



*ISAE 2022
Young Graduates' Forum
(YGF)
Faculty of Agriculture
University of Ruhuna
Sri Lanka*



Proceedings of the International Symposium on Agriculture and Environment 2022

Young Graduates' Forum (YGF)

Proceedings

***“Advanced Technologies, Training and Research for
Optimizing Agricultural Production”***

**5th December 2022
Faculty of Agriculture
University of Ruhuna
Sri Lanka**

PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM ON AGRICULTURE AND ENVIRONMENT (YGF) 2022

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Published by
Faculty of Agriculture
University of Ruhuna
Mapalana, Kamburupitiya 81100
Sri Lanka.

Telephone +94 (0)41 229 2200
Fax +94 (0)41 229 2384
Website www.agri.ruh.ac.lk

ISSN: 1800-4830

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Oral Presentations

Measuring reproductive hormones in the serum of male and female Bengal tigers (*Panthera tigris tigris*)

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Abstract

Hormones tightly regulate animal reproduction. In Bengal tigers, several reproductive hormones are yet to be measured due to lack of optimized enzyme immunoassays (EIAs). The aim of the current study was to: (1) optimize an enzyme immunoassay for measuring concentrations of 5 α -dihydroprogesterone (5 α -DHP) in female Bengal tigers and compare its dynamics with the well-known female hormone, progesterone. (2) Optimize an enzyme immunoassay for measuring concentrations of insulin-like peptide 3 (INSL3) in male Bengal tigers and compare its dynamics with the well-known male hormone, testosterone. (3) Investigate the correlations between concentrations of 5 α -DHP and progesterone in female Bengal tigers, and concentrations of INSL3 and testosterone in male Bengal tigers. The blood samples were collected from three males (Miki, Kolla, Caprio) and two females (Leo and Nikini) kept at Ridiyagama Safari Park, through cephalic vein puncture. Hormone concentrations were measured using competitive EIAs. The detection ranges of the progesterone, 5 α -DHP, testosterone and INSL3 were 0.156 to 40 ng/mL, 0.098 to 100 ng/mL, 0.04 to 40 ng/mL and 0.31 to 80 ng/mL, respectively. The intra-assay coefficients of variations were 9.1% (n = 5) for progesterone and 14.5% for 5- α DHP (n = 3), 11.0% (n = 5) for testosterone and 7.6% for INSL3 (n = 5) EIAs. Serum progesterone and 5 α -DHP concentrations of tigresses ranged from 0.14 ng/mL to 13 ng/mL and 15.21 ng/mL to 77.62 ng/mL, respectively. There was a significant correlation between 5 α -DHP and progesterone (r =0.84; n = 15). Serum testosterone and INSL3 concentrations ranged from 0.162 ng/mL to 6.26 ng/mL and 0.43 ng/mL to 2.03 ng/mL respectively. There was no correlation between testosterone and INSL3. In conclusion, 5 α -DHP EIA was successfully optimized. The 5 α -DHP concentrations were markedly higher than progesterone concentrations in Bengal tigresses, and there was a strong positive correlation between 5 α -DHP and progesterone concentrations. The 5 α -DHP appears to be a better alternative for pregnancy diagnosis in Bengal tigresses. A novel EIA was optimized to measure INSL3 concentrations in male Bengal tigers. This study reports the first evidence of the quantification of 5 α -DHP and INSL3 in Bengal tigers.

Keywords: Bengal tiger, Enzyme immunoassay, INSL3, 5 α -DHP, progesterone, testosterone

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Evaluation of the Disease Control Potential of *Trichoderma* enriched Vermicompost in Managing Tomato Damping-off caused by *Rhizoctonia solani*

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Abstract

This study aims to evaluate the efficacy of vermicompost enriched with two different *Trichoderma* strains (KMM2, MM3) against *Rhizoctonia solani*, the causal agent of tomato damping-off disease under controlled conditions. The bioassay was conducted with untreated tomato (Var. Thilina) seeds at the germination stage by inoculating sterilized potting media with the pathogen followed by treating with vermicompost preparations (Treatment 1: vermicompost + KMM2, Treatment 2: vermicompost + MM3, Treatment 3: vermicompost + KMM2 + MM3, Treatment 4: only vermicompost). The experiments were conducted along with negative control (damping-off inoculated soil) and the positive control (Thiram fungicide) using completely randomized design. The performances of the treated and control seedlings were evaluated based on disease incidence percentage and plant growth parameters (plant height, number of leaves and root length). Results revealed that, all of the treatments suppressed the pathogen invasion significantly compared to the negative control, as evidenced by reduced disease incidence percentages and higher plant growth metrics. The actions of the positive control were emulated by MM3 enriched vermicompost and vermicompost itself by 14 and 28 days after sowing. MM3 enriched vermicompost outperforms the positive control while KMM2, KMM2 + MM3, and vermicompost only produced positive results but fell short of the positive control at 14 and 28 days after sowing. Based on the overall findings of this study, it is concluded that *Trichoderma* enriched vermicompost has a big potential to reduce damping-off disease incidence and increase the plant growth parameters while MM3 enriched vermicompost performed the best under the tested conditions.

Key words: enrichment, *Rhizoctonia solani*, *Trichoderma*, Tomatodamping-off, vermicompost,

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Chemical and Microbiological Properties of Ceylon Black Tea at the Pre-auction Stage in relation to Elevation, and Management.

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Abstract

Ceylon Black Tea (CBT) is a unique tea product made solely from tea leaves grown in Sri Lanka and crafted using traditional orthodox production methods. Sri Lanka ranks among the top five tea producing nations in 2022 and has the distinction of producing the world's first ozone-friendly tea. The purpose of this research is to examine the quality consistency of CBT during the pre-auction stage, assess the variation in quality parameters based on the ISO 3720 standard and microbiological quality parameters with respect to elevation, tea grade category, factory size, and broker. Additionally, this study aims to provide recommendations for reducing the rejection of CBT during the pre-auction stage due to quality issues. Primary data available at the Sri Lanka Tea Board for the period of 2018 to 2021 was used for the study. The collected data was subjected to a statistical analysis using Minitab software. The results revealed that there was a significant association between the rejection probability of CBT, with the elevation, tea grade category, management, and the broker, while no significant associations were observed between the rejection probabilities with the factory capacity. Moreover, the highest rejection percentage (81.58%) was recorded in teas from low elevation while high elevation showed the lowest (3.53%) rejection percentage. The rejection percentage observed in teas provided by private manufacturers was higher (42.14%) than that of regional plantation companies; mostly due to microbial contaminations. Off-grade teas from the orthodox production method showed a higher rejection percentage (68.61%), while Crush- Tear-Curl teas (CTC) showed a lower rejection percentage (5.44%). Failure of the chemical parameters was mostly due to the high crude fiber content, which can be eliminated by using quality green leaves. High number of failures at Yeast and Mold count test was the main cause of rejections in microbiological criteria, notably in CBT produced using orthodox methods at lower elevations. The reduction of handling steps and the maintenance of appropriate packing and storage conditions can eliminate it. To decrease the rejection rate of 41.9% overall, it is necessary to implement Good Manufacturing Practices (GMP), Hazard Analysis Critical Control Point (HACCP) certification for production facilities, and quality monitoring programs.

Keywords: Ceylon Black Tea, ISO 3720, Pre-auction stage

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Role of Social Media in Managing Product Harm Crises: Application of Social Influence Theory

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Abstract

Product harm crises are discrete well-publicized incidents where products are found to be defective or dangerous. Irrespective of many management strategies adopted by millions of companies, product harm crises are increasing at an accelerating rate throughout the world recently resulting negative impacts on both companies and consumers. Despite extensive discussions in existing literature on various aspects of this issue, the role of social media in managing product harm crises from the perspective of both companies and consumers in today's digitally interconnected world has not yet been adequately addressed. Therefore, the main objective of the study was to discuss the application of social influence theory to see the compatibility of company implemented and consumer expected response strategies to manage product harm crises. Primary data was collected using a purposive sampling technique through an online questionnaire. A fictitious crisis story featuring a victim and a preventable crisis involving a milk powder brand was included in the questionnaire, as Sri Lankan consumers had recently experienced a similar crisis. Data were analyzed by using Smart PLS (version. 4.0). As per the findings, social media emerged as the preferred secondary communication tool during crises for both companies (n=18) and young consumers (n=289). The positive effects of normative and informational social influence are apparent in crisis management. Both companies and consumers exhibit a preference for effective management of crises related to product harm, indicating compatibility between their perspectives. Both groups agreed that "Facebook" was the top social media platform, and that implementing superb effort and proactive strategies were the most effective ways to manage both crises. Both strategies; proactive and super effort increased the purchase intentions of the crisis brand with means values around 3.7 and 3.9 respectively. Study provides useful insights for companies particularly in managing victim and preventable crises while assuring the financial stability.

Keywords: *Preventable crisis, proactive strategy, social influence theory, victim crisis*

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Hydrological modeling for runoff and erosion estimation Kelani river basin using soil water assessment tool (SWAT)

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Abstract

Water flow and water quality of surface water bodies are changing all over the world as a result of climate change and anthropogenic activity, particularly in river basins. When the flow pattern of a river changes, the frequency of floods, the length and intensity of floods, and the flow of water for hydropower generation all fluctuate. Understanding flow variability and forecasting river flow requires reliable data sets, hence flow modeling using computer software is the most appropriate and cost-effective approach. Hydrological models are increasingly recognized as an important and crucial tool for managing water and environmental resources. In this regard, the Soil and Water Assessment Tool (SWAT) model was used for the Kelani river watershed to evaluate SWAT's ability to model continuous monthly stream flow in the Kelani river basin, to determine SWAT's applicability for Kelani River soil erosion estimation, and to perform a sensitivity analysis using SWAT-CUP. The SWAT Model works in tandem with Arc GIS. In the current study, the catchment area was defined using a DEM (Digital Elevation Model) and then divided into 25 sub-basins, which were then divided into 128 HRUs (Hydrological Response Units). The SWAT Calibration and Uncertainty Program's Sequential Uncertainty Fitting Algorithm (SUFI-2) was used to calibrate and validate the model sensitivity analysis (SWAT-CUP). The research period ranged from 1998 to 2019, with a three-year warm-up phase for model setup. The hydrologic and meteorological datasets for SWAT simulations were divided into two sub-datasets: one for SWAT calibration (2001–2013, Deraniyagala station), and the other for SWAT validation (2014–2019, Hanwella station). The model was successfully calibrated for observed streamflow data from Deraniyagala station using CN2.mgt, GWQMN.gw, REVAPMN.gw, SOL AWC(..)sol, ESCO.hru, OV N.hru, and GW DELAY.gw parameters that relate to stream flow and soil erosion. The model performance evaluation revealed that the acceptable value ranges for observations standard deviation ratio (RSR), Present Bias (PBIAS) and Coefficient of determination (R^2) for calibration were 0.64, 19.5 and 0.77, respectively while the values for wearers during the validation periods were 0.65, 17.9, and 0.78. These results reveal that SWAT performed well in evaluating SWAT's capacity to estimate continuous monthly stream flow in the Kelani river basin and determining SWAT's applicability for Kelani River soil erosion estimation. The largest annual average soil loss in Nuwara Eliya district was 564 t/ha/year, while the lowest annual average soil loss in Colombo district was 16.87 t/ha/year. The upper part of the watershed major susceptible to the soil erosion than the lower part. Future study on the Kelani watershed model should concentrate on water quality issues.

Keywords: Flood hazard, Hydrological modeling, Kelani river basin, Soil erosion risk

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Physico-functional and nutritional properties of banana flour and instant brownie mix developed from three different banana varieties

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Abstract

Banana (*Musa acuminata* L.) which is one of the significant sources of nutrients, growing abundantly in tropical and subtropical countries, and is consumed either in raw or processed form. Green banana flour is an excellent alternative to keep the nutritional value of fresh bananas while minimizing post-harvest losses. The present study aimed to evaluate the physico-functional, nutritional, and chemical properties of flour obtained from three different banana varieties (*Seeni* banana, *Ambul* banana, and Cavendish banana) and to assess the possibility of developing banana flour-based instant brownie mix. Physico-functional, nutritional and chemical properties of banana flour and instant brownie mixes from selected banana varieties were measured using standard methods. Green banana flours showed significant differences ($p < 0.05$) in colour parameters (CIEL*a*b*), swelling capacity, transparency, gelatinization temperature, pH, and titratable acidity, with no significant difference ($p > 0.05$) in bulk, and tapped densities, water and oil holding and foaming capacities. There was no significant difference ($p > 0.05$) in the amount of crude fiber among all three flour types, while *Seeni* banana flour showed a significant amount of carbohydrate ($88.65 \pm 0.39\%$) and polyphenols (31.41 ± 0.61 mg GAE/100 g of sample) and flavonoids (337.7 ± 31.11 mg quercetin equivalent/100 g of sample). Cavendish banana flour showed the highest antioxidant content (576 ± 0.028 mg of TE/g of the dried sample) compared to the other two varieties. Based on the physico-functional characteristics of instant brownie mixes made from three different banana varieties, *Ambul* banana instant brownie mix showed higher values for swelling capacity (10 ± 0.00 mL), tapped density (0.82 ± 0.02 g/mL), compressibility index (39.02 ± 1.05), Hausner ratio (1.64 ± 0.03), and oil absorption capacity ($237 \pm 1.41\%$). Overall acceptability for brownies made from instant brownie mix was awarded the highest score (50.23) for *Seeni* banana, followed by *Ambul* and Cavendish banana. Compared to the other brownie mixes, the *Seeni* banana mix was rich in crude fat, protein, fiber, and carbohydrate. The average shelf-life of banana instant brownie mix packed in high-density polyethylene packages and Kraft paper zip lock bags was around two to three months at ambient temperature. The obtained results confirmed that green banana flour is a good source of nutrients and can be effectively used in developing a gluten-free instant brownie mix.

Keywords: Antioxidant activity, banana flour, instant brownie mix, nutritional properties physico-functional properties,

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Carbon fractions in relation to physical characteristics of soil

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Abstract

Soil organic carbon (SOC) is the main constituent of soil organic matter and acts as the largest carbon pool under the global terrestrial systems. Stable and labile fractions of C represent different forms of SOC that have different potentials to be stable or recycled. Favorable conditions for the decomposition in soils determine the quantities of these C fractions. In general, soil physical characteristics can alter the conditions favorable for decomposition and affect the dynamics of stable and labile fractions of C. This study examines the stable and labile C fractions in relation to the physical characteristics of soils under different types of vegetation including four non-repellent forests, two repellent forests, and one wetland (seven sampling sites). The C contents were measured using Walkley black method (low levels of C) and the loss on ignition method (high levels of C). The stable and labile C fractions were differentiated using the physical size fractionation method. Bulk density, porosity, particle density, soil texture, aggregate stability, infiltration, sorptivity, unsaturated hydraulic conductivity, and degree and persistence of water repellency were measured as soil physical characteristics. In addition, pH and EC were also measured. All measurements were conducted in three replicates. Total C contents were higher in wetland soil (~14%), which showed higher labile C content (~9%) compared with stable fraction (~5%). All non-repellent forest soils did not show significant differences between stable and labile C fractions. Two repellent soils showed significantly higher stable C content. Bulk density showed a strong negative correlation ($R^2=0.86$ and 0.87 for stable and labile C), while porosity showed a strong positive correlation ($R^2=0.80$ and 0.89 for stable and labile C) with both stable and labile C fractions. Stable C as a percentage of total SOC showed a moderate positive correlation, whereas labile C as a percentage of total SOC showed a moderate negative correlation, with sand content. All C fractions did not show any relation with clay content, aggregate stability, and hydrophysical characteristics. Results revealed that bulk density, porosity, and sand in soils are closely related to the potential of SOC to be stable or recycled. Since the study is confined to low country wet and dry zones, further experiments would be required to confirm the results under the same vegetation types with different environmental conditions.

Key words: Labile carbon, physical characteristics, physical size fractionation of C, soil organic carbon, stable carbon,

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Mechanochemical synthesis of polymorphic urea-oxalic acid co-crystal as a sustained-release nitrogen source

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Abstract

Since urea is a rich source of nitrogen, it is commonly used to manufacture fertilizer. Our study focuses on developing urea-containing nanoparticles that may be used as nano fertilizers to distribute crop nutrients in a regulated manner. Because of their higher water solubility, rapid moisture absorption, and urea volatilization, they are less effective as nitrogen source. Co-crystallization is a long-lasting approach for modifying the undesirable characteristics of urea. The study aims were to create urea and oxalic acid co-crystals and analyze their structural properties. Both the stirring method and the solid-state grinding (dry) approach were used to produce the co-crystal of urea and oxalic acid. The co-crystal formation was confirmed by combining data from Fourier-transform infrared spectroscopy and powder x-ray diffraction (PXRD). PXRD patterns of co-crystals of urea and oxalic acid were examined for structural changes. The nitrogen release of the co-crystal forms was determined using FTIR spectroscopy. The data analysis demonstrates that the motor and pestle method we used to synthesis Form 3 (Urea: Oxalic Acid ratio 2:0.50) of the formation indicates a slower release of nitrogen than the other forms we manufactured.

Keywords: Co-crystal, FTIR, Nitrogen fertilizer, Oxalic acid, PXRD, Slow release, Urea

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Estimation of sugarcane leaf nitrogen using different vegetative indices by multispectral image analysis

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Abstract

Sugarcane demand has grown significantly in tandem with population increase. Sugarcane is the most important sucrose extracting crop in Sri Lanka for sugar production. Rising production costs are one of the issues in the Sri Lankan sugar industry that threaten its long-term survival. Farmers rely on obsolete technology and have little knowledge of new production techniques. The primary goal of this study was to assess the efficacy of various vegetative indices in estimating sugarcane leaf nitrogen and to select the most appropriate vegetative index for estimating sugarcane leaf nitrogen at the grand growth stage using high-resolution multispectral images captured by an unmanned aerial vehicle at two heights (35m and 50m) and sugarcane leaf nitrogen content. This study examined five vegetative indices: green normalized difference vegetation index (GNDVI), normalized difference vegetation index (NDVI), chlorophyll index - green (CIG), soil adjusted vegetation index (SAVI), and ratio vegetation index (RVI). In 128 sampling plots, ground-based destructive data of sugarcane leaf nitrogen content were measured using a modified Kjeldhal method. The collected samples' leaf N concentrations, as measured by the lab, ranged from 1.00% to 2.35%. Ortho-mosaicked images were also used to create multispectral-based vegetation indices. From simple linear regression analysis, the relationship between the vegetation indices and leaf N content was discovered. The results showed that CIG ($R^2 = .80$) at 35 m and CIG ($R^2 = .68$) at 50 m. According to the findings, 35 m was the best height. The results showed that 35m was the best height and that CIG were the best vegetation indicators.

Keywords: Leaf Nitrogen Content, Multispectral, Sugarcane, UAV, Vegetation Indices

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Resource use conflicts and Stakeholders' perspectives on marine spatial planning in Weligama Bay

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Abstract

Marine spatial planning (MSP) aims to efficiently address conflicts among stakeholders by coordinating human activities in marine environments to achieve ecological, economic, and social objectives for sustainable long-term development. Weligama Bay, located on the south coast of Sri Lanka, is a popular tourist destination that encompasses a coastal zone where industries such as tourism, fishing, aquaculture, fish trading, and boat anchoring are interconnected. This study focuses on identifying resource use conflicts in Weligama Bay and stakeholders' perspectives on MSP. The data was gathered by conducting a questionnaire survey (40) and participatory mapping with key Weligama Bay stakeholders. The data were analyzed descriptively, and Arc-GIS was used to map conflict hotspots. The results find that conflicts between fishermen themselves over the same deep-sea fish stock, as well as those between surfers themselves, particularly between local and foreign surfers, and between hotels themselves. There are various conflicts between different resource users in the area, including those between hotels and fishermen, and between marine fishers and surfers, with regards to the utilization of the beach. The primary sources of conflicts between users and the environment include the use of illegal fishing methods, the disposal of damaged boat fibers, nets, and other materials, as well as improper waste dumping activities. The findings of participatory mapping explore several conflict hotspots in Weligama Bay. The majority of the stakeholders have a positive perception of marine spatial planning as a conflict resolution tool. They believe that MSP could manage ocean resources responsibly while resolving conflicts and enhancing economic growth. Results find that accurate and informed MSP is challenging as stakeholders have various objectives and priorities. However, they have identified that the marine and fisheries industry needs the highest priority in Weligama Bay. This study suggests that diverse parties, including businesses, the government, environmental protection, and recreation, should collaborate to make decisions on how to divide up space among competing economic activities while conserving marine environments.

Key words: Conflicts, Marine Spatial Planning, Resources, Stakeholders

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Impact of USD Exchange Rate Increment on Wildlife Tourism in Hurulu Eco Park, Sri Lanka: Application of Transaction Cost Theory

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Abstract

Hurulu Eco Park is an elephant paradise based in *Hurulu* Conservation Forest – *Habarana*, North Central province in Sri Lanka where, the seasonal movement patterns of elephants can be seen throughout the year. As *Habarana* acts as a tourism hub, it has the potential to attract more tourists and make *Hurulu* Eco Park as one of the best destinations for wildlife tourism. Efficient management of costs in any type of transaction is critical, and the Transaction Cost theory provides a useful framework for achieving this goal. In the case of wildlife tourism, the demand and transaction costs are especially susceptible to economic crises and the rise in USD exchange rates in Sri Lanka. The study aimed to explore how stakeholders involved in wildlife tourism in *Habarana* perceive the impact of the increased USD exchange rate, examine the changes in transaction costs experienced in the sector as a result, and identify effective strategies for reducing and managing transaction costs. All the stakeholders, who have directly engaged in transactions in *Hurulu* Eco Park, were considered as the target population of the study. Selected stakeholders were interviewed for collecting primary data, and snowball-sampling technique was also used to select samples. This study examines transaction costs between 2018 and 2022 under various USD exchange rates in Sri Lanka. The findings showed that transaction costs have had both positive and negative effects with increasing USD exchange rates. Tour guides have seen a considerable success, and hotel owners and safari drivers have seen an increase in expenditures. The situation has also had an impact on the number of foreign tourists' arrivals and their transaction costs. The increment of the exchange rate is a stimulation factor for the increment of foreign tourist arrival rate but there should be other infrastructure factors to continue the arrival rate properly. In addition, the increment of USD exchange rates causes for the increment of transaction costs in the wildlife tourism sector while some stakeholders have a pleasant profits. The three key recommendations to keep transaction costs to a minimum are retain the transaction channels with few intermediaries, build more online transaction platforms, and collaborate with international and private parties to maintain the wildlife tourism sector effectively under any economic situation.

Key Words: Foreign Tourists Arrivals, Transaction Cost, Wildlife Tourism, USD Exchange Rate

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Poster Presentations

Occurrence of gut acanthocephalans in Frigate tuna (*Auxisthazard*) and Mackerel tuna (*Euthynnusaffinis*)

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Abstract

Understanding the occurrence of parasites is important in marine food fish trade. This study focused on the identification of gut acanthocephalans in Frigate tuna (*Auxisthazard*) and Mackerel tuna (*Euthynnusaffinis*) with a comparative analysis of their occurrence in the two species of fish. Fifty specimens from each fish species were purchased from a retail store in Kandy, Sri Lanka, from June to September 2022. The fish were dissected and inspected for gut helminths. Recovered gut helminths were washed and microscopic morphometry of the head and other organs was carried out for identification. The occurrence of parasites in the two fish species were statistically analyzed using the Chi-square test. The microscopic examinations revealed that two different acanthocephalan genera, namely *Rhadinorhynchus* and *Neorhadinorhynchus*, Juveniles of genus *Rhadinorhynchus* (Frigate tuna: 205 ± 0.84 , Mackerel tuna: 485 ± 1.47) and genus *Neorhadinorhynchus* (Frigate tuna: 61 ± 0.91 , Mackerel tuna: 28 ± 2.2) were recovered from the gut. The prevalence of *Rhadinorhynchus* was 82% and 74% in mackerel tuna and frigate tuna, respectively, whereas that of *Neorhadinorhynchus* was 4% and 20%, respectively. While the prevalence of *Neorhadinorhynchus* was lower in mackerel tuna compared to frigate tuna ($p < 0.05$), the co-occurrence of both parasitic genera in mackerel tuna was also low ($p < 0.05$). The parasite abundance for *Rhadinorhynchus* were 9.7 and 4.1, and 0.56 and 1.22 for *Neorhadinorhynchus*, in mackerel and frigate tuna, respectively. The present study marks the first attempt to explore acanthocephalans in Sri Lankan marine food fish.

Keywords: Acanthocephalans, frigate tuna, mackerel tuna, *Neorhadinorhynchus*, *Rhadinorhynchus*

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Effect of *Salvinia (Salvinia molesta)* as a litter material on growth performance, behavior and welfare of broiler chicken

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Abstract

Paddy husk (PH) is becoming less available as a litter material for poultry production since it is competitively demanded by a number of other sectors. *Salvinia (Salvinia molesta)*, free floating tropical aquatic plant has become an environmental and social issue in some parts of the world, including Sri Lanka. With the objective of determining the suitability of *salvinia (SAL)* as an alternative litter material, present study compared the growth performance, welfare parameters, behaviour and meat organoleptic properties of broilers that raised either on PH or SAL. Giving a completely randomized design experiment, 240 broilers were raised in 12 floor pens (25ft²/pen), each provided either PH or air-dried SAL plants as the litter material, from day 11 to 36. Scan sampling method, assisted by an ethogram was used to determine the behavior of birds. A scoring system was used to determine the welfare indicators such as plumage cleanliness, breast blisters, footpad dermatitis and hock burn damage. Sensory evaluation was conducted on breast meat samples for colour, aroma, flavour, texture and overall acceptability. Growth performance parameters were statistically analyzed using t-test while Mann-Whitney U test was used to compare behavioural, welfare and meat organoleptic parameters. Live Weight on day 36 (2034±31g), weight gain (1729.9 ± 31.2g), feed intake (2676.5 ± 13.0g) and feed conversion ratio (1.56 ± 0.02) of broilers raised on SAL were not statistically different from those raised on PH (2046.5 ± 33.4g, 1733.7 ± 32.2g, 2686.7 ± 17.5g and 1.58 ± 0.03). None of the welfare scores or meat organoleptic properties was significantly affected by the type of litter material. However, percentage of birds engaged in eating and wing flapping were significantly higher on PH compared to SAL. The study concluded that SAL can be utilized as an alternate litter material for broilers.

Keywords: behaviour, litter, performance, poultry, *salvinia*, welfare

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Morphological, Physiological and Molecular Characterization of 35s: *VlmybA2* Butterfly pea *Clitoria ternatea* (Katarolu)

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Abstract

Butterfly pea *Clitoria ternatea* (Katarolu in Sinhala) is a native multi-purpose legume used for flowers, therapeutics, bio pesticide, fodder and mulch. Genetic improvement of *Clitoria ternatea* is important for efficient utilization of the plant for flower colour and other uses. However, a well-established transformation protocol for *Clitoria ternatea* is not available. The objective of this experiment was to determine an efficient transformation method for *Clitoria ternatea* using 35s: *VlmybA2* gene of anthocyanin biosynthesis pathway. Three transformation methods were tested including seedlings, leaf explants and floral dip using *Agrobacterium* harbouring 35s: *VlmybA2* gene. Experiments were laid in a completely randomized design. Selected morphological and physiological characters were measured in the resulted plants. Purple pigmentation was recorded in leaf explants, flower buds and seedlings under *in vitro* condition. However, leaf explants used for callus regeneration on MS medium with 0.5mg/L BAP and 1mg/L 2,4-D, was not successful and flower buds of floral dip could not develop into pods. The putatively transformed seedlings under greenhouse condition were not pigmented while being significantly different in plant height (10.33 ± 1.61 cm), leaf length and width (13.32 ± 0.37 and 9.51 ± 0.28 cm), Number of leaflets per leaf (7.16 ± 0.16) and flower length and width (3.95 ± 0.34 and 3.63 ± 0.31 cm) in contrast to those of wild type (23.7 ± 1.21 cm, 14.34 ± 0.33 and 9.76 ± 0.38 cm, 5.6 ± 0.27 , 4.92 ± 0.07 cm and 4.20 ± 0.08 cm, respectively). Stomatal conductance, chlorophyll fluorescence and efficiency of photosystem II were not affected in transformed plants. PCR amplification of *VlmybA2* gene proved the transgene transfer in seedling transformation. Above results indicated that seedling transformation is a candidate method for efficient transformation of *Clitoria ternatea*, which should be confirmed through repeated experiments.

Keywords: *Agrobacterium*, *Clitoria ternatea*, seedling transformation, *VlmybA2*

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Determination of the optimum time period from emasculation to pollination of *Platycodon grandiflorus* in hybrid seed production

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Abstract

Platycodon grandiflorus, known as bell flower or balloon flower which belongs to the genus *Platycodon* L. in the family Campanulaceae is a hardy herbaceous perennial plant that is usually grown from seeds. It is a highly valuable plant in medicine, food industry, floriculture and landscaping. At present, there is a great export demand for *Platycodon* hybrid seeds especially in the countries such as Japan, China and Korea. F1 hybrid seeds are produced in industrial level under tropical greenhouse conditions in Sri Lanka. The major issue faced by commercial level floricultural export producers is, reduction of final yield of *Platycodon* hybrid seed production due to incorrect identification of the most effective receptive stage of the flower for cross pollination. The main objective of the study was to identify the most effective receptive stage for cross pollination in order to increase the production and to reduce the labor cost for cross pollination. Male and female *Platycodon grandiflorus* parental line plants were grown separately and after six months of transplanting, cross pollination was started among two parental lines. The time period between emasculation to pollination was considered as the treatments. Artificial cross pollination was done by hand. Accordingly three, four, five, six and seven days after emasculation were considered as the five treatments. Experiment was conducted according to a CRD with ten replicates. Matured pods were harvested 45 days after pollination, and finally seed processing was done. Parametric data analysis was done using SPSS software. The pollination success percentage, wet weight per pod, average pod size, net weight percentage and dry weight of seeds of 5 to 7 days pollinated plants were significantly higher than 3 to 4 days pollinated plants. Therefore, the flower receptivity of the stigma become most effective from 5 to 7 days after emasculation and it is considered as the optimum time period for cross pollination.

Keywords: cross pollination, flower receptivity, hybrid seeds, *Platycodon grandiflorus*, stigma

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Decomposing of different organic waste materials using black soldier fly larvae (*Hermetia illucens*) as a bioconversion agent

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Abstract

In the fields of waste management and environmental preservation, the management of solid waste is becoming a critical concern. Landfills or incinerators are typically used to dispose of solid waste. Composting has emerged as a promising substitute that may be used to minimize waste and turn it into valuable goods as traditional techniques confront significant difficulties. The present study was conducted to study the decomposing ability of different organic waste materials using Black Soldier Fly Larvae (BSFL). The experiment was setup according to the completely randomized design with three replicates and conducted at the Faculty of Agriculture, University of Ruhuna. Seven different organic waste materials including soybean meal, coconut scraping, cow dung, rabbit droppings, vegetable and fruit wastes, mixtures of 50% poultry litter + 50% rice bran and 50% goat manure + 50% rice bran. The live biomass of BSFL, physicochemical properties and qualitative parameters of the end substrate were measured four weeks after establishment. The results revealed that the live biomass of larvae, weight of end substrate harvested and decomposition percentage were significantly different between treatments. The pH, Electrical Conductivity, Total Dissolved Solid and Salinity of the aqueous solution prepared from the end substrate were significantly different between the treatments. Furthermore, a significant difference was found in color and texture of the end substrate of different treatments. However, the smell of the end substrate was not significantly different between treatments. The highest live biomass of larvae was reported when feeding them on coconut scraping. Rabbit droppings and the mixture of 50% goat manure + 50 % rice bran are decomposed by BSFL more efficiently. Therefore, BSFL could be used as a useful species for solid waste management as they have given a great rate of waste reduction.

Keywords: Black soldier fly larvae, decomposition, waste management

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Effect of biofilm bio fertilizer as an ameliorant to rhizobium-legume symbiosis using bean (*Phaseolus vulgaris* L.) as the test plant

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ABSTRACT

Rhizobium species have been effectively utilized as biofertilizers worldwide, with the aim of establishing nitrogen-fixing symbiotic associations in leguminous crops. Multiple microbial species, attached to each other forming biofilms are used as bio fertilizers, termed biofilm bio fertilizers (BFBFs). A study was conducted to evaluate the effect of BFBFs as an ameliorant to rhizobium-legume symbiosis using bean (*Phaseolus vulgaris* L.) as the test plant in a farmer's field in Padiyapelella, Nuwaraeliya district of Sri Lanka, during Yala season 2022. The experiment comprised five treatments, namely: Department of Agriculture (DOA) recommended chemical fertilizer for beans (CF), Rhizobium biofertilizer (Rh), Biofilm biofertilizer (BFBF), a combined application of Rh and BFBF (Rh+BFBF) developed by the National Institute of Fundamental Studies, and a control group with no fertilizers (C). Treatments were employed in 12m² plots with a randomized complete block design. Data on shoot and root fresh and dry weights, number and weight of nodules/plant at the flowering stage, and number of pods/plant, weight of pods/plant along with soil pH and moisture at both stages were collected. According to the results, significantly higher shoot dry weight (175g), root dry weight (2.69g), nodule number/plant (278), and nodule dry weight/plant (0.744g) were observed in the Rh +BFBF treatment ($p < 0.05$). There were no significant differences between Rh and Rh+BFBF treatments in terms of the root dry weight and nodule dry weight. Furthermore, significantly higher number of pods/plant (257) and weight of pods/plant (2145g) at two harvesting cycles were observed in the Rh +BFBF treatment. In conclusion, the combination of Rhizobium and Biofilm biofertilizers can be viewed as an innovative biofertilizer formula for legume cultivation. Nevertheless, additional research under diverse field conditions is necessary to assess the effectiveness of this biofertilizer practice for various legumes in different soil and climatic conditions.

Keywords: Bean, Biofilm bio fertilizer, Crop yield, Rhizobium

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Performance evaluation of newly design solar dryer model for cinnamon drying

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Abstract

One of the most significant spices for the export sector is cinnamon. Inadequate drying of the cinnamon quills can result in microbial and insect infestation on the quills, which lowers the quality of the finished product. The goal of this study was to identify the ideal dryer settings. The quills were processed and dried using various temperatures (30°C, 40°C, 50°C, 60°C, 70°C, 80°C) and drying techniques (solar, oven, shade) until they reached a moisture content of 14%. The experiment involved six treatments utilizing different drying techniques, which were carried out in triplicate. The quality parameters (oil percentage, water activity, quill color, and time needed to reach 14% moisture content) were compared. Quality parameters were measured both before and after the treatments were applied. Comparing the quality of cinnamon quills under solar dryer and shade drying conditions, only color L* showed significant differences. The cinnamon quills dried at 30°C in a solar dryer yielded the highest L* value, while the lowest L* value was observed in the quills dried under shade. Comparing the quality of quills dried under oven and shade drying, significant differences were observed in color L* and water activity among the treatments. Oven drying at 80°C resulted in significantly higher L* value and significantly lower water activity compared to other treatments. Solar drying at 50°C was more effective than shade drying for drying cinnamon because it took a shorter time period (10 hours) to achieve the desired moisture content. When comparing the sun dryer and sterilized oven, the sterilized oven had to raise its temperature to 70°C in order to capture the quality characteristics of quills at 50°C in the solar dryer. Improvement of yellow color is occurred drying at constant, low temperature. But in shade drying, temperature was varied time to time and the yellow color of cinnamon quills was reduced. All of the treatments contained more than 1% oil. All of the water activity levels were less than 0.750, indicating that no microbes, including yeast and mold, could develop. The results suggest that a solar drying method within the temperature range of 30°C to 50°C can be used for drying cinnamon quills.

Keywords: Color, oven dryer, oil content, shade drying, solar dryer, water activity

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Design and fabrication of mechanical paddy weeder

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Abstract

Weeding is one of the most challenging tasks in an agricultural field, especially in humid tropical settings. Weeds are a serious issue in Sri Lankan agriculture owing to a lack of appropriate technologies. Existing commercial power weeding machines on the market do not provide the precise operation required in Sri Lankan rice farming. Farmers are discouraged from using high-yielding row planting or row seeding methods due to issues with existing weeding machines such as low efficiency, difficulty in handling, a higher percentage of missing points in weeding, and an increased damaging percentage of paddy plants due to inconsistent drum spacing. Therefore, the design and construction of a mechanical paddy weeder to be compatible with paddy agriculture in Sri Lanka was the major emphasis of this research. The paddy power weeder was developed for the purpose of weeding without harming plants. It consists of two cage wheels with blades positioned in the shape of fingers that are connected to a gear box via a common shaft. A gasoline engine of 1.6 HP powered the shaft. Through the power transmission shaft, the engine's produced power was transferred to the gearbox. The machine moves ahead while being weeded at the same time as the cage wheels rotate. The field performance evaluation of machine was conducted in Farm Mechanization Research Center (FMRC), at Mahailuppallama. The results of the study showed that the theoretical field capacity, effective field capacity, and field efficiency of the machine were 0.0679 ha/h, 0.057 ha/h, and 83%, respectively. The machine's speed was 0.539 m/s. The average weeding efficiency of the machine was found to be 60%, and the fuel consumption was 0.8 L/h (equivalent to 10.4 L/ha). The estimated operation cost was Rs. 9035/ha.

Keywords: Manual, mechanization, paddy weeder, weeding

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Physico-chemical, nutritional, functional and sensory properties of coconut oil extracted using different extraction methods

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ABSTRACT

Coconut oil (CO) is a product obtained from fresh and mature kernel of the coconut by mechanical or natural means with or without the application of heat. The quality of CO determines its physico-chemical, functional, nutritional and sensory properties. Different methods are being identified as low cost affordable methods for coconut oil extraction at small scale or home scale. This study was aimed to compare the properties of coconut oil extracted using three different extraction methods namely, dry extraction of CO from copra using an expeller machine (EX), traditional extraction (TE), and cold extraction methods (CE). The CO extracted using these methods were quantitatively and qualitatively compared with a commercially available coconut oil sample (CCO). Physico-chemical, nutritional and sensory properties of the oil samples were examined using standard methods. According to the obtained results, physical properties of CO were found to be significantly different according to the extraction methods. The highest yield ($62.58 \pm 4.35\%$), oil recovery percentage (236.27%) and smoke point ($175 \pm 0^\circ\text{C}$) values were showed by the EX method and oil extracted from CE method showed the highest relative density (0.95 ± 0.01) value. There was no any significant difference among the pH, moisture and saponification values for the oil extracted from different methods. The highest acid value (0.68 ± 0.06) was shown by TE method while the highest peroxide value (5.82 ± 1.62) was shown in EX method. Lauric acid was the most prominent fatty acid in all coconut oil samples, while the TE method showed the highest Lauric acid content (51.28 ± 0.01). Oil extracted from TE method showed the highest total phenolic content (480.56 ± 47.43 mg gallic acid equivalent per gram) and the highest total antioxidant content (1651.2 ± 16.97 mg Trolox equivalent per gram of sample) while CCO gave the highest total flavonoid content (2192.00 ± 318.20 mg of quercetin equivalent per 100 mL of the sample). According to the sensory evaluation results, the method of oil extraction did not affect to the sensory qualities of the fried product. However, the smell and the transparency of the raw coconut oil were affected by the extraction method. Overall, it can be concluded that the method of oil extraction effects on the quality of physio-chemical, nutritional and functional properties of coconut oil.

Key words-: coconut oil, coconut oil extraction methods, functional properties, nutritional properties, physio-chemical properties

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Development of a Jackfruit bar (*Artocarpus heterophyllus*) and Evaluation of its Physicochemical and Sensory Qualities

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Abstract

Jackfruit (*Artocarpus heterophyllus* L.), which is one of the staple foods in Sri Lanka, is rich in nutrient contents and has many health benefits. Due to the present economic crisis, busy lifestyle, and less awareness of producing value-added foods from locally grown food in Sri Lanka, it is necessary to focus on introducing functional and innovative Ready-to-eat (RTE) food products using jackfruit. This study was carried out to develop an RTE nutritious jackfruit bar from dehydrated jackfruit pulp incorporated with other functional ingredients (Green gram, Groundnut, and Sesame). The jackfruit pulp was processed by following direct Oven drying, blanched and Oven drying or direct baking, and mixed with other functional ingredients following five different mixing ratios: 40:60, 45:55, 50:50, 55:45, and 60:40 (w/w), respectively. The product formulation was followed by the best processing method and the best mixing ratio, which were determined by evaluating the product's sensory attributes with 30-member panel using a 7-point hedonic scale. The study aimed to determine the shelf-life of jackfruit bars under different storage conditions and packaging materials. Two different combinations of three packaging materials (oil paper, high-density polyethylene (HDPE), and triple laminated aluminate) were used, and the bars were stored under refrigerated and ambient temperature conditions. The shelf-life was determined by measuring free fatty acid (FFA), peroxide value (PV), and total plate count value (TPC). The jackfruit bar made from direct oven-dried jackfruit pulp and other functional ingredients with a ratio of 50:50 was found as the best mixing ratio, which the panelists mostly preferred to possess better quality with respect to taste, smell, texture and overall acceptability. Obtained proximate data showed that the developed jackfruit bar contains $20.19 \pm 0.31\%$ crude protein, $6.07 \pm 0.25\%$ crude fiber, $1.48 \pm 0.30\%$ minerals, $13.74 \pm 0.93\%$ crude fat and $47.2 \pm 1.11\%$ carbohydrates, respectively. Moreover, the product's caloric value was 393.2 kcal/100g. In evaluating shelf-life stability, based on FFA, PV and the TPC value, the product wrapped in oil paper, high-density polyethylene (HDPE), and triple laminated aluminate could be stored for more than six weeks under refrigerated conditions without adding any preservatives. The developed jackfruit bar, rich in essential nutrients, would be ideal for teenagers, and further investigations will be undertaken to make product improvements.

Keywords: Drying, jackfruit, proximate, sensory evaluation, shelf-life

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The effect of water treatment plant sludge-bound compost pellets on growth and yield performance of radish (*Raphanus sativus* L.)

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Abstract

Most of the issues that arise with loose compost can be minimized with pelleted compost. Molasses, starch, paper waste, bee wax, clay, water, and sawdust have been used previously as binding agents in pelletizing compost. Water treatment plant sludge (WTPS) is a potential compost pellet binding agent and contains clay, organic matter, nutrients and, induces a liming effect. It is important to explore the possibility of WTPS as a compost binding agent and its effects on crop growth. This study focused on characterizing the different compost pellets and to determine the comparative effect of the compost pellets on the growth and yield performance of *Raphanus sativus* L. under the Department of Agriculture (DoA) recommended fertilizer application schedule. The experiment was set up as a pot experiment according to Completely Randomized Design with six treatments (T1: ordinary compost, T2: commercial compost pellet (100% compost), T3: commercial integrated pellet (90% compost + 10% inorganic NPK-fertilizer), T4: WTPS-bound compost pellet (90% compost + 10% WTPS), T5: WTPS-bound integrated pellet (80% compost + 10% WTPS + 10% inorganic NPK-fertilizer), and T6 (control): inorganic NPK-fertilizer recommendation by the DoA) in five replicates. Pellets were incorporated with soil as 1.5% w/w. Shoot fresh weight (SFW), root fresh weight (RFW), root length (RL), root diameter (RD), root volume (RV), number of leaves (LN) and total leaf area (LA) were measured at 45 days after seed sowing. According to the characterization results, the T4 treatments showed the highest cation exchange capacity while T5 showed the highest pellet length and stability. In the pot experiment, significantly higher ($p < 0.05$) SFW and LA were obtained from T3 (SFW: $63.19 \text{ g} \pm 3.46$ and LA: $1397.10 \text{ cm}^2 \pm 171.64$) and T5 (SFW: $49.24 \text{ g} \pm 7.17$ and LA: $1243.83 \text{ cm}^2 \pm 161.83$) treatments compared to the T6. Significantly higher ($p < 0.05$) RFW ($77.06 \text{ g} \pm 18.08$) and RV ($75.90 \text{ cm}^3 \pm 19.98$) were shown by the T3 compared to the T6. Comparison of the T2 and T3 group vs. T4 and T5 group did not show any significant difference for any response variables except SFW. The use of commercial integrated pellet and WTPS-bound integrated pellet showed higher growth and yield performance than the DoA recommendation for radish. WTPS can be utilized as a binding agent in pelletizing compost along with inorganic fertilizer integration for radish cultivation. Further experiments are required to investigate the long-term effects of WTPS-bound pellets on crop varieties.

Keywords: Compost pellets, inorganic fertilizer, integrated pellet, WTPS

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Performance evaluation of wetland based vertical-flow-filter with ornamental plants to treat domestic wastewater for home garden irrigation from synthetic wastewater

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Abstract

Domestic water consumption has had a major impact on water resources. This effluent from domestic discharge causes huge environmental damages. Constructed wetlands begin to popular due to its low construction cost, simple operation and aesthetic value. When considering the performance efficiency constructed wetlands are more suitable for wastewater treatment in tropical than in temperate regions. Use of ornamental flowering plants as vegetation cover is a good solution for domestic installations. The objective of this study was to investigate the efficacy of *Canna indica* and *Crinum bulbispermum* in removing pollutants from domestic wastewater at three different hydraulic retention times. Vertical flow filters with sand and gravel as filter media were used in an experimental setup with a height of 0.45 m and a diameter of 0.398 m. The study aimed to determine whether these two plants can effectively treat domestic wastewater. Synthetic wastewater was used as the influent. According to the results, treated water from both plants suitable for the home garden irrigation. 48 hours hydraulic retention time showed that the optimal removal of pollutants in both plant species. There was a significant effect on vegetation cover for BOD₅, TDS, TSS, NO₃ -N, NH₄ -N removal and there was no significant effect for pH and EC removal. The removal efficiencies of pH, EC, BOD₅, TDS, TSS, NO₃ -N, NH₄ -N for *Canna indica* were 10.7±0.7 %, 76.1±1 %, 63.52±1.1 %, 79.37±0.1 %, 93.4±0.1 %, 65.96±0.1 %, 52.3±0.3 % and for *Crinum bulbispermum* were 9.4±0.7 %, 74.769±0.4 %, 60.0±2.0 %, 79.06±0.1 %, 92.95±0.2 %, 64.63±0.05 %, 45.84±0.3 %, respectively at 48 hours of retention time. There were no significant differences between the two ornamental plants in terms of pH and EC removal. However, *Canna indica* showed higher removal efficiencies for BOD₅, TDS, TSS, NO₃-N, and NH₄-N. These results suggest that a retention time of 48 hours with *Canna indica* as the plant species can provide optimal conditions for pollutant removal.

Keywords: Constructed wetland, hydraulic retention time, phytoremediation, synthetic wastewater, wastewater treatment

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Experimental Investigation on the Manufacture of Pavement Blocks using Industrial Chemical Sludge

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Abstract

Sludge is one of the most significant byproducts of wastewater treatment plants. Chemical and heavy metal concentrations are high in chemical sludge produced by industrial processes. As a result, sludge disposal is a severe problem with several environmental implications. Furthermore, sludge treatment/disposal accounts for 50% of a wastewater treatment plant's capital and operating expenditures. This research examined at the feasibility of employing chemical waste from industrial applications as a partial replacement for cement in the production of cement paving blocks. Cement paving blocks of the non-traffic strength class (Grade 15) were made by partially substituting cement with 0% (control), 10%, 15%, 20%, 25%, and 30% industrial chemical waste. The sludge cement mortar's consistency, beginning and final setting times, and consistency complied with industry standards. The pavement blocks' compressive and flexural strengths were found to be 16.12 N/mm² and 15.52 N/mm² and 3442.25 N and 2353.12 N, respectively, with cement replacement levels of 10% and 15%. There was a considerable improvement in the compressive strength and flexural strength of the pavement blocks when the water content of the mortar paste was decreased from 25% to 15%. The pavement block that had 10% more cement than the control showed a difference in water absorption and drying shrinkage of 0.06% and 0.008 mm, respectively. According to the findings, it is possible to make pavement blocks with a 10% sludge substitution of cement.

Keywords: Alternative Materials, cement pavement blocks, cement replacement, chemical sludge, recycling

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Sensitivity analysis of cultivar trait parameters in agricultural production systems simulator (APSIMx) sugarcane model: reference to the production environment in Higurana, Sri Lanka

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Abstract

Sugarcane is an economically important crop across the world since it is a major source of sugar, bio-ethanol, and biomass. Although Sri Lanka is currently emphasizing on expanding sugarcane production, the implementation of process-based crop models is vital in determining management options for coping with the temporal and spatial variability of sugarcane yield. Cultivar parameterization is critical when implementing such a model in order to provide accurate model predictions. Sensitivity analysis (SA) can be used to solve the problem because measuring a lot of parameters is practically challenging. However, SA of process-based crop models is frequently a costly task. In order to determine how sensitive cane dry weight (CDW) and biomass weight (BM) were to trait parameters implemented in the Agricultural Productions System Simulator (APSIMx)-Sugarcane model under particular environmental and management conditions in Hingurana, Sri Lanka, we conducted a global sensitivity analysis based on Gaussian process emulation. A 37-year simulation was conducted with three different soil types and under rainfed and irrigated conditions. The most sensitive parameters on CDW and BM were found to be *radiation use efficiency* (RUE), *green leaf no* (GLN), *transpiration efficiency coefficient* (TEC), *thermal time from emergence to beginning of cane*(EB), and *cane fraction*(CF). Together, these variables accounted for more than 90% of the variation in CDW and BM. The results also demonstrated how sensitive parameters can be used to measure the impact of water stress on sugarcane yield. RUE and TEC were found to be sensitive and needed to be assessed before parameterizing APSIM-Sugarcane for a new cultivar, even though they were not included as cultivar parameters in the model. To address the temporal and spatial variability of sugarcane output in Hingurana, Sri Lanka, our results can be used to improve modeling accuracy and efficiency as well as to determine the most successful management practices. In order to accurately represent new kinds in model simulations, the results of this analysis could be utilized to influence the calibration of the APSIM model.

Keywords: APSIM, gaussian process emulation, global sensitivity analysis, sugarcane

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Potentials and prospects of Industrial Hemp (*Cannabis sativa* L.) in Sri Lanka

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Abstract

The global industrial hemp market is a rapidly growing market and it mainly consists of nine sub-markets: agriculture, apparel, food and drink, automotive, furniture, recycling, paper, construction and personal care. Despite being an indigenous plant, Sri Lanka has yet to fully acknowledge the immense potential of industrial hemp. Therefore, this study attempts to explore the potential and opportunities for the Industrial hemp industry in Sri Lanka. SWOT (strengths, weaknesses, opportunities and threats), PESTLE (political, economic, social, technical, legal and environmental) and TOWS (threats, opportunities, weaknesses, strengths) matrix have been used as research methodologies. Primary data were collected through focus group discussions and interviews with stakeholders such as traditional cannabis growers (10), Ayurvedic practitioners (10), manufacturers (03), academics (03) and government officials (05). They were selected purposively. The findings indicate that Sri Lanka has the potential to develop the hemp industry. One of the main strengths is that unique knowledge and skills to produce hemp-based medications using indigenous and ayurvedic medicinal systems. The most significant barriers are the illegal nature of hemp, religious and cultural norms and values, and cannabis-related drug abuse. Modern manufacturing technologies and opportunities opened up by social media, online marketing platforms are one of the opportunities available to the hemp industry. Research and development is still lacking in this industry and this is one of the major weaknesses to be overcome. The PESTLE analysis stressed the importance of political support and potential economic gains. TOWS matrix describes the various strategies to maximize the opportunities and minimize the threats. Proponents of traditional production methods highlight the advantages of minimizing pest and disease damage, as well as the favorable climatic conditions for hemp cultivation. To establish a thriving hemp industry in Sri Lanka, it is crucial to develop comprehensive long-term plans, accompanied by a well-structured legal framework and a regulatory body.

Keywords- Industrial hemp, PESTLE analysis, Sri Lanka, SWOT analysis, TOWS matrix

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Information and Technology Dissemination Process of Tank Cascade System: A Study of Muthukandiya Tank

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Abstract

The formation of an ancient small tank system was mainly recognized as a “chain of tanks” and identified as a “Tank Cascade System” in Sri Lanka. This viable system is considered as an Internationally Consequential Agricultural Heritage System. The viability of the tank cascade system essentially depends on the information, knowledge, and technology flow emulated by the community around the cascade. The survey was conducted to analyze the information and technology dissemination process of the tank cascade system. The survey was conducted in the *Muthukandiya* area, *Monaragala* district, Uva province in Sri Lanka. A questionnaire survey was conducted using randomly selected 120 farmers representing six farmer organizations. Data were analyzed using basic descriptive statistical tools and social network analytical tools. The viability of the small tank cascade system depended on the most supportive actors in the community mainly extension officers, colleagues, institutes and organizations of farmers, and private organizations as well as their own experience and diversity of the social network for each farmer organization. The overall network density was 55.4% implying the possible enhancement of knowledge sharing among the actors to maintain the tank viability and agricultural productivity. The majority of the respondents (84.17%) used market information, technologies, and knowledge (74.17%) through the social network. It has a considerable impact on timeliness cultivation (81.67%); depletion of bio, agro and wild biodiversity (67.50%); decrease ecosystem services benefits (92.50%); and, soil and water resource depletion (100%). Furthermore, based on the network density (55.3 %), the social network has not been fully utilized for information sharing and there is a possibility to improve the social network to enhance knowledge sharing among the actors. Hence, it is advisable to establish effective two-way communication channels among the stakeholders within the network. While the cropping intensity in the Maha season is already higher around the cascade system, there is untapped potential to further increase cropping intensity in the yala season by utilizing the water capacity of the cascade. Moreover, there is an opportunity to develop agro-based industries in the vicinity of the cascade.

Keywords: Agricultural activities, Cascade system, Information and Technology, Knowledge transfer, Social network

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Development of online Marketing strategies for Sri Lankan virgin coconut oil in Singapore consumer market

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Abstract

In light of the current health-conscious trends, consumers are increasingly opting for healthier food options, including dietary oils. Virgin Coconut Oil (VCO), known for its health benefits, is experiencing a surge in demand. Japlan Holdings (Pvt.) Ltd. has devised a plan to introduce VCO to the Singapore market via the Shopee e-commerce platform. Consequently, it is imperative to develop robust online marketing strategies to effectively compete in the Singaporean market. The objectives of this study were to examine the consumer preference for VCO in the Singapore market, to analyze the company readiness level for online marketing and to develop online marketing strategies for VCO in Singapore. Primary data were collected by using a pre-tested structured questionnaire from 85 conveniently selected consumers in Singapore and structured interviews with the management of the company. Four P's Marketing Mix model was used to develop marketing strategies for VCO. Wilcoxon sign rank test was employed to analyze the data. Findings revealed that consumers had mostly visited the Shopee website for online purchasing of VCO. Consumers prefer the English language on the label and are willing to pay SG\$25 - SG\$30 for the most preferred pack which is 1000 mL and expected delivery within 3 days. Consumers have mentioned that online shopping is convenient and saved the time while it missed the shopping experience. Results of the Wilcoxon sign rank test shows that health benefits of the product were significantly considered by the consumers ($p < 0.05$) when they purchased VCO. Further, it was revealed that cooking and adding into shakes are significant purposes ($p < 0.05$) of buying VCO, and product discounts and shop vouchers are significant promotional factors ($p < 0.05$). According to the company's readiness, it has high management commitment and skills, technological knowledge, international marketing intelligence and opportunities for online marketing. The study has suggested that the company is having good potential for marketing VCO through the Shopee website as certified healthy dietary oil with competitive promotional strategies.

Keywords: Company Readiness, consumer preference, online marketing, virgin coconut oil

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