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JAFFNA SCIENCE ASSOCIATION

Abstracts 2004

12th Annual Sessions

21, 22 & 23 April 2004

Jaffna, Sri Lanka

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The Annual Sessions of the Jaffna Science Association held yearly contributes to popularize scientific thinking and encourage scientific research oriented projects. This volume commemorates the 12th Annual Sessions of the Jaffna Science Association, to be held from 21-23 April 2004. The abstracts of papers to be presented at the 12th sessions are incorporated in this volume. The abstracts are reviewed by competent personnel prior to acceptance. This 12th volume contains 21 abstracts comprising 03 from Section A, 15 from Section B, 01 from Section C and 02 from Section D.

I wish to thank Dr.S.Srisatkunarajah, General Secretary and the Sectional Chairpersons and Executive Committees for their assistance in getting these abstracts refereed in time.

I owe my special thanks to Mr.P.Sureshkumar, Instructor in Computer Technology, Faculty of Agriculture, for the excellent support given to me in publishing this volume in time.

Dr.(Mrs).S.Sivachandiran
Proceeding Editor
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SECTION D

Effect of Some Commercially Available Antimicrobial Agents (Dettol,Harpic, Savlon and Alcare) on Bacterial Growth

Kapilan, R. and Thavaranjit, A.C.
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Disinfectants and antiseptics do not always sterilize because usually they do not kill all microbial spores and their vegetative structures. Their antimicrobial effect depends on the type of antimicrobial agent, the concentration used, the type of organism, environmental factors etc. The objective of the study was to determine the effect of some commercially available antimicrobial agents on the growth of bacterial flora that are commonly present in water and in the laboratory environment and then to recommend the type of agent which removes most of the microbes in a very low concentration.

Dettol was serially diluted up to 10-4 dilution and 1ml from each dilution including the undiluted original sample was transferred into test tubes each containing 12 ml of molten agar and mixed well. Each mixture was then poured into separate sterile petridishes and allowed to solidify. 0.1 ml of *E.coli* inoculam was taken and introduced into the medium using the spread plate technique having enumerated the numberof living cells by the viable count method. Petridishes were incubated at 37^0c for 48 hours. The same procedure was applied with Harpic, Savlon and Alcare. Also the above procedure was repeated with *Klebsiella* instead of *E.coli* with the same antimicrobial agents. Each test was repeated 10 times in duplicate. Controls were maintained without any antimicrobial agent. Following incubation the numbers of colonies were counted to each dilution and analyzed statistically.

The degree of inhibition varied among the antimicrobial agents. Along the dilution series, the number of colonies decreased and in low dilutions, colony counts were impossible, as the numbers of colonies were very high and dense. Dettol showed a significant difference on the growth of *E.coli* and *Klebsiella* and this was applicable to all the antimicrobial agents used expecting Alcare. The effect of each antimicrobial agent on the growth of *E.coli* showed significant differences amongst them and this was applicable to *Klebsiella* also. All these chemicals tested did not allow any growth in their original concentration 10^0 and the 10^{-1} dilution and the 10^{-2} dilution except Alcare. Except Alcare, all the others are strong antimicrobial agents though their effect on bacterial growth differs significantly. Dettol, Harpic and Savlon can therefore be used as antimicrobial agents, in very low concentrations in order to minimize chemical pollution whereas Alcare cannot be used as an effective agent at the concentrations used.

A Preliminary Study on the Effect of Mcnulty's Solution to Detect Helicobacter Pylori in the Human Gastric Biopsies in Sri Lanka

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Helicobacter pylori is a relatively fastidious, motile, slowgrowing, Gram negative, curved rod shaped microaerophilic bacterium. Though there are several methods to detect the presence of this organism, CLO test is a useful rapid test to confirm the presence of *Helicobacter pylori* in the human gastric biopsies. However commercial CLO test kit is costly thus it is not possible to use routinely. The objective of this study is to compare the use of McNulty's Solution with the commercial CLO test on the confirmation of *Helicobacter pylori* and to recommend a cheap, sensitive, easily performable bed site diagnostic test. Forty two patients, (ge range 20 - 80 years) who underwent endoscopy from September to October in 2002 for dyspepsia and had antral gastritis (not or nonsteroid anti-inflammatory drugs) at the Kegalle General Hospital, Endoscopy Unit were reviewed. In all subjects in the study, 4 gastric biopsies were obtained: 2 from the antrum and 2 from the body. Two of these biopsies were tested by McNulty's Solution (prepared at the Kegalle General Hospital) and by the commercial CLO test kit. Expected colour changes and the time taken for the colour changes for both these tests were recorded. There was no difference between the results obtained by commercial CLO test kit and McNulty's solution. This preliminary study confirmed the advantages of the use of McNulty's solution as it is sensitive, easy to prepare and the chemicals are cheap and easily available, compared to commercial CLO. It is possible that the *Helicobacter pylori* strains in Sri Lankan patients could be detected by using the artificial CLO (McNulty's solution) instead of the expensive commercial CLO. Multicentre studies planned according to a statistically valid design are required to corroborate the above preliminary observations and confirmation.

Microbial Quality of Ice-cream Available in Cups in the Jaffna Town

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Indictor organisms are known to reflect the microbiological quality of foods relative to product shelf life or their safety from food borne pathogens. Quality control measures are therefore imperative to maintain the standard of foods before consumption.

Ice-cream samples were examined for Aerobic plate count (APC), Total coliform count, Methylene blue reduction test (MBRT) and for the presence of *E.coli.* Water samples were examined for the total coliform count and the presence of *E.coli.*

Results were analyzed statically. Significant t-test (p=0.05) indicated that the out of six ice-cream manufacturing shops only one shop satisfied the standard requirement for APC. Where as ice-cream from four shops satisfied the hygienic requirement for MBRT. There was a negative correlation (r=-0.478, p=0.05) between the APC and the MBRT. Even though the keeping quality was satisfied by most samples, all the tested samples were not bacteriologically safe for human consumption. This was shown by the total coliform count and the presence of *E.coli* in all samples. Presence of *E.coli* indicated the faecal contamination. At the same time water samples did not meet the standard for coliforms and *E.coli.*

Water source was found to be one of the main reasons for the high coliform number and the presence of *E.coli* in ice-cream samples. There could be other reasons such as improper handling and lack of personal hygienic conditions increase contamination during processing and lead to high microbial load in the final product.

Estimation of Chilli Crop Co-Efficient for Effective Irrigation Scheduling

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Crop co-efficient is one of the most important parameter for successful irrigation. Crop co efficient are generally empirical ratios of crop evapotranspiration to some reference evapotranspiration and were principally derived from experimental measured data of evapotranspiration and climatological data. But these values should be verified under local condition. Hence a study based on climatological approach for local condition is creditable to ensure a level of accurate crop water requirement to supply water to the crop for effective irrigation. Hence field investigation of chilli crop co efficient was carried out at Thirunelvely Research station with the objectives of identifying the crop growth stages of chilli, determining their lengths and selecting the corresponding crop co-efficient.

Sunken drainage type Lysimeter was designed and fabricated with five major units such as storage tank, straining unit, drainage tank, collecting unit and lifting unit. These Lysimeters were installed at Thirunelvely Agricultural Research station field with chilli crop at four different places. Pan evaporation value was measured from Panevaporimeter. Reference evaporanspiration (ETo) were calculated by multiplying Pan evaporation and Pan coefficient. Crop water consumption was estimated by simple water balance equation. Crop coefficient values (Kc) were calculated using the ratio between chilli consumptive use (ETcrop) to ETo.

The actual values are 30, 30, 40 and 20 days for initial, crop development, mid and late season respectively. But identified stages were up to 30 days for initial, then for development 30 70 days, mid season 70 105 days and late season 105 120 days and Crop coefficient values for initial stage 0.31 0.55, for development 0.55 to 1.2, for mid season 1.2 1.1 and for late season 0.95 to 0.85 were obtained. Management practices, cultural practices were not completely same as field condition and not documented for these crop co coefficient estimation. Hence, evaluation or prediction of crop co-efficient value for local environmental condition is very important and enhances the irrigation efficiency.

Selection of Suitable Pressure Head for Sprinkler Irrigation by Uniformity Co-efficient

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Sprinkler irrigation is more suitable for water scarcity area and poor quality water areas. It has high application efficiency of more than 85 % and always field could be maintained at field capacity level even with poor quality irrigation water. Uniformity of the water distribution is an essential component of the sprinkler irrigation and it is important to study the effectiveness of the irrigation system in local field condition. Christiansen uniformity coefficient model was selected to calculate the uniformity coefficient values. The objectives of this study was to find out the effect of pressure on uniformity coefficient and wetting area of coverage and to find out the best combinations of pressure comparable with the internationally accepted standard.

Already installed Side Winder 200 Low Flow (SW 200 LF 'Rain Bird' specification) type sprinklers in the District Agricultural Training Centre, Thirunelvely, Jaffna were selected. In preliminary test, randomly selected eight same type sprinklers were fitted on two laterals with equal spacing of 5m and with riser height of 85cm and trajectory angle of 0^0. Then one side sealed polythene bay was tied in each sprinkler nozzles and was operated for 30 sec at 0.6 bar pressure. From this four sprinklers were selected without significant difference in discharge rate. With four equal discharge rate nozzles, randomly selected five different pressure heads; 0.4, 0.6, 0.8, 1.0 & 1.2 bar with trajectory angle of 24^0 at 85 cm riser height levels with four replicates were used to measure the uniformity co- efficient and wetting area of coverage. Twenty catch cans were placed uniformly around each sprinkler location. Sprinklers were allowed to operate 30 minutes and collected water in each catch can was measured by a measuring cylinder. The selected sprinklers were interchanged randomly in each replication. Gate valves of 1.5 inch were fitted on each starting point of sub-main to regulate the pressure. A RBG liquid filled pressure gauge was fitted at the junction of main and sub main to measure the pressure.

The relation ship between pressure and discharge rate was showed by best-fitted model with acceptable R^2 value; in linear model $Y=1.8538X + 0.8625$ ($R^2=0.9165$) and $Y= 1.394 \text{ Ln } (X) + 2.7547$ ($R^2 = 0.9751$) in logarithmic function in which X denotes the pressure in bar and Y denotes the discharge rate in l/min. Both functions could be accepted, but best correlation is with logarithmic function. The obtained uniformity co-efficient values were 64% , 84%, 87%, 86% and 90% for 0.4, 0.6, 0.8, 1.0 & 1.2 bar respectively. According to the internationally accepted level of above 85% of Christiansen's uniformity coefficient values, the 0.8, 1.0 and 1.2 bar pressures were selected under local field condition as suitable. When pressure level increases, the wetting area of coverage also increases until 1.0 bar pressure, then slightly reduces as pressure level increases from 1.0 to 1.2 bar at local field condition. Hence 0.8, 1.0, and 1.2 bar pressure levels could be selected to achieve better uniform distribution of water in sprinkler irrigation under local field condition.

Some Preliminary Studies on the Production and Properties of -amylase from Bacillus licheniformis ATCC 6346

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Thermostable α-amylase is produced by a mesophilic organism, *Bacillus licheniformis*. Single colony of *B. licheniformis* ATCC 6346 from nutrient-agar slants (grown at 37°C for 24h) was transferred to activation medium and incubated at 42°C in a rotary shaker (100rpm) for 12h and used as inoculum. The nutrient-agar medium contained (gl^{-1}) nutrient agar, 25.0 and soluble starch, 3.0 and the activation medium contained (gl^{-1}) nutrient broth, 25.0 and soluble starch, 3.0. The fermentation medium was inoculated with inoculum (20%, v/v) and incubated at 42°C and 100rpm. The Fermentation medium contained (gl^{-1}) soluble starch, 2.0; $(NH_4)_2SO_4$, 2.0; peptone, 2.0; NaCl, 1.0; $FeCl_3$, 0.005; $MgCl_2$ $6H_2O$,0.005; $CaCl_2$. $2H_2O$, 0.005; KH_2PO_4, 1.0 and K_2HPO_4, 2.5. The strain *B. licheniformis* ATCC 6346 reached log phase at 12h. Highest Optical density (OD_{600nm}) 1.905 was at 12h and the highest α-amylase activity (20.58Uml^{-1}) was obtained at 33h. Amounts of soluble starch and $(NH_4)_2SO_4$ in the fermentation medium were optimized to improve the enzyme production. The soluble starch concentration in the medium was varied in the range of 2-10gl^{-1} while all other contents of the fermentation medium was kept the same. The highest α-amylase activity (28.7 Uml^{-1}) was produced in the fermentation medium containing 4$g1^{-1}$ soluble starch. Then to the fermentation medium containing 4$g1^{-1}$ soluble starch, different concentrations of $(NH_4)_2SO_4$ (2-9gl^{-1}) was added and the highest α-amylase activity (39.60Uml^{-1}) was obtained in the medium containing 5$g1^{-1}$ $(NH_4)_2SO_4$. Kinetic properties of the α-amylase produced by *B. licheniformis* were studied. Enzyme activity with time was determined and the reaction time was fixed as 10 min. The optimum pH was determined as pH 7.0 for enzyme activity. The activity was measured at different temperatures ranging from 40 to 95°C and the optimum temperature for the enzyme activity was 85°C when soluble starch was used as the substrate. Michaelis constant of α-amylase for soluble starch was 0.47gl^{-1} at pH 7.0 and 85°C. The enzyme pre incubated at 85°C and at pH 7.0 lost 25% of its original activity in 5min while that pre incubated at 75°C retained 75% of its initial activity at 90min. When the enzyme was incubated at 85°C and pH 9.0 retained 73% of its initial activity at 30min; and at pH 8.0 retained 63% of its initial activity at 10min. At pH 7.0 and 8.0 and at 85°C the enzyme lost the total activity at 60min and 50min respectively. Further studies are in progress to increase the enzyme production and to purify the enzyme.

Isolation and Characterization of Bacterial Strains Producing Xylanase

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This study was aimed at isolating a moderately thermophilic xylanase producing bacterial strain. Therefore strains from hot environment were selected. From cow dung (3 samples CD_1, CD_2 and CD_3), hot rice broth (one sample HB), water used in autoclave (3 samples AC_1, AC_2 and AC_3), opened agar plate (3 samples SM_1, SM_2 and SM_3), beetroot peel (9 samples BR_1 to BR_9) and opened xylan liquid medium (26 samples GS_1 to GS_{26}), 45 bacterial strains expected to produce xylanase were isolated. Single colonies of the bacterial strains were obtained by cultivating the organisms in xylan-agar medium containing (gl^{-1}) nutrient agar, 25.0; and xylan, 20.0. To select the potential xylanase producer, single colonies from the samples mentioned above (45 samples) were selected, activated in xylan-nutrient broth medium [containing (gl^{-1}) xylan, 20.0; and nutrient broth, 25.0] at pH 7.0 and 42°C while shaking at 100rpm for 16h and used as inoculum. The inoculum was transferred into the fermentation medium containing (gl^{-1}) xylan, 20.0; peptone, 2.0; yeast extract, 2.5; $CaCl_2.2H_2O$, 0.005; $MgCl_2.6H_2O$, 0.005; $FeCl_3$, 0.005; K_2HPO_4, 2.5; KH_2PO_4, 1.0; NaCl, 0.1 and $(NH_4)_2SO_4$, 2.0. The fermentation was carried out at 42°C and pH 7.0, while shaking at 100 rpm. The enzyme activity was measured at optimised conditions of pH 6.9 and 60°C by incubating the enzyme with $20gl^{-1}$ xylan in 0.01M sodium phosphate buffer (pH 6.9) for 4 min. Among the 45 strains, 2 strains did not show xylanase activity under the experimental conditions. However among the strains, 32, 4, 4 and 3 strains have respectively produced the xylanase activity in the range less than 10, 10-20, 20-40 and 40-46Uml^{-1} ($U=mgmin^{-1}$). Hence the three strains (GS_{19}, GS_{22} and GS_{24}), which produced the xylanase activity in the range of 40-46Uml^{-1} were selected for characterization. Single colonies of GS_{19}, GS_{22} and GS_{24} were isolated and their microscopic, cultural and biochemical studies were carried out. Since the strains GS_{19}, GS_{22} and GS_{24} were gram-positive, sporulating, motile, catalase positive, aerobic, -haemolytic rods these three strains were confirmed to belong to the Genus *Bacillus*. Among the three strains, the best xylanase producer GS_{22} was selected and further studies of microscopic, cultural and biochemical studies were studied to identify its species. In Genus *Bacillus*, 48 species are described. Based on the characteristics such as shape and arrangement of spores, ability to produce acid and inability to produce gas from glucose fermentation, growth temperature, ability to hydrolyse starch and to utilise $(NH_4)_2SO_4$ for growth, strain GS_{22} was identified as *Bacillus pasteuri*.

Kinetic Studies of xylanase Produced by Bacillus pasteuri

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The aim of this study is to optimise the conditions for the production of xylanase produced by *Bacillus pasteuri* and to optimise the compositions of the fermentation medium. Single colony of *Bacillus pasteuri* was obtained by cultivating the organism in xylan-agar medium containing (gl^{-1}) nutrient agar 25.0; and xylan, 20.0. Single colonies were selected, activated in xylan-nutrient broth medium (containing (gl^{-1}) xylan, 20.0; and nutrient broth, 25.0) at pH 7.0 and 42°C for 16h and used as inoculum. The inoculum was transferred into the fermentation medium containing (gl^{-1}) xylan, 20.0; peptone, 2.0; yeast extract, 2.5; $CaCl_2.2H_2O$, 0.005; $MgCl_2 6H_2O$, 0.005; FeCl3, 0.005; K_2HPO_4, 2.5; KH_2PO_4, 1.0; NaCl, 0.1 and $(NH_4)_2SO_4$, 2.0. The fermentation was carried out at 42°C and pH 7.0, while shaking at 100 rpm. To improve the production of xylanase, the components of the fermentation medium were changed. The amount of xylan in the fermentation medium was increased from 2 to 80 gl^{-1} and at 48h of fermentation, enzyme activity was measured at pH 7 and 60°C using 10gl^{-1} xylan. The enzyme activity increased from 0.6 to 12.3Uml^{-1} ($U=mgmin^{-1}$) when the xylan concentration was increased from 2 to 80gl^{-1}. The rate of increase was high up to 20gl^{-1}(9.0Uml^{-1}). Therefore for further studies, 20gl^{-1} xylan was used. The amount of $(NH_4)_2SO_4$ in the medium was increased from 0 to 6gl^{-1} while other components of the medium were kept constant and the enzyme produced was monitored at 24, 48, 72, 96 and 116h. The highest enzyme (45.69Uml^{-1}) was produced at 48 hours of inoculation when 2gl^{-1} $(NH_4)_2SO_4$ was added to the medium, while 46.0Uml^{-1} enzyme activity was obtained at 72h when 6gl^{-1} $(NH_4)_2SO_4$ was added to the medium. Therefore 2gl^{-1} was selected for further studies. *B. pasteuri* was cultured at different temperatures of 27, 37, 42, and 50°C xylanase activities were 12.2, 44.7, 48.0 and 3.6Uml^{-1} respectively. Therefore the optimum cultivation temperature for the maximum xylanase production was 42°C. Kinetic properties of xylanase obtained from *Bacillus pasteuri* were determined. Xylan (20gl^{-1}) was allowed to react with xylanase for 4h, the amount of reducing sugar produced was monitored and the reaction time for incubation was fixed as 04min. The pH for the enzyme assay was changed from 4.0 to 9.15 and the optimum pH for the enzyme activity was 6.9 in 0.01M sodium phosphate buffer at 60°C. When the temperature for the assay was changed from 30 to 75°C, the enzyme showed the highest activity at 60°C (49.9Uml^{-1}). The substrate concentration used for the enzyme assay was varied from 10 to 60gl^{-1} and the Michaelis constant was 90gl^{-1}. Further studies are underway to improve the organism and to determine the enzyme stability.

Improvement of Bacillus licheniformis M27 for Protease Production

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This study was aimed to improve the protease production by *Bacillus licheniformis* M27 (CFTRI, Mysore). Single colonies of the strain were transferred to nutrient-agar slants and grown at 37°C for 24h. The nutrient-agar medium contained (gl^{-1}) nutrient broth, 10.0; peptone, 10.0; sodium chloride; 5.0, and bacteriological agar, 17.5. The bacterial cells grown on the slants were transferred into activation medium and incubated in a shaker water bath at 42°C and 100 rpm for 18h. The activated strains were used as inocula and inoculated (20% v/v) to fermentation medium. Fermentation was carried out in shaker water bath at 42°C and 100rpm. Samples were taken at different time intervals and tested for protease activity measurement. The activity of protease was measured by estimating the amount of tyrosine released from casein. Both activation and fermentation media were same and contained (gl^{-1}) $(NH_4)_2SO_4$ 10.0; peptone, 4.0; glucose, 6.0; Na_2HPO_4 8.0; KH_2PO_4 4.0; $MgSO_4 .7H_2O$, 0.5; and $CaCl_2. 2H_2O$, 0.02. Concentration of glucose and nitrogen sources in the fermentation medium was optimized to improve the protease production. The $(NH_4)_2SO_4$ concentration in the medium was increased from 0 to $15gl^{-1}$ while all the other components of the fermentation medium was kept constant. The highest protease activity ($2.17x10^5$ Unit ml^{-1}) was produced in the fermentation medium containing $10gl^{-1}$ $(NH_4)_2SO_4$. Then to the fermentation medium containing $10gl^{-1}$ $(NH_4)_2SO_4$, different concentrations of peptone were added (0 6 gl^{-1}) and highest protease activity (2.30×10^5 Unit ml^{-1}) was obtained in the medium containing $2gl^{-1}$ peptone. The ratio between $(NH_4)_2SO_4$ and peptone concentration was varied (from 1:1 to 1:8) while keeping the total nitrogen concentration constant ($2.4gl^{-1}$). The highest protease activity (4.13×10^5 Unit ml^{-1}) was obtained in the medium which had a nitrogen ratio between $(NH_4)_2SO_4$: peptone as 1:4. Thus, the amounts of $(NH_4)_2SO_4$ and peptone were optimized as 2.26 and $14.22gl^{-1}$ respectively. To the medium containing optimized amount of $(NH_4)_2SO_4$ and peptone, glucose of different concentration varying from 3 to $12gl^{-1}$ was added and $7.5gl^{-1}$ glucose containing medium gave the highest protease activity (1.27 times higher than the control). While optimizing the medium, the strain improvement studies were also carried out. Initial cells in activation medium was $3.02x10^7$ ml^{-1} and 254Hz UV-irradiation was applied from 6cm of distance to (growth time in activation medium was 18h) bacterial cells. Viable cells were counted at different time intervals. The number of viable cells decreased suddenly to 19% in 10 min; and there after decreased very slowly. When the UV exposure times were 40, 60 and 80 min, the percentages of survival cells were 5, 3, and 2.5% respectively. Samples, which were UV-irradiated for 40, 60 and 80 min, were diluted serially and spread evenly on nutrient agar plates. Selected single colonies were activated and fermentation was carried out. Samples were taken at different time intervals and tested for protease activity. After 72h, protease activity increased by 1.43 times in a colony (from 60 min irradiated sample) and by 1.60 time in another one colony (from 80 min irradiated sample). These two strains were named as UV_A and UV_B respectively and they were kept for second cycle of UV-irradiation. In the second cycle, UV-irradiation was applied for 80min. From each of UV_A and UV_B 12 colonies were selected. The same procedure was carried out as in the first cycle of UVirradiation. The activity was increased by 1.06 times in a colony from UV_A and by 1.13 times in another one colony from obtained UV_B. These two strains were named as UV_{A1} and UV_{B1} and further studies are carried out to improve the strain.

Determination of Achievable Calorific Values for Selected Locally Available Fuel Materials

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Energy is defined as the capacity to do work. There are many forms of energy in this universe, even though only some of them are now widely employed in the world. Particularly fossil fuel is a good example, a predominant factor plays a vital role in every activity of human beings, may be completely exhausted in the near future. Scientists have forecasted and warned that the fuel will last only for 35 years. It is essential to prevent the situation of depletion of non-renewable energy source. In advanced countries with introduction of new technology many forms of energy are utilized as alternate energy source such as solar energy, wind energy, tidal energy, geothermal energy and hydro electricity. In contrast developing countries with limited technological advancement and economic barrier locally available energy source such as local fuel materials should be methodically and carefully utilized as appropriate energy source in various industries. To justify this task, knowledge of maximum achievable energy content, burning duration and burning characteristics of local fuels are very important.

A modified calorie meter was designed, fabricated and tested to obtain maximum calorific value of some selected locally available fuel materials. The calorie meter was built with materials readily available in laboratory. The meter has prime body and an air blower. The prime body consists of combustion unit with combustion chamber and heat receiving unit.

The optimum level of fuel material and water quantity used in the modified calorie meter to achieve better results was determined by regression analysis. By using standard materials the efficiency of modified calorimeter was determined 70 %, and then energy content for 13 types of local fuel materials, burning duration of 10 types of fuel materials were determined, the average burning duration maximum 4 minutes.

Screening of Brinjal Accessions Resistance for Bacterial Wilt Caused by Ralstonia solanacearum (Yabuchchi et al, 1995)

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One of the most destructive factors limiting Solanaceous crops cultivation in tropical, subtropical and warm temperate region is the incidence of bacterial wilt caused by *Ralstonia solanacearum.* In Sri Lanka, crop loss due to bacterial wilt is about 61-100 percentages while 50-100 percentage observed in dry seasons in South Asia. It is necessary to screen accessions of these crops for selection of inherent resistance in existing or old varieties, wild forms of the same species and closely related species.

Eighteen brinjal accessions were evaluated to assess their potential for resistance to *Ralstonia solanacearum* under green house conditions at HORDI, Gannoruwa from October 2002 to February 2003 by using the split-plot experiment design with three replicates.

The test plants were inoculated one month after planting when they were at five-leaf stage with using SB11 isolates of *Ralstonia solanacearum*. Bacterial inocula were prepared using one-day culture on Sucrose Peptone Agar slant media. Ten milliliters of the bacterial suspensions was used to inject in to the stem of each test plant. After inoculation, soil moisture was maintained at a high level and temperature was maintained at 32°C to 37 °C inside the screen house.
The inoculated plants were observed daily and bacterial wilt symptoms were recorded and disease index (DI =?ni X i) / (N X imax), i = 0-5,imax=5, n=no. of plants, N =total number of plants) were calculated.

Seven brinjal accessions, EGH438 (DI=0), EGH338 (DI=0), EGP014 (DI=0), 07145 (DI=0), Kaththippidy blue (DI=0), EGH1418 (DI=9.32), and L.S.Lanna irri (DI=8.67), were resistant to the bacterial wilt disease. Three accessions EGH2318 (DI=11.55), EGH318 (DI=19.34) and Jaffna local (DI=13.65) were moderately resistant accessions and six of them EGH3818 (DI=28.20), EGH1438 (DI=32.59), EGH323, (DI=23.66), EGH423 (DI=29.46), EGH2338 (DI=32.90) and Kaththippidy white (DI=36.20) were moderately susceptible. Rest of them, Thirunelvelly purple (DI=61.39) and EGH938 (DI=48.00) were highly susceptible to the disease.

These selected resistant accessions can be used in the hybridization programs to produce bacterial wilt resistant varieties with commercially acceptable characters including high yield.

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Preliminary Characterisation of Village Chickens According their Qualitative Characters and Pleiotropic Influence on Performance Traits

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A Study was conducted to characterize indigenous fowl according to their phenotypic characters and to determine the Pleiotropic effect on economic traits among local chicken's ecotype at the Central Poultry Research Station (CPRS), Karandagolla, and Kundasale. The different ecotypes having 485 adult local chickens and 882 pedigreed birds from different eco-climatic region of Sri Lanka were studied. For this purpose 485 adult scavenging local chickens were purchased from Puttalam, Vavunia, Walpita, Matale, Pottuvil, Trincomalee, Anuradhapura, Matara, Kandy and Kotmale etc. Their measurements of body weight and observations of plumage colour and pattern, ear lobe colour, skin colour, feather growth rate and the comb type were taken. The Pleiotropic effects on economic traits such as body weight, Fertility were assessed. Eleven distinct ecotypes were identified and named based on their external phenotypic characters, as Naked Neck, Giant, Deep Brown, Orange Tan, Black, Black Silver, White, Light Brown, White Brown, Silkie and White Silver.

The results revealed differences in qualitative characters between 11 ecotypes both in baby chicks and adult birds. It was observed that the darker birds are in higher proportion. With age secondary growth of sexual feathers and darkening were clearly noticed in all ecotypes. Shank and beak colour also varied with plumage pigmentation. White Silver baby chicks could be auto sexed where only the females have black dots on back and head portion. The Giant had mostly pea and walnut combs, while other ecotypes were mostly single combed. All birds except Silkie had red ear lobe, face and Yellow skin where as black in case of Silkie. Slower feather growth birds were significantly different from rapid feather growth birds, which have higher body weight than rapid feather growers. Pea comb birds were significantly heavier than Single comb birds at 4th and 8th week of age. Walnut and pea comb males don't significantly differ in fertility.

Evaluation of Some Locally Available Brinjal (Solanum melongena L.) Genotypes Under Monoculture Cropping System Practiced in Jaffna

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Seven brinjal (*Solanum melongena*) genotypes, consisting of five local genotypes and a variety "Palukamam Purple" were evaluated with the standard check variety "Thirunelvely Purple" for their morpho- agronomic characteristics in monoculture under the normal conditions practiced by the Jaffna farmers. All the seven entries were arranged in a Randomized Complete Block Design (RCBD) experiment with three replications. Data on days to 50% first flowering, plant height at 50% first flowering and first harvest, yield, fruit characters, number of fruits and response to shoot and fruit borer (*Leucinodes orbonalis*.Geun) were collected. The data were subject to standard ANOVA and the means were compared using LSD. Correlation analysis was also performed for the fruit characters.

The yield of local genotype2 is significantly higher than that of standard check variety. The shoot and fruit borer (*Leucinodes orbonalis*. Geun) damage is significantly lower in local genotype2 compared to standard check variety.

Among the entries, Local Genotype 2 showed significantly better morpho- agronomic characteristics than the standard check (control) variety "Thirunelvely Purple". This local genotype out yielded "Thirunelvely Purple" by producing double the number of fruits and double the yield. It is 100% more in fruit number and yield than "Thirunelvely Purple". The damage caused by shoot and fruit borer (*Leucinodes orbonalis*. Geun) was at a lower level (16%) compared to "Thirunelvely Purple" (57%)..
Considering all the important economic characters, Local Genotype 2 showed promise and it is a potential one to be selected.

The yield of local genotype2 is significantly higher than that of standard check variety. The shoot and fruit borer (*Leucinodes orbonalis*. Geun) damage is significantly lower in local genotype2 compared to standard check variety.

The Effect of Under Ground Competition by Trees on Crop Production in Agro-forestry Systems

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Crops that are grown with trees show less yield mainly due to the shading effect by the trees and competition for under ground resources like space, water and nutrients. The interaction between the trees and the crops is therefore both above the ground and also below the ground. To evaluate below ground competition an experiment was conducted between teak (*Tectona grandis*) and field crops such as cowpea, groundnut, okra and maize in Kilinochchi district. The crops were planted at spacing of 30 x 20 cm. A trench was dug around one tree of matched pair of trees. No trench dug around the other tree. Growth parameters such as plant height and root length were measured. At a very early stage both parameters appeared to be depressed in the absence of a trench to prevent underground competition by the trees. In a separate study of root distribution different aged trees were selected by picking from distinctly different stem diameter classes. It was found that two third of the total root mass was in 0 to 30 cm soil layer. The teak tree therefore competes strongly with crops if their root systems are not separated.

Diversity Structure and Utilization of Home Gardens in Vavuniya District, Sri Lanka.

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Home garden is an intimate association of multipurpose trees and shrubs with annual and perennial crops and invariably livestock within the component of individual houses, with whole crop-tree-livestock unit being managed by family members. Also it is an important agro forestry system in Vavuniya District. This study was carried out in 60 randomly selected households in Vavuniya district, Sri Lanka from January 2003 to June 2003. Structured questionnaire was used to study the species richness, diversity index, structure and importance of home garden. Most of the information's were obtained from interviews with household members and through direct visual observations. More than 147 useful species were identified in the study area. These include rare species of Ebony (*Diospurosa ebenum*), Satin wood (*Chloroxylon swietena*) and endemic species (*Sysygium umbrosuma*). These species are used for multi purpose such as food, medicine, timber, ornamental, and other special requirement (fire wood, fuel). The species density declines with the increasing garden size. Species diversity index (Shannon_Winner Index.) of the study area was 2.804. It is lower than Kandyan Forest Garden in Sri Lanka (3.93) it is mainly due to the climatic variation. Three vertical strata were identified in the study area. Home garden fulfills the local peoples socioeconomic needs in a sustainable way and also home garden act as conservation site. Therefore home garden should be introduced or enrich all over the country to prevent the species extinction as well as to conserve existing forest cover.

Trade Liberalization and Economic Growth in Sri Lanka

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This article investigates the combined effects of growth in exports, investment and labour supply on economic growth in Sri Lanka between 1959 and 2002, using co integration and error correction models. Market-oriented policy reforms initiated in 1977 and sustained over the past two decades have however dramatically transformed colonial export structure. Sri Lanka is now classified as one of the only four countries outside East Asia that have achieved a clear policy shift from import-substitution to export-oriented industrialization. Foreign direct investment (FDI) has played a pivotal role in expansion of manufacturing exports. The results of this study shows that the effects of exports and investment tend to be over the long run and short run. Effect of export on economic growth is significant, but as with other studies, the effects of investment and labour supply on growth is insignificant. Error correction model shows that adjustment back to equilibrium is very slow following an exogenous shock. So, in common, with other similar countries in Far East such as Singapore, the export-led growth hypothesis can be accepted for Sri Lanka.

Evaluation of the Nutritional Status of the Children Living in orphanages

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The civil war that lasted for more than two decades led to the destruction of family structure of people in the Northern Province and had led to an increase in number of orphanages and affected their nutritional status. This research was carried out to evaluate the nutritional status of children living in two orphanages closer to the Medical Faculty. For this project 28, 31 & 26 subjects were selected from two orphanages falling under 7-12, 13-16 & 17 and above 17 years of age groups respectively. The total serum protein level, bound iron and Total Iron Binding Capacity (TIBC) of the children were measured. The height, weight and blood pressure were measured and more information were collected from the children by perfecting questionnaires. Majority of the children in these two orphanages were under the desirable nutritional level based on their, height and weight measurements. The mean serum protein level of children in the age group between 7-12 years from Orphanage A and B was, 5.44 (1.21) and 7.69 (0.59) g/dl, while that of the children in the age group between 13-16 years from Orphanage A and B was, 5.25 (0.76) and 7.27 (0.7) g/dl respectively. The above said measurement of children in age group 17 years and above from orphanage A and B was 6.47 (0.76) and 7.08 (0.54) g/dl respectively, while that of the children in the age group between 7-12 years from Orphanage A and B was, 82.81 (34.32) and 96.21 (46.51) g/dl respectively. The mean serum bound iron level of children in the age group between 13-16 years from Orphanage A and B was, 77.04 (44.52) and 55.72 (30.28) g/dl respectively. The above said measurement of children in age group 17 years and above from orphanage A and B was 71.86 (38.51) and 128.62 (44.32) g/dl respectively. TIBC of children between 7-12 years from orphanage A and B were 415.91 (141.84) and 432.92 (89.89) g/dl respectively while that of children between 13-16 years from orphanage A and B was 365.44 (61.83) and 389.12 (52.78) g/dl respectively. The above said measurements of children in age group 17 years and above from orphanage A and B was 507.01 (10.92) and 450.39 (76.91) g/dl respectively. From the results it was found that under nourishment was found in all the following age groups such as between 7-12, 13-16 and above 17 years; 75.3 & 67 (from orphanages A & B), 35 & 18.18 (from orphanages A& B) and 15 & 12.5% (from orphanages A & B) respectively. This research indicated that 41.62 & 52.38 % of the children from orphanages A and B between the age group 7-12 years; 35 & 54.6% children from orphanages A and B in the age group between 13-16 years and 27.27 & 40% of the adolescence from orphanages A and B in the age group 17 years and over were affected with iron deficient anaemia. Similarly the children from both orphanages have shown reduced serum protein level. From the selected subjects malnourished, anaemic and lower protein level were 48.82, 45.15 and 28.55% respectively. The data collected and analysis of food composition indicated that the children have calorie deficiency and iron deficiency because of their food habit. As the children were given regular worm treatment the iron deficiency due to worm infestation can be ruled out. The results indicated that in average the nutritional status of children living in the orphanages are poor, i.e. below 50 % of the ideal situation.

Data Compression in Image Processing Using 2-Dimensional Centroidal Voronoi Tessellation

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Image compression is an area where many are interested in, and working on. We have developed a compression technique on the basis of spatial coherence using a two dimensional tessellation method. This compression technique differs from those of JPEG, GIF and TIFF in that it is based on 2-D spatial coherence. This method results in better compression ratios for a range of monochrome and colour photographic, scanned images with different colour depths.

In the process of tessellation, an image is decomposed into triangular meshes (or rectangular meshes) so that each mesh element contains 'equal' colour values. The 'equality' is defined by a threshold value. In our system, the user is free to choose the threshold value on which the compression ratio and the quality of the image depend.

Compression is performed by replacing the colour value of each pixel within a mesh element by the colour value of the mass centroid pixel. The algorithm proposed by Shenton and Cendes starts with a set of predetermined points, whereas our algorithm will identify the points in order to keep the mesh to have Delaunay property in Voronoi regions so that each triangular mesh element has the minimum interior angle as maximised as possible to ensure the mesh quality.

As a convenient data structure, a chain list is used to store the mesh data as each mesh element is identified. The data stored in the list will be saved in a data file from which the image can be regenerated. Experiments show that the compression ratio increases inversely with the colour depth of the images.

The regenerated image may suffer from the 'contouring' problem: that is, the common edge of the mesh elements becomes visible with certain thresholds of 'equality'. We ameliorate the contours by the dithering process using a weighted average method.

All the above features and techniques together with an elegant user-friendly interface are implemented in Java. This system has been developed as a cross-platform visual tool, which can be used for teaching purposes and practical applications.

Testing the Effectiveness of Commercially Available Bacillus thuringiensis with Local Mosquito Species in Jaffna District

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Among the methods used to control mosquito, the biological control is preferred to chemical methods, as they are environmentally friendly, less resistance and cheap. The most widely tried biological agent by the scientist is the spore-forming *Bacillus*. Among those *Bacillus* species, *Bacillus thuringiensis* and *Bacillus sphaericus* are more popular. "BACTIVEC" is a commercially available preparation of *Bacillus thuringiensis israliensis* (LABIOFAM SA, Cuba). The objective of this study was to find the effectiveness of commercially available *Bacillus thuringiensis* on mosquito spp. in Jaffna district. Mosquito larvae were collected randomly in Jaffna district with the help of entomological team, A.M.C., Jaffna. They were identified as *Anopheline, Culex* and *Aedes* based on their morphology. These larvae were bred in pure lines and were used in this experiment. Three beakers each containing 360ml of tap water and 0.5g broiler meal were used. Into each beaker 10 Anopheline larvae were added. Into the first beaker, used as the control, 40ml of tap water was added. In to the second beaker 20mlof tap water with 20mlof "BACTIVEC" were added (0.5%). 40ml of "BACTIVEC" were added to the third beaker (10%). The samples were incubated at room temperature and the viability of the larvae was monitored. This experiment was repeated three times. Similar experiment was repeated with *Culex* and *Aedes* larvae. Under laboratory controlled conditions larvae of all three mosquitoes showed 100% survival up to 78h. When the concentration recommended by LABIOFAM SA, Cuba was used, 90% of *Anophelines* and *Aedes* survived at 48 and 6h respectively while *Culex* retained 10% of its original viability at 6h. *Anophelines* did not show any change in the viability beyond 90% till 78h but *Aedes* retained 90% of its original viability till 30h and showed a drop to 80% at 48h and this viability was retained till 78h. *Culex* lost its total viability at 24h. When the concentration of "BACTIVEC" used was double the concentration that was recommended by LABIOFAM SA, Cuba, *Anophelines* and *Aedes* showed 90% of their viability at 6h and *Anophelines* retained 90% of its viability for 78h while *Aedes* showed 80% of the viability till 30h and thereafter retained 70% of the viability till 78h. *Culex* lost all its viability within 6h. This study indicates that the commercially available *Bacillus thuringiensis* is not active at the concentration recommended by the LABIOFAM SA, Cuba for *Anophelines*, and *Aedes* while it is useful to control *Culex* at the concentration recommended by LABIOFAM SA, Cuba. This study opens up an area to isolate more effective *Bacillus thuringiensis* locally, to effectively control *Anophelines*, and *Aedes*, which are mostly important in transmitting malaria and dengue respectively.

Sub-cultural Influence on the Buying Behaviour of High Involvement Products Special Reference to Cross Religion in Jaffna District

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It is obvious that cultural aspects of a person including religion influence his/her social behavior. Culture is defined as a "learned and transmitted behavior, accepted by a social group". Many researchers have identified that there is a strong relationship between sub-cultural components and buying behavior of consumers. Products are divided into two categories. One is high involvement product It is the symbol of prestige/social status, and high priced, high risky and not purchased not frequently. On the other hand, it can be explained on the basis of the time gap between need identification and purchasing decision because of the information-seeking behavior of consumers. Another one is low involvement product. The buyer will not spend much more time in taking decision on it.

Further, it is said that socio-cultural structure of the Jaffna society is rigid as far as sub culture component (religion) is concerned. Therefore, there is a need to identify to what extent the religious structure of the Jaffna society influences on the buying of high involvement products. This study revealed that sub cultural components have significant influences on buying decision of high involvement products. There is a slight deviation that can be found between Hinduism and Christianity. But high involvement products' colour choice can be identified as major deviating factor on buying decision between the religions.

Entrepreneurial Characteristics and Business Succession of Women Entrepreneurs in Jaffna District

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Entrepreneurs are real energetic force in any economy. Because of this feature most of the government of developing nations give high concern to develop entrepreneurial skills among the nationals. On the other hand, non governmental organizations are also in the same track. According to management literature investors differ from entrepreneurs in many respects i.e. they may be or may not be entrepreneurs specially. Creativity and innovations are basic things to separate them from ordinary people. Further personal entrepreneurial. Characteristics have an impact on the success or failure of an organization. In this context, this paper attempts to analyze women entrepreneurs in Jaffna district. Even though Jaffna district is male dominated one, the contribution of females in local community is not to be underestimated.

According this research personal entrepreneurial characters have high influence on their success. More than half of respondents reported that reason behind the success is hardworking or perse verance. Whereas others indicated quality and variety of products and support of the family numbers. So women who are forced into entrepreneurship did better than "chance" or created entrepreneurs.

Thanking you

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