are viscous or particulate. This paper presents the immobilization of Dextrozyme (a balanced mixture of glucoamylase and pullulanase) to Controlled Porous Glass (CPG) and saccharification of liquefied starch in a fluidized bed reactor at 50°C. Dried starch suspended in distilled water (100 or 200gl^{-1}) was gelatinized at 105°C for 5 min, and liquefied with α-amylase (0.25 U ml^{-1} starch) for 1h with constant stirring (200 rpm) at 95°C. CPG (5g) beads were coated with aqueous solution of polyethyleneimine (PEI, 20 gl^{-1}, 10 ml, pH 7.0), and Dextrozyme [100µl; 22.5 Units of glcoamylase (AGU) and 7.5 Units of pullulanase (PUN)] was coupled to PEI coated CPG (1.0g) using 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide (EDAC, 10mg) for 20h at 50°C. To 1g of PEI coated CPG, 16.6 mg protein was immobilized. The immobilized enzyme expressed 5.3 PUN, pullulanase and 13.16 AGU, glucoamylase activities. Thus only 53% of protein were immobilized while 100% each of pullulanase and glucoamylase expected activities were expressed when compared to the free Dextrozyme. To determine the performance of the immobilized Dextrozyme, Dextrozyme, the immobilized Dextrozyme (to 1g CPG) preparation was transferred into the column (20 x 1 cm) and either 100 or 200 gl^{-1} liquefied soluble starch or 100 gl^{-1} maize starch were saccharified at 50°C in expanded mode (flow rate was 3 ml min^{-1}). Complete saccharification of 100 and 200gl^{-1}

soluble starch (50ml of each) took 7h and 14h respectively in expanded bed. While complete saccharification of 100 gl^{-1} (50ml) liquefied maize flour took 16h. Further increase in maize flour concentration to 200 gl^{-1} decreased the expansion of the fluedized bed and blocked the flow of the liquefied starch. Thus the Dextrozyme immobilized to CPG is suitable to hydrolyze purified starch preparation at 100 and 200gl^{-1} levels in expanded bed. However the starch preparation with particulate impurities at high concentration is not suitable for this operation.

YEAR- ROUND TAPPING OF PALMYRAH INFLORESCENCE SAP

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Flowering of palmyrah is seasonal. Male and female palmyrah flowers during January to April. Tender male and female inflorescences are being tapped by 'Ari-pannai' and 'Thattu- pannai' techniques respectively. Fully-grown but green male and female inflorescence are being tapped by 'Valu-pannai' and 'Kaiveddy-pannai' techniques respectively.

Forty-eight palmyrah palms were tapped for inflorescence sap at Tellipalai, Jaffna by selecting 12 palms for each technique. Results indicated that annual yield of sap by 'Valu- pannai' is the highest (342-l/palm/year) compared to 'Kaiveddy-pannai' (254-l/palm/Year), 'Thattu-pannai' (235-l/palm/year) and 'Ari-pannai' (178-l/palm/year). But the duration of tapping in a season by different techniques is not in the same order. 'Valu-pannai' and 'Thattu- pannai' could be tapped for 2.5 months in an year whereas Kaiveddy for 2 months and 'Ari- paimai' for 1.5 months. Therefore the daily yield of sap during tapping season for 'Valu- pannai' is 4.15-l/palm/day which is the highest compared to 4.01-l/palm/day by 'Kaiveddy- pannai', 3.73-l/palm/day by 'Ari-pannai' and 3.12-l/palm/day by 'Thattu-pannai.

Although palmyrah flowers during the first quarter in each year producing about 8 inflorescences, the selection of different techniques for tapping ensured year-round yield of inflorescence sap. This is being achieved by tapping Ari-pannai between January to April, Valu- pannai during April, May, June, Thattu- pannai during May, June, July and Kaiveddy between June to September. On an average, a skilled worker tap 10 palmyrah palms annualy by selecting 3 palms by Ari-pannai technique, 2 palms each by Valu-pannai and Thattu-pannai techniques respectively and 3 palms by Kaiveddy-pannai technique. Therefore on an overall average, a palmyrah palm can be yielded daily 3.75-l (5 bottles) of sap for 65 days (2 months) resulting an annual yield of approximately 250-l of toddy

B15

TIME OF HARVEST IN RELATION TO THE QUALITY OF DEHYDRATED BANANA SLICES

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The 'Kathali' (Embul) variety banana bunch after opening of the flower reaches physiological maturity between 9 to 10 weeks while growth and development of finger progress over thirteen-week-period. The fruits could be preserved by dehydration during the period of glut. The dehydrated banana slices in the market much often lose its consumer acceptability because of its inferior sensory attributes. This studies was undertaken to evaluate the effect of maturity between 10 to 13 weeks of growth of banana fruit on the quality including sensory attributes of dehydrated banana slices.

Pre-drying treatments of fruit slices was standardized before the actual dehydration studies. Different pre-drying treatments were investigated with blanching, food permissible acids, antioxidants, sugar solution, and combination techniques to improve the sensory attributes of the finish product. The most suitable pretreatment is a combination technique with 40-°Brix-sugar solution containing 0.2 percent citric acid for 12 hours at ambient temperature. It gave the highest score for colour 7.5, taste 7.1, texture 6.8 and overall acceptability 7.0, which are significantly different to other treatments ($p < 0.05$).

Harvested banana bunches of 10,11,12 and 13-week-old stages were subjected to ethylene application in order to initiate ripening at the same time. Fully ripe, firm fruits were selected for dehydration studies. They were washed, peeled and cut into 5 -6 mm thick slices. They were then treated with 40-°Brix-sugar solution containing 0.2% citric acid for 12 hours at ambient temperature. The slices were rinsed with water and further dried in a cabinet drier at 63°- 65°C till the moisture content reduced to 18 -20%. The slices were packed in polythene bags and used for studies on physico-chemical and sensory attributes.

Sensory score obtained from the dehydrated slices by an expert taste panel indicated that there is a progressive increase in the quality of sensory attributes starting from 10 to 13-week-old stage. The score out of 10 for banana slices prepared from 13-week-old stage were significantly higher with respect to colour 7.0, flavour 6.0, texture 6.0 and overall acceptability 6.8 as compared to slices from 10-week-old stage, that scored 5.8, 5.6, 5.6, and 4.4 respectively ($p < 0.05$). However there is no significant difference between 12 and 13-week-old stages for the above sensory attributes.

As far as, physico-chemical analyses are concerned total soluble solids, titratable acidity and ascorbic acid content are also increased significantly between 10 to 13-week-old stages ($p < 0.05$). The dehydrated slices from 13-week-old stage contained 54%(w/w) total soluble solids, 1.32%(w/w) titratable acidity and 6.16 mg/100g ascorbic acid as compared to 10-week-old stage that contained 47.20%, 1.18% and 4.90 mg/100g respectively. The recovery of dried sliced banana was higher being 22.30% at 13-week-old stage as compared to 18.37% at 10-week-old stage. The recovery of dried slices banana of 12-week-old stage is 21.74%, which is not significantly different to that of 13 week old stage ($p < 0.05$).

Therefore banana fruits could be harvested between 12 to 13-week-old maturity stages to produce good quality dried banana slices which have desirable sensory attributes and nutrient content.

B16

WATER BALANCE ANALYSIS TO PELWATTE SUGAR CANE PLANTATION IN SRI LANKA

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Water balance technique is a standard hydrologic process based on the basic physical principle of conservation of mass. In most cases, the term water balance implies an analysis which balance the continuity of equation either on a static or dynamic basis. On long term, the changes in storage are relatively unimportant and it is customary to assume that inflow to the system is balanced by out flow.

In Sri Lanka the production of sugar cane can be increased by three folds with the same extent of land under cultivation by supplementary irrigation (Ratnaweera, 1992) since water is the life blood of sugar cane and also is the main limiting factor in achieving the potential yield when sugar cane is grown under rainfed conditions. Water balance studies shows soil moisture changes and the amount of run off which is available to store in the reservoirs which subsequently can be used for supplementary irrigation and this is one alternative approach to over come the yield reduction due to water shortage.

Water balance model consists of balancing input and output of the aquifer was used to calculate water yield from the catchment and analysis was conducted using daily observed rainfall data of 17 stations from 1982 to 1996 and daily pan evaporation readings from 1991 to 1996.

Results showed that only during Maha season there was significant amount of runoff generated and Yala season required irrigation for sugar cane to have optimum growth conditions. In a given year, an average value of runoff generated from rainfall during Maha and Yala seasons were 196 mm and 49 mm respectively. However some years showed very low values of run off generated even in Maha season. Only 200 ha can be irrigated with the generated run off during Maha season from an area of 1000 ha during an average year.

It can be concluded that the amount of runoff and deep percolation depend on not only rainfall and better distribution of rainfall of an year but also an amount of

rainfall received in the previous year and its distribution during Maha and Yala seasons. The generated runoff from the catchment was insufficient to effectively irrigate entire plantation.

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B17

CARBON AS AN OXYGEN FERTILIZER FOR LOW LAND PADDY CULTIVATION

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The rising labour cost and the need to intensify rice production through double and triple cropping provided the economic incentives for a switch to direct seeding. Simultaneously, the availability of high yielding, short duration varieties and chemical weed methods made such a switch technically viable. As the rice production systems undergo adjustments in response to the rising scarcity of land, water, and labour, a major adjustment can be expected in the method of rice establishment and this would be possible since the direct seeded area in Sri Lanka is about 0.7 million ha, which is approximately 77% of the total rice area in the region (Pandey and Velasco, 1991).

In low land direct seeding cultivation particularly when the seeds are placed within the soil, lack of oxygen causes poor germination percentage because oxygen supply decreased almost to zero except in a thin layer at the soil surface in puddle conditions. In Japan and Thailand, calcium peroxide was used as oxygen fertilizer and in Pakistan, soil tilled to depth of 20 cm was irrigated with cold water that contains dissolved oxygen (Nakamura *et.al.*, 1986). These methods are very expensive and therefore experiments were conducted in the laboratory and field to investigate the possibility of supplying oxygen using carbon as an alternative source since carbon is used as an absorbent for gases. This sorptive properties of carbon is the result of their very large internal surface area as 1000 m^2/g (Encyclopedia of Science and Technology, 1982).

Carbon powder was prepared from grinding charred paddy husk and, a carbon coating machine was designed to coat the paddy seeds with carbon. Randomly three different viable paddy varieties BG 380, BG 400-1, and BG 94-1 were used.

Coated and non coated seeds were planted in four different depth; 0 mm, 1 cm, 1.5 cm, 2 cm and seeds were placed manually in the laboratory and Jhonpillai seeder was used in the field.

Laboratory and field observations revealed that the germination was 100 percent for the seeds, which were placed on the soil surface. When the depth of the seed placement was gradually increased the germination percentage decreased in uncoated seed. For coated seeds there was no any significant difference between the seeds which were placed on the soil surface and within the soil.

Coating the paddy seeds with carbon was very effective in germination, improving seedling emergence and subsequent growth, and can behave as a soil conditioner. However, keeping quality of coated seeds and possibility of using this technique for large-scale farming must be tested in a practical situation before recommending this technique.

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B18

DESIGN FABRICATION AND EVALUATION OF A NOODLE EXTRUDER

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As a processing industry noodle has a wide range of suitability to adopt in small-scale production of our region. The adoption of latest technology may be difficult because of cost and scale of production. An extruding machine for noodle processing was designed and fabricated with locally available materials and technology suitable to use, in small-scale industry. Sliding mechanism (piston, cylinder) using manual power is used in machine design. Height of the machine is 130 cm and occupies 1600 cm^2. A worm and wheel gear system attached with a rotary wheel was arranged to obtain and transfer the manual work to piston. The cylinder and gear system were systematically arranged on a flat thick plate. The dough was fed into the cylinder through the hole in the cylinder wall. While rotating the wheel the, piston compresses the dough inside the cylinder against the die. The extruded strands were collected on the net plate, partially cooked and dried.

Selected dimensions for the machine was suitable in handling the machine. Manual power utilization was easy and enough for extrusion. The die produced desirable shape and size strands without overlapping. The noodle prepared with the machine showed good visual characters, good mouth feel and did not dissolved when cooked. Hence the design and material selection are suitable and the machine could be used for the production of noodle.

EFFECT OF LEAF POSITION AND TOPPING ON GRADING OF BCT IN VADAMARADCHI

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Tobacco is one of the main cash crop in Vadamarachi. Market demand for Black Chewing Tobacco (BCT) depends solely on quality and size of the leaf. Quality of the leaf can be improved by better processing. The experiment was conducted in the Department of Agricultural Engineering in Maha season 1998/99 based on Hartana experimental style in measuring the leaf area (LA) and Leaf position (LP) at the plant in the field.

Leaf size is the major factor determined the quality and grading of leaves. Enlargement of leaf has three distinguished processes, such as Running, Puckering and Fattening (RPF). Preferential length of the harvested leaves were 3rd and 4th leaf, logically known as "Sattu". Sattu is more than 90 cm in length. Better leaf size could be achieved as Follows.

a.) Correct time of early planting.

b.) After seeding, 33 days matured young seed-lings were used for transplanting. It was more than 10cm in tender leaf length.

c.) High level of topping was adapted 113 cm in height, average 103cm.

Leaf content Cb(BT) 0.518 and Cb(AT) 0.5778 both were found, Cb(AT) was a valuable factor for determination of grades after curing of tobacco leaves.

EFFECT OF UNDEGRADABLE DIETARY PROTEIN SUPPLEMENT IN UREA MOLASSES BOLUS ON THE DEGRADATION PROPERTIES OF RICE STRAW IN SHEEP

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Supplementation of undegradable dietary protein (UDP) in urea molasses bolus on the degradation properties of rice straw was studied in sheep. Molasses, urea rice bran, salt and mineral mixture, at the rate of 350, 120, 480, 30 and 20 g/kg respectively, were mixed to prepare urea molasses bolus and kept as control (T_0). Four sources of UDP namely local fish meal (T_1), imported fish meal (T_2), refuseed tea leaf (T_3) and heat treated soybean meal (T_4) were incorporated in urea molasses bolus at the rate of 30, 30, 150 and 50 g/kg respectively by substituting equal amounts of rice bran used in control. Two ruminally canulated sheep with average body weight of 20 kg were used. Test feeds were supplemented at the rate of 100 g/head/day with basal feed of rice straw. To estimate degradability, straw was ground to pass 2mm screen and, 5g sample was filled into nylon bags. These bags were incubated in the rumen of sheep for 0, 8, 16, 24, 48, 73, 96 and 120 hours respectively. Disappearance of dry matter and organic matter of straw were calculated at different incubation periods to determine the treatment effect. Dry matter degradation at 5% outflow rate for T_0, T_1, T_2, T_3 and T_4 were 17.7 ± 0.78, 17.7 ± 2.78, 20.6 ± 2.08, 18.7 ± 4.03 and 17.3 ± 1.4 respectively. Organic matter degradation at 5% outflow rate for T_0, T_1, T_2, T_3 and T_4 were 15.0 ± 0.82, 14.8 ± 2.82, 18.0 ± 2.12, 15.1 ± 4.31 and 14.1 ± 1.58 respectively. The results confirmed that the supplementation of tested undegradable dietary protein sources did not alter the degradation properties of rice straw in sheep.

B21

EFFECT OF AGRONOMIC PRACTICES ADOPTED ON THE YIELD OF POTATO IN JAFFNA DISTRICT

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A field survey was conducted during 1998/99 to study the effect of awareness and adoption level of improved production technology on the yield of potato in the Jaffna district. A number of 75 sample farmers from five potato growing Agricultural Service Centers (ASC) were interviewed with a questionnaire.

The study reveals that awareness on production technology was high among the growers but their adoption level was low in all potato growing ASC of Puttur , Urumpirai, Uduvil, Keerimalai and Nallur.

It was also found that the technology adopted in terms of seed rate and planting space, planting time, amount of organic manure used and nitrogen application and age at harvesting had attributed to higher tuber yield in potato. The recommended seed rate of 2000 Kg / ha was planted by 72% of the farmers. The farmers of 68% followed furrow planting and 32% used ridge planting. 58% of farmers agreed to have wider spacing for big tubers. Even though 98% of farmers aware the correct time of planting, only 39% planted during the fourth week of November which gave the highest yield. 62.6% of farmers were known to the necessity and application of organic manure of which very few (12%) were using the recommended level. The application of correct amount of N,P and K fertilizers was known to 11%, 21% and 21% of farmers whereas 9%, 15% and 11% were adopted the recommended rate respectively. In the case of pest control 97.3% and 95% of farmers were aware about the important insect pest and disease of potato. An average yield of potato was estimated as 13 Mt / ha in Jaffna district however a highest yield of 14 Mt / ha was obtained when harvesting was done in 75 days after planting. Positive linear relationships were obtained for the amount of organic manure used ($r = 0.96$) and for seed rate($r = 0.82$) with yield of potato. Improvement on the awareness and adoption levels of improved production technology with recommended practices among growers would increase potato yield in Jaffna.

B22

OLFACTORY RESPONSE OF SHOT- HOLE BORER (*XYLEBORUS FORNICATUS* EICHHOFF) TO TEA PLANT VOLATILES

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Tea plant volatiles were tested to attract Shot-Hole Borer (SHB) (*Xyleborus fornicatus* Eichhoff) at Tea Research Institute (TRI), Talawakale. Field experiments were carried out at St.Commbs, Attampitia, and Hantana estates of TRI. Tea plant volatiles namely linalool, methyl salicilate, phenyl acetaldehyde, t-2 hexenal and geraniol were used individually or in combination at 5000 ppm in the sticky traps. Volatile(s) were absorbed in a piece of cotton wool and were pegged inside a small carton to emit the smell through a common opening in the sticky trap.

The treated and untreated sticky traps were kept in the fields and beetles catch or trap/ day was recorded with 10 replicates (10 for each chemicals) of the above three estates. Volatiles at 1000 ppm were kept in specially designed two olfactometers to determine their olfactory effect on SHB at the laboratory. The primilinary experiments were carried out by using crude extract obtained from clone TRI 2025 (suceptiple to SHB) stern bark showed higher attractancy to SHB.

Among the tested volatiles linalool, phenyl acetaldehyde, and methyl salicilate were attracted SHB significantly either individually or in combination. The flying ability of SHB beetles was affected by temperature, sunshine hours and wind speed and there is no colour influence in attracting beetles were observed (with sufficient replicates).

The tested tea plant volatiles showed no species specificity on SHB, therefore specific SHB pheromones would be incorporated with tea plant volatiles to give results on trapping the beetles in future.

B23

NUTRIENT MEDIUM FOR *IN VITRO* GERMINATION OF TEA (*Camellia sinensis* (L.)) POLLEN.

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Nutrient media were tested to find out their optimum concentration and their stimulatory effect on the pollen germination of tea (*Camellia sinensis* (L.)) and pollen tube growth. Freshly collected tea pollens from selected clones were germinated *in vitro* at Tea Research Institute, Talawakelle. Pollens were cultured in nutrient media using the hanging drop technique. Germination of pollen was determined under microscope (x10) by counting randomly selected 100-200 pollens in each test. Ten pollens were selected randomly and measured the length of pollen tube using an ocular micrometer. Each experiment was replicated three times. Among the tested nutrient media Sucrose (5-15%), H_3BO_3 (2.5-100ppm) and $CaCl_2$ (2.5-50ppm) showed significant improvement on the germination and tube length of tea pollens compared to distilled water. However, optimum levels were determined as 10-12% Sucrose, 5ppm H_3BO_3 and 5ppm $CaCl_2$ for tea pollen germination and tube growth. The optimum pollen germination and maximum pollen tube length were obtained in the medium supplemented with 10-12% Sucrose in combination with 5ppm H_3BO_3 and 5ppm $CaCl_2$. Intra-clonal variation was not found in the tested diploid clones.

B24

EFFECT OF STORAGE CONDITIONS ON TEA (*Camellia sinensis* (L.)) POLLEN VIABILITY

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Viability of tea (*Camellia sinensis* (L.)) pollen under storage condition was examined at different temperature regimes in combination with various Relative Humidity (RH) levels at Tea Research Institute, Talawakelle. Fresh pollens collected from ten tea clones were placed in separate glass vials of eighteen desiccators. These desiccators were maintained at 0%, 10%, 20%, 40%, 60% and 80% RH and to maintain such condition chemicals namely $CaCl_2$, NaOH, $CaCl_2.H_2O$, $MgCl_2.7H_2O$, KCl and NH_4Cl were used respectively. Three desiccators of similar RH were kept under three different temperatures namely laboratory (20°C), refrigerator (5°C) and deep freezer temperature (-10°C). At 10 days intervals, one vial from each storage treatment was taken out randomly without disturbing others and the pollen viability was assayed by germinating in a suitable liquid nutrient medium. Laboratory and deep freezer temperatures irrespective of RH showed complete loss of pollen germination within three months. RH greater than 40% at all tested temperature conditions was also ineffective in maintaining pollen viability. However, tea pollen was successfully stored for four months under refrigerator condition with 0-20% RH. Under this condition pollen viability was more than 50%. There were no significant differences in pollen viability between tea clones tested under different storage conditions. Pollens stored in desiccator containing $CaCl_2.H_2O$ produced longer pollen tube compared to other chemicals and which is a preferred characteristic of tea pollen.

B25

POTENTIAL OF TEA PHYLLOPLANE MICROORGANISMS IN THE CONTROL OF BLISTER BLIGHT IN TEA (*CAMELLIA SINENSIS*)

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Blister blight, the serious disease of tea (*Camellia sinensis*) is caused by fungus *Exobasidium vexans* in Sri Lanka. This study involves screening the naturally occurring phylloplane microorganisms from clones tolerant and susceptible to blister and to determine the role of phylloplane microflora to such tolerant.

Nine different fungal and ten bacterial isolates were isolated from the phylloplane of two relatively resistance / tolerant clones DT1 and N2 and two susceptible clones YRI 3015 and TRI 2025 of *Camellia sinensis,* to blister blight disease.

In-vitro experiments using broth extracts of the isolated organisms revealed that the percentage spore germination and germ tube extension of *E.vexans* would be influenced by some of the microbes very significantly. Three fungi showed different characteristics. They were identified as *Glomerella cingulata.* Two types of *G. cingulata* fungi and one unidentified fungus from resistant clones were found to be antagonistic to *E. vexans* by reducing germ tube extension and / or germination percentage of spores. One type of *G.cingulata* from susceptible and three unidentified fungi differentiated based on hyphal characteristics from resistance and susceptible clones have shown synergistic effect on the germ tube extensions of *E.vexans.* A *Phoma* sp. and another unidentified fungus did not have any significant effect. All the bacterial isolates from resistant and susceptible clones proved to be potential synergists. The main effect being on the germination of *E.vexans* spores. The three antagonistic fungi and two synergistic bacteria from above were tested in the glass house and under nursery conditions. Under the nursery conditions a *G.cingulata* from DT1 clone reduced *E.vexans* infection by 26.67 %, from TRI 3015 by 13.33% and another unidentified fungi from N2 clone

by 13.33%, compared with control. The *Coryneform* sp. and another bacterium from TRI 2025 clone increase the infection level 6.67% and 46.67% respectively, compaired with control. Under the glass house condition a *G.cingulata* from DT1 clone and another *G.cingulata* from TRI 3015 clone were found to completely reduce the infection level compared with control.

It is concluded that some fungi from both resistant and susceptible clones have some degree of antagonistic effect against *E.vexans* spores, lead to reduction in infection and vise versa in the case of synergistic bacteria.

B26

SOME ASPECTS OF MANAGEMENT OF BLACK PEPPER LACE BUG, *DICONOCORIS DISTANTI* DRAKE IN SRI LANKA

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Black pepper (*Piper nigrum* L.) is grown in 13 districts in Sri Lanka as an inter crop. As an alternative strategy for chemical control, methods concerned with management of the pepper lace bug, *Diconocoris distanti* were examined in laboratory and field.

Host preference was studied by choice - chamber and olfactor techniques. Efficacy of entomopathogenic fungi was studied by topical application on adult lace bug. The existing natural enemy system and alternate host were studied in the field. Among the three commonly grown varieties antixenosis resistance was expressed by the variety Kuching to *D. distanti* ($p = 0.05$). Local and Panniyur - I varieties were found to be more susceptible to *D. distanti*. Topical application of the isolates of fungi namely, *Verticillium, Metarrhizium* and *Paecilomyces* showed their infectivity on the adult lace bug. However the spore concentration of 2.5×10^7 spores /ml of the fungus, *Paecilomyces* caused mortality of adult lace bug significantly ($p = 0.05$). *Rodalia cardinalis* and *Brumus* sp., the two coccinellids and a number of hymenopterans were found to be associated with pepper vines in the field. Spider webs in varying sizes 2.5-3.5 cm, 13 – 17cm and 45 – 50cm diameters were also found in large numbers in pepper fields. The remains of the adult lace bugs were found in most of these spider webs. Off bearing pepper vines and " Owl pepper" were found to be alternate hosts of the lace bug and removal of these vines would reduce the *D. distanti* population build up to the next flowering period.

Thus the management techniques may play a substantial control of *D. distanti*.

POPULATION DYNAMICS AND INTRA PLANT DISTRIBUTION OF LACE BUG, *DICONOCORIS DISTANTI* DRAKE IN BLACK PEPPER IN SRI LANKA

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The lace bug, *Diconocoris distanti* has been reported as damaging leaves, tender stems and spikes of black pepper and its damage is severe. Population of eggs, nymphs and adults and their intra - plant distribution were studied in this study.

Monthly random collection of 12 leaves per vine from randomly selected 30 vines in Matale, Kandy and Kegalle districts were made by dividing the vine into three divisions vertically. Four leaves from each tier were collected and examined. Eggs and nymphs were counted with a help of stereomicroscope (x40). Adults were assessed similarly using a modified hybrid-beating tray (Morris and Campos, 1996).

Eggs and adults of *D. distanti* were found to present in large number at the middle and bottom regions of the pepper vine ($p= 0.05$). Nymph population was high in middle region ($p= 0.05$). The population of *D. distanti* fluctuated through out the year. A highest mean number of 3.37 eggs, 3 nymphs and 3.233 adults per vine were obtained at Kegalle district during December 1996 – January 1997. All life stages were found in large numbers during the period of October – February 1997 in which heavy flowering was observed due to the unusual distribution of rainfall during the year 1996/97 and the life stages were reduced during less flowering period from May to July 1997 at three major pepper growing districts.

Therefore it is clear that the populations build up at heavy flowering would cause a greater loss in subsequent harvest. The distribution of life stages indicates the areas of preference. These informations may lead for a control measure that has to be taken against this pest.

Reference

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B28

BIOLOGY OF SHOOT AND FRUIT BORER *LEUCINODES ORBONALIS* GUEN ON BRINJAL IN JAFFNA DISTRICT

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The biology of brinjal shoot and fruit borer, *Leucinodes orbonalis* was studied with regard to egg, larva, pupa, and adult stages to make a life table and life history.

Potted brinjal plants (Var. Thinnavely Purple) bearing leaves, flowers and fruits were kept in insects rearing cages and a female *L. orbonalis* was introduced into the cage after mating. Stages of eggs, larva, pupa and adult were observed periodically and their biology was studied insitu and in the laboratory.

Terminal region of adults would be used to distinguish the sexes morphologically. Sex ratio was 1:1 (p=0.05). Mating took place 7 hours after emergence and copulation lasted for 100 minutes with performing a characteristic courtship behaviour. Longivity of female and male was 52±10.01 and 59.6±17.62 hours respectively at 29.25±1.32 °C. Fecundity was 282 ±45.45 and pre ovipositional period was 19.94 hours. Hatchability of egg was 94.2% and incubation period of egg was 3.176±0.63 days at 29.25±1.32°C.

Eggs measured 0.512±0.09mm long and 0.33±0.05 mm wide., eggs were laid singly or in groups of 2-4 on leaves, petiole, calyx, flower buds, tender stem and young fruits during night, preferably on abaxial surface of leaf nearer to the midrib and lateral veins.

First instar larvae measured 0.9816mm long initially and later 1.6016±0.67mm; the second instar was 2.746±1.69mm; the third instar bearing numerous dark brown spots and hairs all over the body, its length was 6.8±2.039mm; fourth instar was dark pink dorsally and white ventrally and with numerous number of hairs on

its body; its length was 12.318±3.18mm; and fifth instar was 14.256±2.43mm; mean larval period was 13.2±0.44 days at 29.25±1.32°C.

Mean pupal period was 7.944±1.22 days at 29.25±1. 32°C. Pupation was on unexposed surface of plant or undernearth the plant. Premature pupation also recorded.

The total life cycle of *L. orbonalis* was 28.8 days in 29.25±1.32°C and therefore about 13 generations of *L. orbonalis* would occur in a year.

The above life cycle and life table of *L. orbonalis* in agroecosystem in Jaffna will be of immense important if a control measure is formulated for this pest to help the farmers.

B29

THE STUDY OF LARVAL STAGES OF *LEUCINODES ORBONALIS* (PYRALIDAE : LEPIDOPTERA) IN BRINJAL (*SOLANUM MELONGENA*) PLANT BY MORPHOMETRIC STUDIES

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The shoot and fruit borer, *Leucinodes orbonalis* is a serious pest in brinjal. A study of larval stages of this pest in the agro ecosystem of Jaffna is of considerable importance.

The borers were allowed to lay eggs on the brinjal plant after mating and the larval stages were studied in the laboratory and fields.

Larval instars of *Leucinodes orbonalis* collected from brinjal plants in farmers fields to this study and the width of head capsule of 727 larvae were plotted against the larval frequency and the peaks were measured as 0.2448±0.0866, 0.5256±0.0813, 0.8496±0.0873, 1.148±0.08466 and 1.4154±0.085mm respectively and found that there were five instar stages. These results were confirmed by satisfying Dyar's law ($r^2 = 0.9377$).

First instar was very active and bored into the midrib, petiole, ovaries of flowers, flower buds and growing shoots of the plants. First and second larval instars were mostly confined to leaf due to their size. Third and fourth instars damaged the stem. The wilting symptom and the bore- holes were observed all levels of the canopy due to the blocking of assent of sap. Third, fourth and fifth instars were found in large numbers in the brinjal fruit. A maximum of 9 larvae were collected from a fruit. The fifth instar was sluggish preparing for pupation.

Thus the parts of plant where the larvae of *L. orbonalis* are living during their larval stages are an advantage to apply control measures against this pest.

NEEM (AZADIRACHTA INDICA A JUSS) MATERIALS AS NITRIFICATION INHIBITORS OF APPLIED AMMONIUM SULFATE IN THREE SELECTED SOILS OF SRI LANKA

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Nitrification inhibitors not only improve nitrogen fertilizer efficiency but also reduce environmental pollution caused by nitrogen fertilizer application. Neem cake and its extract have been identified as having nitrification inhibitory properties. Laboratory incubation experiments were conducted to know whether blending ammonium sulfate with neem materials alters the forms of nitrogen, rate of nitrification and general microbial activity in Reddish Brown Earth (RBE – *Alfisol*), Reddish Brown Latosolic (RBL – *Ultisol*) and Red Yellow Podzolic (RYP – *Ultisol*) soils of Sri Lanka. The treatments used in these experiments were ammonium sulfate, ammonium sulfate + 20% neem cake, ammonium sulfate + 30% neem cake. ammonium sulfate + 20% neem extract and a control without ammonium sulfate or neem.

All neem treatments conserved ammonium ions and reduced nitrate ions compared to ammonium sulfate alone up to eight weeks in RBL soils and up to 12 weeks in RBE soils. However, no such results were observed in RYP soils. Rate of nitrification increased over time in all soils tested with all treatments. Nitrification was inhibited by all neem treatments in RBE and RBL soils, while percent inhibition of nitrification was reduced over time. However in RYP soil no nitrification inhibition was observed with any neem treatments possibly due to the acidic reaction of this soil. General microbial activity measured as CO_2 evolution had not been negatively affected by any neem treatments, therefore application of neem materials does not hinder general microbial activity in soils. Results of these incubation experiments suggest the potential of neem cake and extract as nitrification inhibitors of ammonium sulfate in RBE and RBL soils.

PATTERN AND LEVEL OF FOOD CONSUMPTION IN SRI LANKA AN ANALYSIS OF TIME SERIES AND CROSS-SECTIONAL DATA

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Sri Lanka is said to be having the best welfare system in South Asia. Most of the Sri Lankan people live in the rural areas, where the main occupation is Agriculture. But domestic food production is inadequate to meet the local food demand. Population and per capita income are the two major determinants of consumer food demand. The overall calorie intake was inadequate to meet the minimum calorie requirements set by the Medical Research Institute of Sri Lanka (2200 calories /day / person).

The main objectives of this study is to determine the daily per capita calorie and protein intake among people of different income groups. Another objectives is to examine the factors that influence daily per capita calorie and protein intake. The third objective is to predict the future demand for food based on the present results.

Data were mainly collected food balance sheets and food consumption surveys done by the Central Bank of Sri Lanka. Together with tabular analysis regression models were estimated and tested by Ordinary Least Square method. From tabular analysis it was noted that rice is the staple food of the nation and the propotion of income spent on food diminished as per capita income increases. From log-log

regression model the elasticity coefficients were find out separately for time series and cross sectional data.

Time series: elasticity	Nutritive part	Income
	Calorie	0.2
	Protein	0.4
Cross sectional : elasticity	Food items	Expenditure
	Rice	0.07
	Wheat flour and bread	0.15
	Meat, fish and eggs	0.15

The regression results suggested that the consumers were less income responsive in allocating their food budget among calorie and major food items.

Future demand for food mainly depends on population growth and per Capita income growth. Increasing population tends to increase the demand for food in future.

Food items	Future food demand in the year of 2000 (Percent increase from 1987)
Rice	21.84
Meat	100.24

This results indicated that the future demand for animal food will be higher than that of starchy foods. So, with time consumer preferences change from starchy foods to food which are rich in protein.

This study conducted that over the period of 1950-1995 though an over all intake of food is clear, very transition from starchy staples to animal based diets not taken place. Even now rice contributes 45 percent to total calorie intake and about 35 percent to total protein supply. Next to rice wheat flour and bread contributions are high and animal products contribution are little.

IMPACT OF INSTITUTIONAL AGRICULTURAL CREDIT ON AGRICULTURAL PRODUCTION A CASE STUDY IN THE VAVUNIYA DISTRICT

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Credit is thought to be a strategic variable in enhancing agricultural production in developing countries. Therefore government in these countries place special importance on the provision of institutional credit in agriculture.

This study was carried out to assess the implication of institutional credit on the red onion production in Vavuniya divisional secretariat division, which is typical of the Sri Lankan dry zone. Purpose randomly selected sample farmers, from the Kovilkulam and Pamparnadu agrarian service centre divisions were interviewed with a structured questionnaire. The study compared the calculated t-probability values with fixed probability level of 0.05. An appropriate functional form was decided by comparing the t- probability values, R. square, adjusted R square, D. W and VIF (Variation Inflation Factors) of the functions.

Firstly t-test was performed to compare the yield difference of red onion both borrowers and non-borrowers. Second t-test was performed to test the total liability difference of both borrowers and non-borrowers. Here total liability implies the summation of formal and informal borrowings of borrowers and total informal borrowings of non-borrowers. Then multiple regression analysis was performed to test the influence of total borrowing on the level of inputs used by the farmers. Second multiple regression analysis was done to test the production

response to the input usage level of borrowers and non-borrowers. Finally correlation analysis was performed to check for any interrelationship within the inputs used in the production.

0.0001 t-probability value implies that there is a significant difference found between the yield level of the borrowers and non- borrowers. According to the results of the second t-test, the t probability value 0.0078 indicates the significant difference found between the total liabilities of both category farmers. Total borrowing of borrowers had a significant impact on the input usage level of land, seed hired labour and nitrogen fertilizer. But for non-borrowers total borrowing were found to be significant only for the inputs of seed and hired labour . Final regression analysis implies the productivity of purchased inputs on the production. But the productivity of inputs was found to be higher for the borrowers of credit than non-borrowers. Interactions found within two inputs of non-borrowers were detected by the correlation analysis. Ultimately the research concludes that institutional credit has statistically significant impact on the production of red onion.

B33

SOME ASPECTS OF INSTITUTIONAL AGRICULTURAL CREDIT ON AGRICULTURAL PRODUCTION A CASE STUDY IN THE VAVUNIYA DISTRICT

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Credit is thought to be a strategic variable in enhancing agricultural production in developing countries. It is in this backdrop, that an attempt is made to understand the dynamics of the agricultural credit system in Vavuniya district, where the traditional paddy based agricultural system is in the phase transition into a commercialized agricultural system. Vavuniya district is considered to be a relatively less endowed district in Sri Lanka. It is a district with typical dry zone characteristics.

This study was carried out to asses the credit need of the red onion cultivators, contribution percentage of the non-institutional sources as against the institutional sources and the factors affects the farmers access to the credit. Final objective is to recommend possible measures to evolve a better credit culture in the district.

Purposive randomly selected sample farmers from the Kovilkulam and Pampamadu agrarian service center divisions were interviewed with a structured questionnaire to obtain the information. Descriptive statistics, chi-square test, and simple tabular analysis were used to analyze the data.

Credit needs of the farmers were estimated on the basis of potential credit need, expressed credit need and credit need based on the 75 per cent of the total cash cost of production. Assessment of the credit need based on the cost of cultivation

showed a highest value than other two. Expressed credit need of the farmers was found to be far below than the credit need estimated based on the cost of cultivation. But potential credit need of the farmers showed the lowest value.

Out of the total borrowing of the red onion cultivators in the Vavuniya Divisional secretariat division, informal sources contributed 31 percent as against the formal sources. But total Bank loans alone contributed 42.25 percent out of the total borrowing of the farmers.

This study identified several factors such as age, educational level, family labour previous borrowing experience, availability of water and storage facilities, size of holdings and off farm income which have been influencing farmers effective access to the institutional credit. Finally the research recommend some possible measures to evolve better credit culture to improve the productivity of farmers through proper supervision and guidance of borrowers and by ensuring timely provision to adequate amounts of formal credit.

Replacing the asset based lending system by introducing a group based lending scheme, allowing farmers organization to be as a guarantor to the poor farmers, channeling more credit to the construction of storage structures and rehabilitation of the wells, extending the Bank services via introducing the temporary mobile service units during the lending seasons, employing more clerical staff to reduce the paper works of the borrowers and reducing the time to sanction the loans. could be expected to prevent farmers from securing loans from high cost informal sources.

C1

HISTOLOGICAL TYPES OF FIBROADENOMA OF THE BREAST AND THEIR CLINICAL PROFILE IN WOMEN

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Fibroadenoma is benign tumor like lesion of the breast. These frequently cause anxiety among the affected women, regarding malignant changes in these lesions. This study discribes some of the clinical features of women with fibroadenoma of the breast.

Seventy eight female patients clinically diagnosed as having fibroadenoma of the breast and admitted to the Jaffna Teaching Hospital, were interviewed using a structured questionnaire. The morphological characteristics of the lumps were recorded after excision. Eight two biopsies were examined by staining paraffin wax sections with Haematoxylin and eosin.

Of the 82 fibroadenomo examined 56.1 % were found to be pericanalicular type; where as, 23.2% were of the intracanalicular varieties and 20.7% showed a mixed patterns. In those below the age of 25 pericanalicular type was observed in 57.7%. In the older age groups all three patterns were seen with approximately equal frequencies. Lumps less than 2.5 cm diameter and less than 3 months duration were predominantly pericanalicular and mixed types (67.5% & 62.5%s); those more than 4 cm diameter and more than 6 months duration were mainly intracanalicular (53%). Tumors weighting less than 25 g were mainly (59%) associated with a pericanalicular pattern. Above 25 g the intracanalicular pattern was predominent (56%).

The pericanalicular type was common in both single and married patients, being 66.7% and 52.5% respectively. Among the 46 patients with pericanalicular type, 27 patients (58.6%) were mentally depressed due to disasters. Forty-nine percent of those who had attained menarche below 13 – 14 years had pericanalicular fibroadenoma.

This study shows that smaller lumps are mainly of pericanalicular and mixed patterns; whereas the larger lumps have an intracanalicular pattern. A marginally significant association ($p=0.08$) was observed between the type of fibroadenoma and the size of the lumps. There was no significant association between the type of fibroadenoma and other clinical features such as age groups, duration, weight of the lump, marital status, depression and age at menarche.

C2

SURVEY FOR THE PREVALENCE OF HOOK WORM EGGS IN SOIL IN JAFFNA DISTRICT

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Hookworm infection is a major disease of man where ever open yard defaecation is practised. Individuals who walk barefoot on defaecation grounds, are liable to get the infection. The relative risk caused to a community could be studied by examining soil samples for contamination with hookworm eggs.

Soil samples from selected locations in Jaffna District, were examined for the presence of hookworm eggs. Prevalence of hookworm eggs in soil was studied. Locations were selected from defaecation yards suspected to be having a high degree of contamination with hookworm eggs. Surface layer sample of 1cm deep, from the soil, was collected for examination and brought to the laboratory. Centrifugal flotation technique described by Dada 1977 was employed to isolate hookworm eggs from soil samples. This technique was found to work well under local condition.

The highest percentage of locations (27-37%) which are positive for the eggs, were observed during wet season (January to March). Low percentage of locations, positive for hookworm eggs were noted in September 1998, could be the result of destruction of eggs by direct sunlight.

The eggs hatch in one to two days under favorable condition in soil during rains or get buried by dung beetles. As such less or nil hookworm positive locations were noted in May and July. The increase in the percentage of positive locations during wet season, suggests that it is an adaptation to natural condition and coincides with the high transmission period.

With the knowledge of exact locations of soil contamination it is possible to advise on remedial measures in the affected locations.

D1

A SURVEY ON THE IMPLEMENTATION OF SCHOOL BASED ASSESSMENT SCHEME - BASED ON GRADE 9 SCIENCE IN SCHOOLS IN THE NALLUR DIVISION

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Among the proposals for the new Education Reforms in Sri Lanka, the School Based Assessment (SBA) scheme is one of the important proposals introduced for the quality improvement in Education. SBA will bring about improvement both qualitatively and quantitatively in the learning, teaching and evaluation processes. Assessment in this context, means that the Teacher will interact closely with the student and identify his capabilities and weaknesses and thereby, will be able to help him in his learning process. So, SBA will raise the achievement level of the majority of the students to the expected mastery level and will lead to the development of a balanced personality.

The objective of the study was to assess the success of the implementation of the SBA programme in achieving the objectives of SBA, to identify factors that are not conducive to it, and to provide a proposal of recommendation to improve SBA programme.

The above survey on the implementation of the SBA programme was carried out in 20 schools in the Education Division of Nallur. The data were collected from the Principals, Teachers, Students and their parents through questionnaires. Also the grade 9 Science and Technology question paper from 10 selected schools were collected and analysed to find out the suitability of the achievement test as an assessment tool.

The findings of the research reveals teacher resource, knowledge and opinion regarding SBA and Assessment tools such as the written test, practical tests and observation charts, as favourable aspects of the programme.

At the same time, the desirable size of the classroom, physical resources, recording work and a few assessment tools such as check lists, open book tests and project work, appropriateness of progress test papers and remedial teaching are not conducive to the implementation of the SBA programme.

The proposals to improve the efficiency of the SBA programme, the effective use of resources and proper function of SBA committee were also included in the paper.

D2

RESEARCH STUDY OF COST SHARING IN EDUCATION IN SRI LANKA

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The objectives of the study are to analyze the cost of education, quality of education and the affordability of cost of education by the individual families of a village which has the characteristics of remoteness, rural/peri-urban and experiencing poverty. On the basis of the above criteria Andimunai village, in Puttalam was se'ected.

Focus groups of the study were Principal/Teachers, Parents, In-School Children, Dropouts, School Leavers, never been to school and others such as Tuition Masters/ Mistress, Politicians and Kovil/Temple Societies. Participatory method / tools were used to obtain primary data from the above focus groups for necessary analysis. Secondary data also used to analyze the cost of education.

The study revealed that the cost of education is less as most of the children of the village are getting their primary and secondary education from their village school. Inability of the parents to afford the cost of education due to less and unstable income, of school going children of family, available opportunities to earn money in their young age, constrain in getting suitable white collar jobs after the completion of their secondary education and value given to education by the parents and children are the major factors affecting the schooling of the children of the village. At the same time the school which is in the village is struggling to provide quality education due to some constrains. The studies found all these are contributing factors, which decide the cost, quality, affordability of cost of education.

D3

A STUDY OF THE RELATIONSHIP BETWEEN THE TECHNICAL SUBJECT STUDIED AND THE CHOICE OF ADVANCED LEVEL SUBJECTS

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Technical Subjects are taught in our schools from grade 8 to 11. Besides the major aims of teaching these subjects, it is also expected that any learning that had taken place upto grade 11 should be related to the learning that is to take place in grades 12 & 13 in someway or other. A study of the relationship between the Technical Subject chosen by a child and the Advanced Level subjects he follows is thought to be a useful exercise in this context.

This study was conducted on a sample of 115 grade 12 students drawn from ten schools in the Jaffna Educational district. The sample included students following the Arts, Commerce, Science and Maths streams.

Data for the study were gathered through a questionnaire. The data obtained were analysed and the summary of the findings is as follows:

Students had chosen six different Technical subjects of which Commerce, Agriculture, and Home Economics were found to be popular - selected by 52,22, & 20 students respectively. The other three were chosen by just one student each. Thus the analysis centres mostly around the three popular subjects. The results of the study indicates a very weak relationship between the Technical subject studied at the Ordinary Level and the Subjects/ Stream chosen at the Advanced Level. Also, there is no evidence to suggest that any attempt had been made either to propagate any such relationship.

Several suggestions are put forward for improving and strengthening the relationship expected without jeopardising the other aims of Teaching the Technical Subjects.