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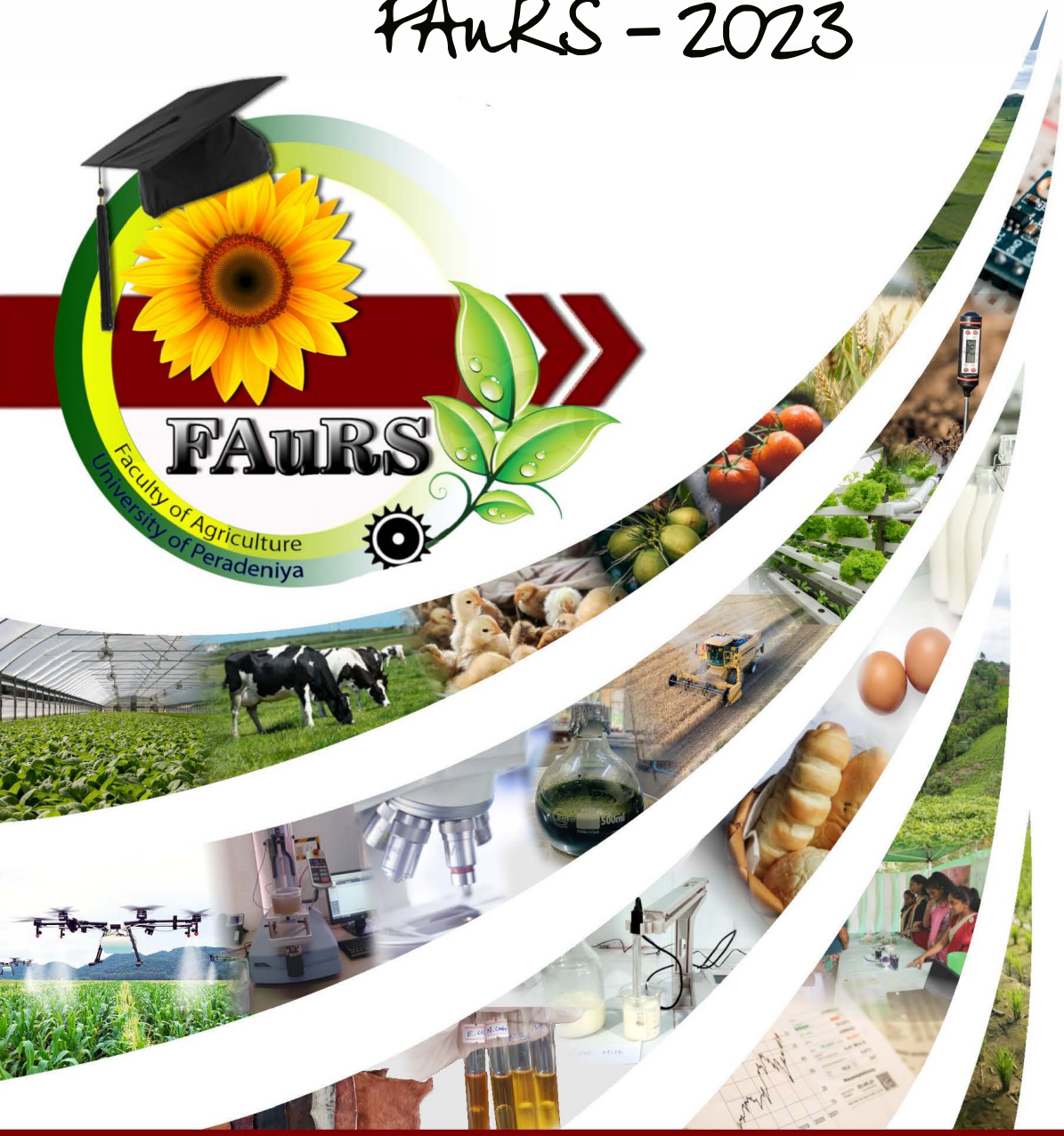
Faculty of Agriculture Undergraduate Research Symposium

FAuRS - 2023



Faculty of Agriculture
University of Peradeniya
Sri Lanka

26th March 2024

Proceedings of the 9th Faculty of Agriculture Undergraduate Research Symposium

FAuRS - 2023

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Editorial Board

Message from the Vice Chancellor

It is with great pleasure that I write this message on the occasion of the Faculty of Agriculture Undergraduate Research Symposium (FAuRS-2023) organized for the 9th consecutive time. Agriculture is a science of applications that has a wide array of disciplines to explore.

Blending the wisdom of young undergraduates who are capable and enriched with knowledge, skills and positive attitudes in the fields of Agricultural and allied sciences, is vitally important to solve local and global issues. As the pioneer in agriculture higher education and research in Sri Lanka, the Faculty of Agriculture of the University of Peradeniya has taken the leadership in driving its human resources with a futuristic vision to groom young undergraduates for finding effective solutions for multiple challenges for confronted by the agriculture sector. In the process, the Faculty of Agriculture has taken steps to obtain required collaboration of the stakeholders at all levels, both locally and internationally.

I am confident that the FAuRS 2023 would provide a unique platform for young undergraduates, to unveil their research findings to an and learned audience, interact and build networks with experts, industry partners & policymakers, and thereby to explore the future world that would open to them. I believe that, this unique event will promote forward-thinking, insightful and valuable perspectives on strategic challenges of the agriculture and allied sectors.

I take this opportunity to congratulate the Dean of the Faculty of Agriculture, Coordinator and the organizing Committee of FAURS 2023 for their untiring efforts in organizing this event, despite the many challenges that we are facing today.

Finally, I wish the FAuRS 2023 of the Faculty of Agriculture a great success.

Professor M.D. Lamawansa
Vice Chancellor
University of Peradeniya
Peradeniya

26th March 2024

Message from the Dean

I am pleased to provide this message to the FAuRS 2023, when we celebrate our 75 years of contribution to the Country's higher education system. The faculty's journey since its inception in 1948 has been marked by countless innovations that have drastically changed the trajectory of the Country's higher education sector, particularly in agriculture and allied fields.

Thanks to our forefathers for laying the foundation and creating a conducive culture that has become a breeding ground for scientific discoveries while gifting generations of scientists to society with an excellent aptitude for engaging in research, development and outreach.

A significant milestone of the faculty was introducing the research component to the undergraduate curriculum in 1975, which allowed undergraduates to sharpen their research skills while grooming them as young scientists. Since then, a few academic Departments have organized research symposia at departmental levels to communicate student research findings, culminating in a faculty-wide undergraduate research symposium, *i.e.* the Faculty of Agriculture Undergraduate Research Symposium (FAuRS) in 2014. Since then, FAuRS has become a key event in the faculty's calendar. FAuRS provides the Faculty's final-year students with a platform to showcase their research findings and helps them develop their confidence through engaging in numerous healthy competitions and sharpening their organizing skills by volunteering to be a part of the FAuRS organizing committee.

As the dean of the Faculty, I take this opportunity to congratulate the FAuRS coordinator and the Organizing Committee for making the FAuRS 2023 a great success amidst numerous challenges imposed by the Country's ongoing economic circumstances. While inviting you to witness the talents of our students, I wish you all a productive proceedings of the day.

Professor Sarath S. Kodithuwakku

Dean
Faculty of Agriculture

26th March 2024

Message from the Coordinator

It is with great pleasure that I forward this message as the Coordinator of the Faculty of Agriculture Undergraduate Research Symposium 2023 (FAuRS 2023). The FAuRS this year is organized for the 9th consecutive time and it has flourished to greater heights over the years unearthing, grooming and rewarding the multitude of talents of our undergraduates.

The FAuRS is an invaluable platform for the final year undergraduate students of the faculty, to blend with experts in the field of research and showcase their talents. In the process students are provided with ample opportunities to improve their knowledge, skills and attitudes by participating in technical competitions and open non-technical competitions.

The unique feature of FAuRS is the opportunity that all the undergraduates of the faculty get to publish their research findings in FAuRS proceedings. The current issue, 'Proceedings of FAuRS 2023' includes 235 scientific abstracts based on four themes; Agricultural Production & Productivity Improvement, Technological Interventions & Applications in Agriculture, Food Quality, Safety & Product Development, and Community, Environment & Management. These abstracts include submissions from the students of the three degree programmes offered by the Faculty, BSc in Agricultural Technology & Management, BSc in Food Science & Technology, and BSc in Animal Science & Fisheries, thus covering a wide range of topics related to agriculture and allied fields.

This annual symposium provides our students an opportunity to improve themselves, build professional linkages, impress potential employers and exchange ideas facilitating them to step into their career paths aiming to reach new heights.

I am confident that the FAuRS 2023 will fulfill the expectations of the Faculty of Agriculture and our students equally.

I wish all the students who are about to graduate all the success in their future endeavors.

Professor S.A.C.N. Perera
Coordinator
FAuRS 2023

26th March 2024

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A Detailed Analysis of Selected BPH Resistance QTLs in *Rathuheenati* and Local Mega Rice Varieties

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Brown Planthopper (BPH) (*Nilaparvata lugens* Stål) is a sap-sucking insect pest posing a major economic threat in rice-producing countries. BPH biotypes caused detrimental losses to rice yield in Sri Lanka. *Bph3* is a durable and broad-spectrum Quantitative Trait Loci (QTL) associated with BPH resistance. It was first identified from the Sri Lankan traditional rice variety, *Rathuheenati*. The present study was conducted to determine the genic and allelic variations in *Bph3* QTL among local mega rice varieties and to incorporate *Bph3* into the susceptible rice variety Bg352. DNA was extracted from local mega rice varieties, and known BPH-resistant varieties, *Rathuheenati*, Ptb33 and Bg379-2. Genotyping of rice varieties for *Bph3* QTL was carried out using the QTL-associated SSR markers RM589 and RM19291. Fragment of the expected size of 186 bp of the *Rathuheenati* allele was amplified from all the local mega rice varieties for the marker allele RM589. For the RM19291 primer, 146 bp fragment was amplified from all mega rice varieties and the resistant variety Ptb33. However, *Rathuheenati* accession 5579 and the resistant variety Bg379-2 did not amplify this marker allele, indicating sequence divergences in the marker loci. Although alleles of similar fragment size were amplified, different haplotypes were identified among the tested varieties. Based on rice genomic data, five candidate genes were predicted from the *Bph3* and *bph4* QTLs that encode plant defense proteins: NBS-LRR, ZINC RING finger, CAMK, CrRLK1L-1, and DELLA. Incorporating *Bph3* QTL of *Rathuheenati* to a susceptible popular rice variety Bg352 was initiated by cross-pollinating *Rathuheenati* as the male and Bg352 as the female parent.

Keywords: *Bph3* QTL, BPH resistance, *Rathuheenati*

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A Multivariate Statistical Analysis of Key Performance Indicators in Small and Medium-Scale Dairy Farms From Selected Districts in Sri Lanka

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This research examines the influence of Key Performance Indicators (KPIs) on milk production in Sri Lankan dairy cattle farms, using secondary data collected and validated from 412 small and medium-scale dairy farmers. The study focuses on baseline and current milk production, average milk yield increment per milking cow per day, and adoption of 10 selected KPIs. Objectives were to identify the positive impact of KPIs on milk production, determine the optimal number of KPIs for enhancing production, understand the relationships between KPIs and milk production, and develop statistical models for yield prediction based on farm data. Paired T-test results reveal a significant increase in milk yields post-KPI adoption, with an average increase of 12.55 liters per farm per day ($P<0.001$). Regression analysis established a predictive model linking KPI adoption and milk yield per cow per day, represented as $y = \text{Constant (C)} \mp a*x \mp b* z$, where y is the predicted milk yield per cow per day, Constant (C) the constant milk yield increment value, a, b are numerical values, x represents the number of cows, z represents the KPI practice. These findings help optimizing farming practices, enhancing sustainability and productivity in small and medium-scale dairy cattle farming in Sri Lanka.

Keywords: Dairy cattle, Key performance indicators (KPIs), Milk production, Milk yield prediction statistical model, Small and medium scale dairy farms

This research was supported by Cargills Dairies (Pvt.) Ltd.

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Analysis of Culturable Microbial Community of Different Types of Compost Tea

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Compost tea is a water-based extract of mature compost that is used as an organic fertilizer in sustainable agriculture. However, the microbial composition and activity of compost tea were not well understood and highly vary depending on the type, quality, brewing method, and additives used. This study was aimed to compare the structure and function of culturable microbial communities of different types of compost tea and to evaluate their effect on plant growth and health. 3 types of compost tea prepared using black soldier fly larvae (BSF) mediated compost, vermicompost, poultry manure-based compost and a liquid fertilizer Jeevmurtham was used. 3 compost teas were aerated for 48 hours. Bacteria and fungi were isolated from each compost tea after 48 hours of preparation. 30 types of morphologically different bacteria and 8 types of morphologically different fungi were isolated from all 3 compost tea types and Jeevmurtham. The isolates were screened for plant growth-promoting traits: nitrogen-fixing ability, phosphorous solubilizing ability, indole acetic acid (IAA) production ability, and antagonistic effects against soil-born pathogen *Fusarium* sp. using nitrogen-free malate media, Pikovskay's media, nutrient broth with tryptophan, and dual culture plate assay respectively. According to the results, nitrogen fixing bacteria were highest in poultry manure-based compost tea while, phosphorous solubilizing bacteria were highest in BSF mediated compost tea. Both jeevmurtham and poultry manure-based compost tea were rich with bacteria and fungi capable of IAA production. There were no antagonistic isolates found against the soil-born plant pathogen *Fusarium* sp. Statistical analysis showed that the bacterial species diversity is highest in poultry manure-based compost tea which is composed of nitrogen fixers, phosphorus solubilizers and IAA producers. Vermicompost showed the highest diversity of phosphorus solubilizing and IAA producing fungi.

Keywords: Compost tea, Microbial analysis, Microbial diversity, Plant growth promotion

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Analysis of Structural Diversity of *Cis*-regulatory Elements in Master Stress Regulators Across the Rice Genome

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In plants, the regulation of gene expression plays a crucial role in responding to various stresses. Specific conserved regions across the gene promoters that facilitate transcriptional regulation are called *cis*-regulatory elements (CREs). These elements regulate the spatiotemporal gene expression patterns. This study focuses on seven major stresses and stress combinations that impact the growth and development of Rice, namely cold, heat, heat/Cold, flood, drought, salinity, and UV radiation. Based on the available literature, 103 genes responsible for stress response were identified. The 1,200 base pair regions around each gene's transcription start site (TSS) were analyzed, including 1,000 base pairs upstream and 200 base pairs downstream of the TSS. These regions were scanned for CREs and their enrichment using CiiiDER. CREs that provide transcription factor binding site (TFBS) for DOF 5.3 TF were common for all seven stress categories except flood, ABH-12 was common for all stress except UV and salinity, and DOF 5.6 for heat, heat/cold, drought, and salinity. Among TFBS overrepresented ($p \leq 0.05$) categories, BHLH34 TFBS was common between cold, drought, heat/cold, heat, and salinity stresses. CMTA2 TFBS was present in drought, flood, heat/cold, heat, and salinity. Both TFs are known to be involved in stress response and can be considered potential candidates for genome editing. The outcome of this study provides insight into the structure and conservation of stress response TFBSs in major stress regulators. The findings of this study can potentially be used to develop new stress-tolerant rice varieties using novel genetic engineering strategies.

Keywords: Abiotic stress, *cis*-regulatory elements, Gene expression regulation, Plant stress response

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Antioxidant and Antidiabetic Potential of Postbiotics from *Lactobacillus* and *Bifidobacterium* Isolated from Swine Cecal Content

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Postbiotics are the bioactive soluble metabolic by-products produced by probiotic microorganisms, providing physiological benefits towards the host. Postbiotics have shown the potential to serve as an alternative to probiotics in modulating host physiology. The current study was conducted to investigate the antioxidant and antidiabetic potential of postbiotics from *Lactobacillus* and *Bifidobacterium* isolated from swine cecal content. A series of *in-vitro* assays was performed using the harvested cell-free supernatant (postbiotics) of *Lactobacillus* and *Bifidobacterium*. The antioxidant activity of postbiotics was determined using the (1, 1-diphenyl-2-picrylhydrazyl) (DPPH) assay, [2, 2'-azinobis (3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) assay, Ferric ion Reducing Antioxidant Power assay (FRAP) and Oxygen Radical Absorption Capacity assay (ORAC) and Total Phenol Content (TPC) assay. The antidiabetic activity was determined by α-amylase and α-glucosidase inhibition assays. A higher (P<0.05) antioxidant activity of postbiotics was observed in *Bifidobacterium* postbiotics as shown by DPPH (635.44±7.7 mmol TE/L) and FRAP (1,439.7±2.55 mmol Fe^{2+} Eq/L) assays. *Bifidobacterium* postbiotics also showed a higher (P<0.05) TPC (11.62±2.27 mg GAE/L). However, *Lactobacillus* postbiotics showed a higher (P<0.05) antioxidant activity based on ABTS assay (4,801.92±0 mmol TE/L). The concentrations of antioxidant compounds produced by both *Lactobacillus* and *Bifidobacterium* were not sufficient enough to be detected in ORAC assay. The postbiotics from *Bifidobacterium* exhibited a higher (P<0.05) α-amylase and α-glucosidase inhibition activity (IC_{50}=22.09±0 µL and IC_{50}=18.88±0.12 µL respectively), indicating more antidiabetic properties. In conclusion, swine cecal content can be considered a potential source for the isolation of *Lactobacillus* and *Bifidobacterium* for postbiotics production, and they possess antioxidant and antidiabetic properties, highlighting their potential use as a novel agent in pharmaceutical and functional food industries.

Keywords: Antidiabetic, Antioxidant, *Bifidobacterium*, *Lactobacillus*, Postbiotics

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Aphicidal Activity of Aqueous Extracts from Clove Twigs Against Aphid, *Myzus persicae* (Sulzer)

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Unlike the dried-unopened flower bud of cloves (*Syzygium aromaticum* L.), clove twigs (stems of the inflorescence) carry a lower market value. The green peach aphid, *Myzus persicae* is an important pest of cultivated crops. The current study assesses the potential aphicidal activity of aqueous extract of clove twigs. Clove twigs were ground into a fresh and dry powder, and an aqueous extract was prepared covering a weight/volume basis concentration series (fresh - 100% (T1), 75% (T2), 50% (T3), 25% (T4), and 12.5% (T5); dry - 25%(T7), 20% (T8), 12.5% (T9), 10% (T10), and 5% (T11)), in an experiment where distilled water was used as a control (T6). An *invitro* contact bioassay was conducted and the mortality of aphids was calculated after 24 and 48 hours. Data was analyzed using analysis of variance and significance was tested using Tukey's multiple comparison tests. Results of the contact bioassay revealed significantly ($P< 0.05$) higher aphicidal activity in T1, T2, T7 and T8, compared to T6. *Invitro* spray assay conducted with T7 and T8, revealed that both treatments have significantly ($P< 0.05$) higher mortality compared to T6. In an *invitro* feeding bioassay involving 25% dry clove powder diluted in sucrose (weight/volume), revealed no significant ($P> 0.05$) difference in the survival between the treatment and control experiments (20% sucrose solution) at 24, 48 and 72 hours. A pot experiment, conducted with T7, recommended insecticide (positive control) and negative control, conducted over a 10 days interval, revealed significantly ($P< 0.05$) higher mortality in both T7 and the insecticide compared to the negative control, after the second topical application. Further, no significant ($P> 0.05$) difference was detected between the T7 and insecticide. Hence, aqueous extract of dry clove twigs has the potential to be developed as a botanical pesticide to control aphid *M. persicae*.

Keywords: Aphicidal activity, Botanical pesticide, Clove twigs

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Assess Nutrients Use Efficiencies and Productivity Variations under Different Fertilizer Management in Tea

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Enhancing nutrient use efficiencies and productivity is essential to optimize tea production while ensuring sustainable agricultural practices. A field experiment was conducted in vegetative propagated (VP) tea fields of clone PK 2 (*Camellia sinensis* L.) in Pedro Estate, Mahagasthota, Nuwara Eliya. Nine fertilizer treatments (T1: No 'N' + TRI recommended MOP and ERP; T2: VP/UM 910:TRI recommendation; T3: 75% TRI recommended 'N' + TRI recommended ERP and MOP; T4: U 709 – 80% TRI recommended 'N'; T5:YARA mixture (75% TRI recommended 'N'); T6 : U 709 – Urea coated with DCD + NBPT (75% TRI recommended 'N'); T7: Limus treated Urea + TRI recommended ERP and MOP (75% TRI recommended 'N'); T8: U 709 – 75% TRI recommended 'N'; T9: U 709 – 100% TRI recommended 'N') were assessed. Shoot growth and green leaf production, soil and leaf N, P, K and Mg content of leaves, chlorophyll fluorescence, SPAD meter readings, shoot density, and Banji weights were measured in two weeks intervals for three months period after imposing treatments. Thenitrogen use efficiency (NUE) of applied fertilizers was calculated using partial factor productivity of applied nitrogen (PFPN). Cumulative green leaf production during the experiment for a period of 3 months was significantly higher in T3 (0.945 kg/m^2), T4 (0.943 kg/ m^2) and T5 (0.945 kg/ m^2) treatments compared to the control (0.842 kg/ m^2). A significant difference ($p<0.05$) was observed in N and P in leaves, and N, P and K levels in soil, Banji weights, SPAD meter readings and fluorescence among treatments from 4th weeks after fertilizer application. The PFPN was significant among treatments and the highest value was recorded in T7 (33.2 kg/ kg of N). The results revealed that Urea coated with DCD and NBPT, and Limus treated Urea treatments with nitrification inhibitors have shown the highest improvement of yield and NUE of tea.

Keywords: Fluorescence, Nitrogen use efficiency, Tea leaf production

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Assessing Photosynthetic Light Response Parameters of Coconut Seedlings Under Water Stress Conditions

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Coconut cultivation in Sri Lanka utilizes a diverse array of varieties, each demonstrating unique responses to environmental stimuli. Understanding physiological traits such as carbon assimilation provides crucial insights into plant resilience in stressful environments. Therefore, this study was conducted to study varietal variations in photosynthetic light response parameters and physiological traits under both field capacity and 50% soil moisture level conditions. DGT, TDB, TT and DB varieties were used. Experiment was conducted at the Coconut Research Institute, Lunuwila Photosynthetic capacity (Amax), Light Compensation Point (LCP), Light Saturation Point (LSP), and leaf Dark Respiration rate (RD) were measured. While there was no variation in photosynthetic light response parameters among the four varieties under the same moisture level, However, significant reduction ($P<0.05$) in Amax and LSP, and a significant increase in LCP were observed in the varieties subjected to 50% moisture level compared to their counterparts grown at field capacity. Leaf nitrogen concentration varied significantly ($P<0.05$) among the varieties at both moisture levels. However, significant differences in chlorophyll and phosphorus contents were noted between the two moisture levels. Moisture stress exhibited a significant effect on Amax, LCP, LSP, leaf nitrogen, and chlorophyll contents in coconut seedlings. At 50% soil moisture level, the increased LCP showed disadvantageous as plants struggled to maintain a positive carbon balance at low light levels. Additionally, the reduced Amax hindered carbon fixation, while diminished LSP compromised the effective utilization of available CO_2 for photosynthesis. Consequently, a 50% soil moisture level resulted in lower net carbon gain in coconut seedlings. Therefore, it is recommended to maintain soil moisture levels closer to field capacity through irrigation in the absence of rainfall and/or implement strict soil moisture conservation measures until coconut seedlings are well-established in the field.

Keywords: Coconut, Light response curves, Moisture stress, Photosynthesis

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Assessment of Chronic Physiological Stress in Goats Using Adrenal Gland Structure and Molecular Markers

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Assessing chronic stress in goats is important for the welfare of the animals and it ensures accurate research results and interpretations. Goats are becoming more popular as a ruminant research model on one hand and the other hand because of their physiological parallels to humans, flexibility, and affordability, they are used *in vivo* modeling. Thus, it is critical to understand their long-term stress status before and during the research work. Therefore, this work investigated an approach for a more thorough evaluation of chronic stress in goats: combining genetic marker analysis with adrenal gland histology. Forty-two (n=42) goats' (male, n=17 and female, n=25) adrenal glands were examined for structural abnormalities like accessory cortical nodules, hemorrhages, and fibrosis, which could be signs of long-term stress. Additionally, a gene expression assay was optimized to assess the expression of the adrenal stress-responsive genes; P450 and HSP90 in six goat adrenal samples. Our results showed that histological abnormalities were highly prevalent (73.8%), indicating that a considerable proportion of the goats had been under chronic stress and thus may not be presented with ideal physiological status. Results also revealed that compared to males (64.7%), females had a higher prevalence of abnormalities (80%). Moreover, gene analysis assay was established successfully using semi-quantitative RT-PCR. Overall, the aforementioned two methods provide insightful information about the animals' long-term stress history, which is essential for promoting animal welfare and strengthening the validity of study findings. More investigations are required to verify this strategy and assess its efficacy compared to current practices. In conclusion, this integrated approach has great potential to advance more moral research procedures that will shed light on the physiological status of goats that are used as an *in vivo* research model.

Keywords: Adrenal gland, Chronic stress, Goat, Histopathology, Molecular markers

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Bioavailability of Cu in Coir Based Growth Media Produced Targeting to Grow *Cannabis sativa* L.

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Cannabis (Cannabis sativa L.), being a hyper-accumulative plant, requires precise micronutrient management in its growth substrate as any heavy metal available exceeding critical limits may contaminate plant materials. This study aimed to examine Cu bioavailability in a coir-based growth medium (coir-slabs), and to identify steps in the production process important for deciding Cu content of the medium. First, a plant house experiment was conducted to determine the bioavailability of Cu in growth medium using *Brassica juncea* (L) Czern, which is another hyper-accumulative plant as the test crop, because growing cannabis is illegal in Sri Lanka. Plants were grown for six weeks in coir-slabs treated with and without Cu at 6 mg/kg and analyzed for Cu uptake in shoots and extractable Cu in growth media. Secondly, raw materials and coir-slabs (end product) from three production locations were analyzed for total Cu content. Thirdly, the production process of growth media at one location was closely studied to analyze total Cu contents in coir raw material before and after washing, coir-slabs, leachate removed during washing and irrigation water used for washing. Results indicated that Cu concentration in shoots of Cu-treated and untreated coir-slabs were 36.6 mg/kg and 19.76 mg/kg, respectively, but the difference was not significant ($P<0.05$). Total Cu levels of raw materials ranged from 3 to 12 mg/kg and the mean Cu level in coir-slabs was 3.8±0.56 mg/kg. Washing raw material during processing has significantly reduced ($P<0.05$) Cu by 55.48%. Total Cu in irrigation water was undetectable. About 70% of coir-slabs contained Cu exceeding the critical limit of 3 mg/kg. In conclusion, coir-slabs produced targeting to cultivate cannabis have Cu in bioavailable form and often exceed the critical limit. The washing step of raw material can be improved further to reduce Cu in coir-slabs.

Keywords: Bioavailability, Coir-based Growth media, Hyperaccumulation, Mustard

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Biological Value of Gliricidia Leaf Meal Pellets for Supplementing Ruminant Rations

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There is a deficiency of crude protein (CP) supplements for ruminant feeding in Sri Lanka. The protein sources used for ruminant feeding are expensive. A substantial amount of gliricidia (*Gliricidia sepium*) leaves rich in CP are wasted from the gliricidia plantations managed for Dendro Power generation, The objectives of this study were to produce gliricidia leaf meal pellets and asses their biological value as a supplementary feed for ruminant rations. Gliricidia leaves were dried (65°C) and finely ground using a laboratory mill. The nutritive value of leaf powder was analyzed. Subsequently, the potential to produce leaf meal pellets with a higher inclusion of leaf powder by mixing with binding agents (corn powder, copra meal, rice bran, rice polish, molasses, wheat flour, rice flour) was examined. It was found that a higher amount of gliricidia leaf powder could be incorporated into pellets when molasses and wheat flour are used as ingredients. To produce leaf meal pellets with the highest level of gliricidia leaf powder, five leaf meal pellets were prepared with different levels of leaf powder, molasses and wheat flour using a laboratory pelletizer. The dried pellets were compared for nutritive value. The experiment was conducted as a complete randomized design. Gliricidia leaf powder recorded 25.09 % CP, 62.36 % *in-vitro* organic matter digestibility (OMD), and 9.06 MJ/kg metabolizable energy content (ME). Leaf meal pellets, including 89 % leaf powder, exhibited significantly ($P<0.05$) different nutritive value (23.90 % CP, 69.20 % OMD, 10.15 MJ/kg ME) compared to pellets with 77 % leaf powder (20.62 % CP, 80.69 % OMD, 11.96 MJ/kg ME). Nevertheless, all investigated leaf meal pellets exhibited significantly ($P<0.05$) greater OMD and ME compared to leaf powder. The study confirms the greater potential of gliricidia leaf meal pellets as a protein supplement in ruminant rations.

Keywords: Crude protein, Metabolizable energy, Organic matter digestibility

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Biological Value of Ipil-Ipil and Calliandra Leaf Meal Pellets for Supplementing Ruminant Rations

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Conventional protein supplements used in ruminant feeding in Sri Lanka are expensive. Ipil-Ipil (*Leucaena leucocephala*), and Calliandra (*Calliandra calothyrsus*), are naturally grown in the low country dry zone and up country wet zone. Their leaves are rich sources of proteins. This study aimed to produce Ipil-Ipil and Calliandra leaf meal pellets and asses their biological value as a protein source in ruminant rations. Ipil-Ipil and Calliandra leaves were dried and finely ground. The leaf powder was analyzed for nutritive value and the biological effects of tannins. Subsequently, the potential to make leaf meal pellets with higher percentage of leaf powder by mixing with potential binding agents (ground corn, copra meal, rice bran and polish, wheat flour, molasses) was physically examined. It was realized that molasses and wheat flour act as good binding agents for making leaf meal pellets. Two experiments were conducted each with Ipil-Ipil and Calliandra leaf powder, according to Complete Randomized Design. Leaf meal pellets were prepared with varying inclusion rates of Ipil-Ipil or Calliandra leaf powder, molasses, and wheat flour, using a laboratory pelletizer. Nutritive values of the dried pellets were analyzed. The crude protein (CP), *in vitro* organic matter digestibility (OMD) and *in vitro* metabolizable energy (ME) contents of Calliandra leaf powder were 21.56 %, 29.17 % and 4.08 MJ/kg while those of Ipil-Ipil leaf powder were 27.22 %, 45.36 % and 6.46 MJ/kg, respectively. Enhancements recorded in OMD (29.17 vs. 38.00 %) and ME (4.08 vs. 5.43 MJ/kg) in the presence of Polyethylene glycol confirmed a significant ($P<0.05$) biological effect of tannins in Calliandra leaves. The best quality Calliandra (21.71 % CP, 62.31 % OMD, 9.18 MJ/kg ME) and Ipil-Ipil (24.43 % CP, 80.67 % OMD, 11.90 MJ/kg ME) leaf meal pellets were achieved with 76% inclusion of their dried leaf powder.

Keywords: Crude protein, Metabolizable energy, Organic matter digestibility, Tannins

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Calcium Alginate Encapsulation of Seed Paddy to Facilitate Crop Establishment, and Improve Growth and Yield of Rice

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Coating seed paddy with absorbing material assures seed safety from external damages and supports crop establishment and early plant growth in moisture-limited situations. This study evaluated the feasibility and efficacy of calcium alginate-encapsulated seed paddy for direct-seeding. Experiments were conducted in *Maha* 2023/24 (October to February) at the Rice Research and Development Institute, Batalagoda, Sri Lanka, in a germination chamber, plant house (pot experiment), and open-field condition using the rice variety Bg252 (2½ month age category). As this is a preliminary study, irrigation water was supplied to keep the soil in field capacity in plant house and open-field conditions. Delayed and low seed germination % ($P<0.05$) was observed in the encapsulated seeds compared to the control without seed encapsulation. In the pot experiment (60 cm diameter x 45 cm height), the seedling count, tiller count, and number of panicles/pot, number of spikelets/panicle, and thousand-grain weight with encapsulated seeds was higher ($P<0.05$), and the pot yield was more than 50% higher ($P<0.05$) compared to the control. The field experiment (4 m x 4 m) conducted using 60 seeds/m^2 showed similar crop yields ($P>0.05$) in encapsulated and non-encapsulated plots, probably due to the low seed rate used. The seed paddy encapsulated with calcium alginate provided promising results in the plant house experiments. Further studies are required to confirm the results at the field level with the recommended seed rates and under different soil moisture conditions.

Keywords: Calcium alginate, Crop establishment, Growth and yield, Rice, Seed encapsulation

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Calibration and Validation of APSIM Model for Sunn hemp (*Crotalaria juncea* L.) and Optimization of Planting Density and Sowing Time for Higher Green Manure Yield

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Sunn hemp (*Crotalaria juncea* L.) is considered as a promising green manure crop however, recommendations are not available in Sri Lanka for optimal sowing and planting density to achieve higher biomass yield. The research was conducted at the Mahailuppallama subcampus, Faculty of Agriculture, University of Peradeniya with the objective of calibration and validation of APSIM crop model to simulate Sunn hemp growth and evaluate the model performance. Scenario analysis was conducted by using calibrated model with 30 years long-term weather data to optimize planting density and sowing time for higher green manure yield. Experimental data of a previous research conducted in 2021 was used for model calibration while current field experimental data was used for model validation. Sunn hemp seeds were sown in 4-plots (4×4 m) at 100kg/ha rate as per previous research finding. Plant growth data, phenological data and initial soil nitrogen content were measured. Past 30 years' weather data was collected from Field Crop Research and Development Institute, Mahailuppallama. Phenological parameters (plant emergence, juvenile period, floral initiation, flowering) and growth parameters (leaf area, canopy height) were adjusted during the model calibration. Model validation was done by comparing model output with observed data in 1:1 graph and using model validation indices; Root Mean Square Error (RMSE), and Model Efficiency (ME). Results revealed, RMSE and ME values of dry matter yield were 823.38 kg/ha and 0.62 respectively. In phenology, RMSE value was 1 day and ME was 0.99. Model based scenario analysis showed optimum sowing window between 23rd January and 7th February in *Yala* season and 23rd July and 7th August in *Maha* season (before the land preparation for rice) for obtaining higher biomass. 500 plants/m^2 was determined as optimum planting density in both *Yala* and *Maha* seasons. Accordingly, the optimum sowing rate of sunnhemp was calculated as 166.8 kg/ha.

Keywords: APSIM, Calibration, Scenario Analysis, Sunn hemp, Validation

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Comparative Analysis of Antioxidant and Antimicrobial Properties of Extracts from Fruit and Vegetable Waste, and Tea (*Camellia sinensis*) Leaves

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There is a growing interest in exploring the possibility of utilizing waste from fruit and vegetable processing in food applications. This study evaluated the polyphenolic content, antioxidative, and antimicrobial activities of extracts from *Anamalu* banana peel (*Musa acuminata*), pineapple peel (*Ananas comosus*), onion peel (*Allium cepa*), and tea (*Camellia sinensis*) leaves. Using Folin-Ciocalteu method, total phenolic content (TPC) was determined while antioxidant capacity was assessed using diphenylpicrylhydrazyl (DPPH), ferric reducing antioxidant power (FRAP), and thiobarbituric acid reactive substances (TBARS) assays. Antimicrobial efficacy against *Bacillus cereus* and *Escherichia coli* was evaluated via disk diffusion assay. Results revealed a significantly high ($P<0.05$) TPC in onion scales and banana peels (51.81±0.71 to 74.17±0.71 and 50.47±2.07 to 73.85±1.99 mg of gallic acid equivalents (GAE)/g of extract, respectively). Banana peel and onion scale extracts also showed significantly high ($P<0.05$) antioxidant effects, with trolox equivalent antioxidant capacity (TEAC) (38.75±1.66 to 46.72±0.03 mg). Tea and onion scales exhibited significantly high ($P<0.05$) FRAP values (41.76±0.108 to 75.56±0 mg of ascorbic acid equivalent (AAE)/g) and 6.2±0.089 to 19.43±0.18 mg AAE/g of extract, respectively. Additionally, banana peel and tea leaf extracts demonstrated significantly low ($P<0.05$) total TBARS content. Concerning antimicrobial activity, 80% acetone extracts exhibited a significantly high ($P<0.05$) efficacy against *Escherichia coli* (0.23±0.40 to 1.07±1.01 mm). Extracts from banana, pineapple, and onion showed inhibitory effects against *Escherichia coli* (1.07±1.01, 0.5±0.5, and 0.33±0.29 mm, respectively). In conclusion, the promising properties of the above extracts as antioxidants and antimicrobials underscore the need for continued investigation and utilization in various applications.

Keywords: Antimicrobial activity, Antioxidant activity, Banana peel, Onion scales, Pineapple peel, Tea leaves

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Comparison of Culturable Endophytes in Healthy and Dieback-affected *Calophyllum walkeri* in Horton Plains

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Tree dieback has been a pervasive condition which threatens the natural ecosystem in Horton Plains (HP). This project intended to compare the endophytic microbial community in healthy and dieback-affected *Calophyllum walkeri* plants in HP to fill a knowledge gap on the development of dieback. Leaf, stem and root samples (i.e. 45 samples) were collected from healthy and dieback-affected trees according to a disease severity scale (i.e. Healthy, S1, S2, S3, S4 stages). Percentage isolation frequencies of endophytic fungal, bacterial and actinomycete morphospecies was determined using specific culture media. Species richness (SR), species abundance (SA), Shannon- Weiner index (SWI) and species evenness (SE) were quantified as community parameters of each microbial population. Antagonistic effect of endophytic fungal isolates at healthy stage against the fungal isolates residing in the most severely-affected stage was assayed *in vitro*. Isolation frequency of *Pestalotioid* fungi (i.e. *Neopestalotiopsis*, *Pestalotiopsis* and *Truncatella* sp.) was prominent in roots (33.3-66.6%) of all stages and in stems (17-58.3%) of all dieback-affected stages. Overall SR and SA of fungi varied significantly ($P<0.05$) among plant parts and SWI differed significantly ($P<0.05$) among plant parts and dieback stages. Endophytic actinomycetes were not reported. Overall SA, SR and SE of bacteria significantly differed among plant parts and SWI differed significantly ($P<0.05$) among stages. Eighty three percent of endophytic fungal isolates in the healthy stage demonstrated their antagonistic potential against the fungal isolates in S4 stage by inhibiting their colony growth, ranging from 43-92%. These findings demonstrated the changes of the endophytic fungal and bacterial populations with reference to their occurrence and diversity among plant parts (especially stem and roots) and stages of dieback and its implications on dieback development. Findings further revealed the antagonistic potential of fungal isolates at the healthy stage, hence the protective role played by the endophytic fungal profile on tree health.

Keywords: Antagonism, Diversity parameters, *Pestalotioid* fungi, Severity stages

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Comparison of Culturable Rhizosphere Microbiome in Healthy and Dieback Affected *Calophyllum walkeri* Plants in Horton Plains

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Dieback is a destructive condition experienced by several tree species in the Horton Plains and it poses a significant risk to biodiversity and environmental stability. In this study, culturable microbes in the rhizosphere of dieback-affected *Calophyllum walkeri* plants at four disease development stages (*i.e.*, S1, S2, S3 and S4) were compared with those in the rhizosphere of healthy plants. Three soil samples/ plant were collected from a depth of 30 cm and 30 cm away from the base of the tree and measured pH and electrical conductivity and isolated fungal, bacterial and actinomycete populations using specific culture media. Based on colony and spore morphology, morphospecies were identified and microbial density (cfu/g of soil) and diversity (Shannon-Weiner Index (SWI)), species evenness (SE), and species richness (SR) were quantified. Fungal isolates were screened for lignolytic and cellulolytic ability *in vitro*. Soil pH ranged between 4.47 – 5.25 and did not differ among the disease development stages. A significantly higher EC value (51.32 µS/ cm) was reported by the healthy rhizosphere than the rhizospheres of other stages ($P<0.05$). SWI was significantly higher ($P<0.001$) for fungi than that of bacterial and actinomycete populations which were not significantly different between each other. SE was significantly different ($P<0.001$) among microbial groups and the highest and lowest SE were reported by fungi and actinomycetes respectively. SR significantly differed among microbial groups and the disease development stages ($P<0.05$). Lignolytic ability was demonstrated by 80, 67, 100 and 83% of the morphospecies at healthy, S1, S2, S3 and S4 stages respectively. The fungi having cellulolytic ability at all stages were lower than the lignolytic fungi. Number of morphospecies possessing a higher lignolytic index and density of such morphospecies (cfu/g of soil) were higher towards severe scales of the dieback. Findings revealed the functional impact of rhizosphere fungi on plant health.

Keywords: Diversity, Horton Plains, Lignolytic ability, Morphospecies, Severity scale

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Cross Protection Ability of *Sclerotium rolfsii*-derived Immunity Activators for the Management of Soil Borne Plant Pathogens

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Inducing plant immunity using pathogen-derived immunity activators/elicitors is a sustainable method to control plant diseases. The present study aimed to determine the cross-protection potential of a pathogen-derived immunity activator (i.e. *Sclerotium rolfsii*) against two other soil borne pathogens, *Fusarium* and *Pythium* spp., when applied as a seed treatment. Chilli (var. MI2) seeds were coated using gum arabic with seven different combinations of dry heated (DH) and moist heated (MH) mycelia and fragmented DNA (FD) of *S. rolfsii*. The treatment codes were; DH, MH, DH+MH, FD, DM+FD, MH+FD, and DH+MH+FD. Treated seeds were inoculated with a mycelial suspension of the two pathogens and 14 days after, germination percentage (GP), seedling vigour (SV), disease severity index (DSI) and activity of a plant defence enzyme (i.e. Peroxidase) were quantified. GP and DSI significantly varied between pathogens ($P<0.01$ and $P<0.001$ respectively) and SV by the pathogen x treatment interaction effect ($P<0.001$). Among the seed treatments, at *Fusarium* inoculation, the highest GP was reported by the DM+MH+FD and DH treatments. SV was significantly higher at FD, DH+MH+FD, DH+FD and DH treatments than the rest of the elicitor treatments with no difference among each other at *Pythium* inoculation. For *Fusarium* inoculation, a significantly higher SV was reported by DH+FD treatment which is on par with the negative controls. DSI was significantly lowered and became on par with the negative controls when coated with DH+MH+FD, FD and DH treatments for both pathogens. The interaction effect of pathogen x treatments was significant on peroxidase activity ($P<0.001$) and in *Pythium* inoculated plants, the highest peroxidase activity was given by DH+MH+FD and MH+FD seed coatings. However, at the *Fusarium* inoculation the lowest peroxidase activity was given by DH+MH +FD treated seeds. A significant reduction of DSI was achieved by DH+MH +FD, FD and DH treatments against *Fusarium* and *Pythium* infections.

Keywords: Elicitors, *Fusarium*, Pathogen associated molecular patterns, *Pythium*

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Decomposition of Crop Residues and Diversity of Soil Microorganisms as Affected by Different Nutrient Management Practices in a Banana Plantation

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In banana plantations, pseudo-stems and banana leaves are incorporated as surface mulches, and different nutrient management strategies are being practiced using chemical and organic fertilizers, targeting to improve crop yield. This study investigated how land productivity, crop residue decomposition and diversity of soil organisms were affected by the combined use of chemical fertilizers (CF) and poultry manure (PM) in a banana plantation in Buttala, Sri Lanka. Banana yield, soil properties and decomposition of crop residues were studied in six treatments as, CF1+PM1, CF1+PM2, CF1+PM3, CF2 +PM1, CF2+PM2, and CF2+PM3. CF1 and CF2 correspond with 75% and 100% of recommended CF application rate, respectively. PM1, PM2 and PM3 correspond with PM application rates of 0, 2.5 and 5 kg/plant. Crop residue decomposition was assessed using litter bags containing two litter materials as banana pseudo-stem pieces and banana leaves, placed at two depths (surface and at 7.5 cm depth). Litter bags were recovered at 17, 31 and 45 days after placement (DAP) and weight loss was determined. The application of PM significantly increased ($P<0.01$) banana yield and decreased ($P<0.1$) bulk density. Type of material and time of exposure to decomposition had significant effects ($P<0.05$) on litter decomposition, whereas depth of placement of litter materials and nutrient management strategy had no significant effect ($P>0.05$) on decomposition except at 17 DAP for pseudo-stems. By 45 DAP pseudo-stems were degraded more than leaves (67.47±13.99 % and 46.90±5.76 %, respectively). Culturable populations of bacteria and fungi were not significantly ($P>0.05$) affected by nutrient management strategy but cellulose decomposers were significantly increased ($P=0.1$) with the application of PM. In conclusion, incorporation of PM in nutrient management has increased land productivity and initiated to change some soil properties in the studied banana plantation.

Keywords: Banana, Decomposition, Litter bag experiment, Nutrient management, Soil microorganisms

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Determination of the Diversity of Culturable Endophytic Microbial Population in the Leaves of Healthy and Circular Leaf Spot Disease Infected Rubber Plants

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Circular leaf spot disease (CLSD) is a newly-reported disease of rubber cultivation in Sri Lanka. Previous investigations have reported the possible involvement of *Colletotrichum* and *Pestalotiopsis* spp. as fungal pathogens of CLSD. However, etiology and management of the CLSD are not fully understood. Eventhough endophytic microbial populations are beneficial for plant health, their structural and functional imbalances promote disease development. The present study was aimed to determine the variation of endophytic microbial diversity of the leaves of healthy and CLSD-infected rubber plants and to screen biological control agents of pathogenic fungi among the endophytic microbes in healthy and early CLSD-developmental stages. Healthy and symptomatic leaves of the four stages of CLSD development (i.e. S1, S2, S3 and S4) were collected from two fields. Culturable endophytic fungi, bacteria and actinomycetes were isolated using specific media and morphospecies were recorded. Species richness (SR), species evenness (SE), relative abundance of the species (RA) and Shannon-Weiner diversity index (SWDI) of morphospecies were quantified. Forty one fungal and 25 bacterial morphospecies were isolated from healthy and different stages of CLSD from location 1 and it was 32 and 13, respectively for location 2. RA of bacteria and fungi significantly differed among the stages of disease progression ($P<0.05$) though SR, SWDI and SE of bacteria and fungi showed no significant difference with the disease progression stages. No endophytic actinomycetes were isolated. Two morphologically different *Colletotrichum* isolates and a *Pestalotiopsis* sp. were isolated from symptomatic rubber leaves and antagonistic effect against them by seven fungal and bacterial morphospecies residing in healthy and S1-stage leaves was assayed. Six of them inhibited the colony growth of the *Colletotrichum* and *Pestalotiopsis* isolates by a range of 20-100%, confirming the promise of endophytic fungi and bacteria in healthy and S1 stage leaves as biological control agents of CLSD.

Keywords: Antagonists, Endophytes, Microbial Diversity, Rubber Diseases

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Determining Optimum Nitrogen Requirements for Maize (*Zea mays* L.) Growth and Yield Using Response Surface Methodology

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Maize (*Zea mays* L.) is the second most important cereal crop in Sri Lanka and Nitrogen (N) management is crucial for maize as N is essential for growth and development. Objective of this study was to determine the optimum N requirements for Maize growth and yield using Response Surface Methodology (RSM). The study was conducted as a field experiment and the experimental design used was Central Composite Design (CCD). Basal dressing and top–dressing applications were considered as factors of the study, and the levels of the two factors were identified as defined by the design. The experiment was conducted under rainfed condition at the university experimental station, Dodangolla. The maize variety Pacific was sown on December 01, 2023. All management practices except N fertilizer were done according to the recommendations of Department of Agriculture (DOA). Total dry weight and leaf area per plant were measured at 50% tasseling stage. Final yields under each treatment were determined at the maturity stage. Data analysis was done using R Studio statistical software. Response surface models were developed to analyze the relationship between each of the response variables; dry matter production, and yield vs N application combinations incorporating both linear and quadratic effects. The results revealed that optimum N fertilizer rates to get the maximum dry matter production at the tasseling stage was 45.9 and 322 kg/ ha for basal and top dressings, respectively. However, RSM analysis for yield revealed that increasing urea application beyond the DOA recommendation led to a notable increase in yield, suggesting that the DOA recommended N level is not adequate during the periods of heavy rainfall as the crop experienced heavy rainfall during basal dressing and top–dressing applications. These insights highlighted the potential of RSM method in evaluating N response in Maize.

Keywords: Basal–dressing and top–dressing, Central composite design, Fertilizer rates, Linear and quadratic effects, Nitrogen application, Yield optimization

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Development of a Nitrogen Fertilizer with Enhanced Efficiency using Biochar and Urease Inhibitors for Maize

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Efficiency of use of urea in Maize (*Zea mays* L.) cultivation is very low (30%-40%) and the efficiency enhancing technologies available are either costly or not environmentally friendly. This study attempted to develop a new efficiency enhanced N fertilizer using urea (U), a duel-active urease inhibitor (Limus®) and rice husk biochar (BC). Effects of the new product on N dynamics in soil, N uptake and growth of Maize were studied. Urea and the inhibitor (I) were intercalated into BC and pelletized to produce a new slow-release urea fertilizer (SRU-I). Using leaching columns, the effects of U, U+I, SRU-I, previously developed biochar based slow-release urea fertilizer without inhibitors (SRU), and no N (0U) treatments on dynamics of pore water NO_3^--N and NH_4^+-N contents in an Alfisol were studied. A field experiment was conducted with Maize (*Zea mays* L.) plants using 0, 50, 75 and 100% of recommended N as U (0U, 50U, 75U and 100U, respectively), 50 and 75% N as SRU-I (50SRU-I and 75SRU-I, respectively), and 75% N as SRU (75SRU). Cumulative NH_4^+-N contents in leachates of U+I was the highest ($P<0.05$). Rate of NH_4^+-N release during 20 to 30 days after incubation (DAI) were significantly higher in SRU-I than that of SRU and U+I, suggesting better slow-release properties. Treatments U+I, SRU-I and SRU, had a significantly higher cumulative NO_3^--N content than 0U and 100U from 6 to 30 DAI and the highest was in SRU-I. In the field experiment, SPAD reading at V7 stage in SRU treatments were statistically not different ($P>0.05$) from 100U. Shoot N recovery efficiency of 50SRU-I at V7 stage (0.48 kg/kg) was significantly ($P<0.1$) higher than 100U (0.32 kg/kg) but comparable to 50U (0.47 kg/kg). The newly developed SRU-I has the potential to increase the efficiency of urea in Maize cultivated in Alfisols.

Keywords: Biochar, Fertilizer use efficiency, Maize, Nitrogen dynamics, Urease inhibitor

We acknowledge Dimo Agribusiness for providing Limus® and their immense support during the field experiment.

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Development of a Protocol to Estimate Sap-sucking Insect Populations in Greenhouses

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Whiteflies, thrips, aphids, and mites are common sap-sucking pests in greenhouses. Population management relies on insecticides and management decisions are made based on population levels. Population estimation methods suit for local greenhouses are not available; hence, this study was conducted with the objective of developing sampling protocols to assess the sap sucking insect populations in green houses. Protocols were developed for whitefly in brinjal, thrips in capsicum and aphids in pak-choi in greenhouses of Lassana Agri Innovations (Pvt) Ltd. Walpita. Plants were examined to estimate the actual population levels, subsequently, six sampling methods: plants on a paths of X, Z, star, triangle, circle shapes, were selected. Random sample was also taken. Comparisons were made among estimates of different methods to select most suited method with accurate representation of the actual population. Whitefly adult population (#/plant) in flowering brinjal (6.9±4.2) was correctly estimated in all sampling methods except in triangle method. When plant number was reduced progressively in each method, 10 plants in X-shape gave an estimation (6.9±4.2) similar to the actual whitefly population. Estimations of total whitefly (adult and nymph) and nymph populations in flowering brinjal were not significantly ($P>0.05$) different among sampling methods. In fruiting brinjal, whitefly adult (106.5±8.5) and total whitefly populations (165.5±4.9) were correctly estimated in all sampling methods. When plant number was reduced progressively in each method, 10 plants in circle-shape gave an estimation (108.9±8.7), similar to actual whitefly population. Estimations of nymph populations were not significantly ($P<0.05$) different among sampling methods. Following the same procedure for other crops, 10 plants in X-shape gave an estimation (111.1±27.5) closest to the actual aphid population in pak-choi and 10 plants in X-shape method (12.31±1.84) in capsicum for thrips population.

Keywords: Aphids, Brinjal, Greenhouses, Sampling, Whitefly

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Development of Chicken Foregut for Efficient Feed Utilization Through Incorporating Insoluble Fiber in Broiler Starter Diet

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The influence of insoluble fiber on growth performance, nutrient, and energy utilization, and foregut organ development of broiler starters (d 1-21) fed mash diets were evaluated. Four dietary treatments with control and 3 insoluble fiber sources (rice hulls, lentil hulls, and wood shavings) at an inclusion level of 60 g/kg (w/w) were developed. All fiber types were ground using a roller mill to pass through a 1.0 mm screen. A total of 120, one-day-old broilers (6 birds/cage; 5 cages/treatment) were used in a completely randomized design. No difference ($P>0.05$) in growth performance parameters was observed during week 1. Beyond d14, however, birds fed control and rice hull diets showed the lowest ($P<0.05$) feed conversion ratio (FCR; 1.079 and 1.129, respectively). Overall growth performance (d 1-21) results showed that birds fed the control diet had the highest ($P<0.05$) body weight gain (1146 g/bird), and lowest feed intake (1,402 g/bird). Birds fed rice hulls and lentil hulls had lower ($P<0.05$) gizzard pH (2.969 and 2.986, respectively) compared to wood shavings diets. Birds fed rice hulls and wood shavings had an improved ($P<0.05$) crop development (3.246 and 3.261g/kg of body weight, respectively) compared to the control, whilst the relative weight of gizzard of birds fed rice hulls was 19.2% higher compared to those fed control (14.58 vs 12.23 g/kg of body weight). Despite being considered a nutrient diluent, insoluble fiber did not impair ($P>0.05$) the gross energy, nitrogen-corrected apparent metabolizable energy, and protein and fat digestibility compared to the control. Overall, including 60g rice hulls/kg diet showed the highest improvement in gizzard growth and consequent low gizzard pH signaling the potential anti-microbial impact on poultry gut, hence suggesting the potential manipulation of fiber as a functional ingredient in broiler starter diets.

Keywords: Broiler starter, Feed utilization, Gizzard pH, Insoluble fiber

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Development of Composite Starch Blends for the Production of Boba Pearls and Assessment of their Physicochemical Properties

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Bubble tea containing tapioca pearls has a universal appeal knows no bounds, enchanting consumers of every age and background worldwide. These pearls are traditionally crafted from tapioca starch, but it's limited utilization in product development is attributed to its higher cyanide content, perishability, and elevated glycemic index. Therefore, the objective of this study was to develop composite starch mixtures for the production of boba pearls and to assess physicochemical properties of starch mixtures and boba pearls. Present study utilized sweet potato (*Ipomoea batatas*) and *kiri ala* (*Colocasia esculenta*) starch in evaluating potentiality of making boba, due to their higher abundance, starch yield and enhanced nutritional properties. The main formulations employed were T (control – 100% tapioca), TS (35% tapioca + 65% sweet potato), TK (35% tapioca + 65% *kiri ala*), TSK (35% tapioca + 35% sweet potato + 30% *kiri ala*), and SK (55% sweet potato + 45% *kiri ala*). Native starches and starch mixtures were subject to comprehensive evaluation, encompassing amylose content, color, pH, morphology, and functional properties. The produced pearls underwent assessment based on their cooking performance, sensory attributes, and texture profile analysis. The boba pearls produced from TS treatment emerged as the optimal formulation as it exhibited consumer acceptance comparable to the control sample, with no statistically significant difference in assessed attributes ($P>0.05$). It demonstrated superior cooking performance, resulting shorter cooking time, lower cooking loss, and higher water absorption percentage (1.37 min, 3.56%, and 53.99%, respectively), along with improved textural properties, notably reduced chewiness. Furthermore, the incorporation of various starches significantly enhanced cooking, textural, and sensory properties of the boba pearls. In conclusion, this investigation highlights sweet potato starch as an effective ingredient for enhancing the production of boba pearls with better cooking performance and organoleptic properties.

Keywords: Boba pearls, Tapioca starch, Sweet potato starch, *Kiri ala* starch, Sensory attributes, Cooking performance, Textural analysis

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Diversity and Distribution of Aphids (Aphididae) in the Garden of University of Peradeniya, Sri Lanka

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Aphids (Hemiptera: Aphididae) are tiny soft-bodied sap-feeding insects. In Sri Lanka, 84 species of aphids in 46 genera and six subfamilies have been reported previously. The garden of University of Peradeniya has been scouted for aphids in 1994 and an annotated list of 17 species of aphids with their host plants has been published. This study was conducted to identify the present diversity and distribution of aphid species in the garden of University of Peradeniya. Flora from ground to approximately 1.5 m high canopy was scouted in an area around 250 ha, in the vicinity of nine faculties, residential halls, Meewatura and Mawalawatta field Stations from December 2023 to February 2024. Live photographs of aphid samples were taken in their natural habitat and in the laboratory. Seventy-five samples were collected and permanent slides were prepared for morphological identification. From the collected specimens, ten species were identified, where eight were taxonomically identified up to species level belonging to six genera and two subfamilies (Aphidinae, Greenidenae). Out of the identified eight species, six had been previously recorded in Sri Lanka while three species were included in the annotated list prepared in 1994. Two species, namely; *Brevicoryne brassicae* L. and *Greenidia psidii* van der Foot were not previously been reported in Sri Lanka. An annotated list was prepared for the identified aphid species along with the host plant, habitat, ant-aphid association and presence of natural enemies. The highest distribution was shown by *Aphis gossypi* Glover. It was the most polyphagous species; collected from the 15 plant species and was found in four different color morphs. Ant-aphid association was observed; in seven species. Continuation of this study, coupled with further sample collection, will be helpful to identify the changes in the species diversity of family Aphididae in the garden of University of Peradeniya after 30 years.

Keywords: Aphididae, Distribution, Diversity, Host Plants, Parasitoids

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Diversity of Weed Flora in Paddy Fields at the Rice Research and Development Institute at Batalagoda in Sri Lanka

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Understanding the diversity of weed flora in agricultural ecosystems is crucial for designing and adopting effective weed management strategies. In this study, weed growth and its spatial dynamics were studied in four different field conditions at the Rice Research and Development Institute (RRDI), Batalagoda, Sri Lanka. The fields evaluated included organic-transplanted (OT), fallowed-transplanted (FT), synthetic fertilizer (SF)-applied and transplanted (SFT) and SF-broadcasted (SFB) fields. Weed samples were collected at seedling (3 weeks after planting; WAP), heading (6 WAP) and maturity stages (9 WAP) of the rice crop using 0.5 m × 0.5 m quadrats. *Monochoria vaginalis* (broadleaf) emerged as the dominant weed species in the OT field during the seedling and heading stages of rice crop while *Isachne globosa* (grass) was prominent during the maturity stage of the crop. *Isachne globosa* dominated the FT field throughout all growth stages of the rice crop, while *Fimbristylis miliacea* (sedge) thrived in the SFT, and *I. globosa* prevailed in the SFB. Both Shannon-Weaver Index and Simpson's Diversity Index indicated that the OT fields had a highly diverse weed community across all growth stages of the rice crop thus affecting the over crop yield. Furthermore, weed dry weight showed distinct trends in weed biomass among broadleaf weeds, grasses and sedges across different field conditions and growth stages of rice crop. Overall, this study underscores the importance of considering field conditions and growth stages of the rice crop in planning and adopting weed management strategies, with implications for sustainable agriculture practices and biodiversity conservation. The findings of the study provide valuable insights for developing targeted weed control measures to specific agricultural contexts, ultimately contributing to enhanced crop productivity and environment conservation.

Keywords: Plant diversity, Paddy fields, Sri Lanka, Weed flora

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Effect of 17 α- Methyl Testosterone for the Masculinization Rate of Guppy Fry

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Guppy (*Poecilia reticulata*) is one the most widely cultured tropical aquarium fish species of the Poeciliidae family. In this study, the masculinization rate of guppy fry was evaluated using 17 α- Methyl Testosterone at different concentrations ((25(T1), 50(T2), 75(T3) mg/kg)). The hormone was incorporated into nursery feed by dissolving in ethanol. Simultaneously, dipping treatment was conducted using different concentrations of 17 α- Methyl Testosterone ((0.847(T4), 1.27(T5), 1.69(T6) mg/L)). For each concentration, 3 replicates were used. Feeding was orally administered to hatchlings throughout the labile period of 21 days. The sex ratio was determined by using secondary sexual characters: Female was identified using gravid spot, while the time taken for colour development and gonopodium were used to differentiate males. In feed treatment, the highest masculinization rate of 88.33% was obtained from T3, and the lowest of 76.19% was obtained from T1. In dipping treatment, the highest masculinization rate 86.33% was obtained from T6, and the lowest 77.18% was obtained from T5. The highest survival rate of 74.29% was obtained from the control and the lowest survival rate of 31.429% was obtained from T6. There was a significant difference in the masculinization rate in hormonal treatment compared to the control. Therefore, incorporating 17 α-methyl testosterone into guppy feed can be utilized as a cost-effective method compared to dip treatment to increase the masculinization rate of guppies.

Keywords: 17 α- Methyl Testosterone, Gravid spot, *Poecilia reticulata*, Sex reversal, Survival rate

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Effect of Amino Acid (Methionine+Lysine) Enriched Rotifer (*Euchlanis dilatata*) on G rowth, Survival and Colour Enhancement of Guppy (*Poecilia reticulata*) During Nursery Period

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Guppy (*Poecilia reticulata*) is among the most popular tropical ornamental fish in the world. Sri Lanka has been the top guppy exporter for the last few decades. Fulfilling nutrient requirement throughout their nursery period is crucial. The effect of feeding with methionine and lysine-enriched freshwater rotifers (*Euchlanis dilatate*) on larval growth, colour enhancement and survival in the guppy (variety- golden tuxedo) was investigated. Four treatments were allocated in triplicate. As treatments, enriched with commercial methionine only and lysine only supplement (900mg/L) respectively, and enriched with combination of methionine and lysine (450mg/L each) were used along with the control group without enrichment. The guppy fry (initial wet weight=65.13±7.069mg) were fed amino acid-enriched rotifers, from the day after birth for 35 days. Growth performance was recorded from 15 days of age to 35 days of age in five-day interval. Colour and survival data were recorded at the 35 days of age. Experiment was done in CRD and data were analyzed using a two-way ANOVA. The growth rate of the fry, fed enriched rotifers with combined 450mg/L methionine and lysine supplementation was significantly higher than other treatments ($P<0.05$). The growth rates of the treatments with only methionine and only lysine were not significantly different ($P<0.05$), but they were lower than the treatment with combined methionine and lysine, which was significantly higher than the control. Survival rate of combined methionine and lysine treatment (96.67±1.892%) was significantly ($P<0.05$) higher than the control. The colour enhancement of combined methionine and lysine treatment and only-methionine treatment was significantly ($P<0.05$) higher than that of the control and only-lysine treatment. The results of this study indicate that guppy (variety- golden tuxedo) larvae benefited from combined methionine and lysine enriched rotifers than non-enriched rotifers.

Keywords: Enrichment, Guppy, Lysine, Methionine, Rotifer

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Effect of Combined Application of Compost and Biochar on the Availability of Some Plant Nutrients and Growth Response of *Hevea* Seedlings

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Although the combined application of biochar and compost offers a potential solution to low macronutrient availability, concerns have arisen related to potential reductions in micronutrient availability. This study investigated the effects of biochar and compost application at different ratios on the plant availability of P, Zn, and Cu in an Alfisol and an Ultisol. All combinations of 0, 0.5, and 2% (w/w) rubberwood biochar (BC) and poultry litter compost (COM) were applied to the two soils. Both amended and unamended soils were incubated for 7 and 42 days at 60% of the water-holding capacity and room temperature. A young budding nursery experiment was conducted using rubber (*Hevea brasiliensis* Agr. Mul.) seedlings grown in the Ultisol, to measure the growth response (girth and height) to different combinations of COM and BC rates (0, 2, and 5%, w/w). Mehlich-3 extractable (M3) P, Cu and Zn were higher in Alfisol (15.3, 7.42 and 0.78 µg/g, respectively) compared to that of Ultisol (3.03, 5.16 and 0.18 µg/g, respectively), and the M3-Zn contents were deficient in both soils. The M3-Cu was significantly ($P<0.001$) high when soils were amended with 2% BC, irrespective of the COM rate in both soils and at both times. However, M3-Zn contents were significantly high in 2% COM amended soils and the highest was observed in the 2% COM + 2% BC treatment. The M3-P contents increased with increasing COM rates at 7 days but only at 2% COM rates at 42 days. Growth responses of *Hevea* seedlings after 30 days showed no significant differences ($P>0.05$) among treatments. Results indicated that the combined application enhances the plant availability of Zn, Cu, and P in soils used, but it is too early to comment on their impact on the growth of *Hevea* seedlings.

Keywords: Biochar, Nutrient availability, Poultry litter compost, Rubber nursery, Growth response, *Hevea*

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Effect of Dietary Inclusion of Seaweeds on Growth Performance of Fish: A Meta-analysis

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Seaweed has gained attention over the years as a sustainable source of aquafeeds. An increasing number of studies have reported the effects of dietary seaweed on fish species with varying degrees of success. In the present study, we investigated the effects of dietary seaweed on the growth performance of fish using a meta-analytical approach. The databases WEB OF SCIENCE (1971-2023) and SCOPUS (1934-2023) were searched systematically to select studies for the analysis, and 138 studies were used for the analysis. The differences in growth performance parameters (i.e., feed intake, specific growth rate, and feed conversion ratio) between the fish-fed control diets and seaweed diets were calculated using a standardized effect size; Hedges'g. The meta-analysis indicated that dietary inclusion of seaweed improved the specific growth rate compared to those fed control diet. Nevertheless, there were no differences in feed conversion ratio and feed intake between the groups fed seaweed diets and control diets. Cochran's Q test showed that there was a heterogeneity in specific growth rate and feed conversion ratio but no heterogeneity in feed intake. A meta-regression was performed to investigate potential reasons for variations in specific growth rate and feed conversion ratio among the studies, and fish species, seaweed species, seaweed inclusion level, and replaced ingredients partially explained the heterogeneity. Subgroup analysis showed that the dietary inclusion of seaweed improved the specific growth rate of Nile tilapia and Rohu but not affected in Atlantic salmon, rainbow trout and Asian seabass. Furthermore, low seaweed levels in diets enhanced specific growth rate of fish, while high levels (i.e. over 20%) decreased specific growth rate. The meta-analysis suggests that dietary inclusion of seaweed can enhance fish growth, but its effectiveness depends on fish species, seaweed species, inclusion level, and the replaced protein sources by seaweed in diets.

Keywords: Fish, Growth performance, Meta-analysis, Seaweed

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Effect of Different Compost Tea as a Foliar Fertilizer on Growth and Yield of Lettuce

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Lettuce, scientifically known as *Lactuca sativa* L., is a widely consumed leafy green in Sri Lanka. In lettuce cultivation, heavy reliance is placed on inorganic fertilizers. However, due to growing concerns about human health and environmental damage caused by excessive use of synthetic fertilizers, there is a rising demand for organically cultivated lettuce. To address this, a study was undertaken to assess the impact of different types of compost teas on the growth and yield of lettuce. The research was carried out using a complete randomized design with four replicates for each treatment within a protected plant house at the University Experimental Station in Dodangolla, Kundasale. The treatments included different types of compost teas: Poultry manure-based compost tea, vermicompost tea, compost tea derived from black soldier fly larval compost, Albert's solution, and no fertilizer treatment. Immature brown loam (IBL) soil and reddish-brown latosol (RBL) soil were used as the growth media. The growth and yield of the plants were assessed based on different parameters, including the number of leaves, leaf area index, fresh weight of biomass, dry weight of biomass, relative chlorophyll content, leaf nutrients, and soil nutrient contents. Mean differences among all the parameters examined in relation to the treatments became significant, at the confidence level of $p < 0.05$. Overall, there was a significant growth and yield improvement in the plants treated with poultry manure-based compost tea. The mean difference in the relative chlorophyll content in leaves in both IBL and RBL soil media was not significant. The poultry manure-based compost tea and vermicompost tea also led to the greatest increase in soil nutrient levels. The IBL medium gave better performance than the RBL medium in relation to the all-measured parameters.

Keywords: Compost teas, Growth and yield, IBL and RBL soil, Lettuce, Organic fertilizer

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Effect of Different Grow Media and Fertilizer Ratios on the Growth and Yield of Iceberg Lettuce (*Lactuca sativa* var. Capitata)

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Iceberg lettuce (*Lactuca sativa* var. Capitata), which belongs to the family Asteraceae, is globally renowned and widely consumed, particularly in salads for its perceived health benefits. Iceberg lettuce remains relatively uncommon in Sri Lanka, predominantly growing in cooler climates. There is no fertilizer recommendation or directions for suitable grow media for Iceberg lettuce production under the climatic conditions in the upcountry, Sri Lanka. This research focused on examining the effect of selected grow media and fertigation options on the vegetative growth and yield of Iceberg lettuce. The research was conducted in a soft plastic-covered tunnel greenhouse at Lindula (WU1), Sri Lanka. It was conducted as a single-factor CRD, with a treatment combination of grow media and fertilization options. Grow media compositions varied with different ratios of topsoil, coco chips, half-burn paddy husk, and compost. Regular disease observations were conducted, and data collection included parameters, including plant height, fresh weight and dry weight of the whole plant, chlorophyll content of leaves, fresh weight, dry weight , and size of heads. Plant height, leaf parameters, and head characteristics varied significantly among treatments, highlighting the effect of fertilizer mixtures and grow media. Leaf color and chlorophyll content of leaves indicated a lesser impact on the head formation of Iceberg lettuce across the treatments. Treatment 4 (Coir: half burnt paddy husk: topsoil - 1:1:2) was the overall best combination for Iceberg lettuce cultivation. Continuous monitoring and adjustments based on specific environmental conditions are recommended for sustainable and profitable lettuce cultivation. The information generated would be useful for drafting a farmers' guide on Iceberg lettuce cultivation.

Keywords: Fertilizer schedule, Grow media, Iceberg lettuce, Protected culture

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Effect of Poultry Manure Application on the Abundance of Bacteria Resistant to Arsenic and Antibiotics in Coconut Grown Soils

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A study was conducted to investigate whether the application of poultry manure increases the abundance of antibiotic resistant and arsenic resistant bacteria populations in coconut grown soils. Three coconut estates, each with a history of more than 10 years of application of either poultry manure (PM) or chemical fertilizer (CF) according to recommendations of Coconut Research Institute were selected for this study. Representative soil samples were collected from the manure circle (n=5) and about 0.5 m away from manure circle (n=3) at a depth of 0-25 cm from each estate. In total, 48 soil samples were analyzed for pH, electrical conductivity, available arsenic concentration, and organic carbon content. Total culturable bacteria population and bacteria resistant to arsenic (1 ppm and 5 mg/kg), tetracycline (10 mg/kg), and amoxicillin (10 mg/kg) were enumerated using 0.3% Tryptic Soy Agar medium in spread plate technique. The percentage of amoxicillin and tetracycline resistant bacteria populations were significantly higher ($P<0.05$) in PM added fields compared to CF added fields. Fertilizer type did not have a significant effect ($P>0.05$) on percentage of arsenic resistant bacteria populations. Percentage of antibiotic resistant bacteria was significantly higher ($P<0.05$) in soil samples collected from manure circle compared to soil taken away from it, in each treatment. The abundance of arsenic resistant bacterial population significantly correlated with both amoxicillin resistant ($r^2 = 0.912$) and tetracycline resistant ($r^2 = 0.864$) bacterial populations. Therefore, application of PM has increased the antibiotic resistant bacterial populations in studied soils but not the arsenic resistant bacterial populations. Remedial measures should be taken to reduce addition of antibiotics and antibiotic resistant determinants along with PM into coconut cultivated soils.

Keywords: Amoxycillin, Antibiotic resistance, Arsenic resistance, Metal resistance, Tetracycline

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Effect of Supplementary Green Light on Physiology and Morphology of Ornamental Plants

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Light serves as a fundamental factor influencing the physiology and morphology of plants. Different wavelengths of light exert distinct effects on plant growth and development. Despite being considered less effective for photosynthesis compared to red or blue light, recent research has highlighted the specific physiological and morphological responses elicited by green light from seed germination to flowering. In recent years, there has been a growing trend in research focusing on the effects of green light supplementation on plant growth and development. The use of artificial or supplementary lighting became essential in controlled environments to ensure optimal light conditions for plant cultivation. Moreover, advancements in LED technology have facilitated precise control over light spectra, enabling researchers to explore the potential benefits of green light supplementation for plant growth and development. In this study, two Coleus (*Plectranthus scutellarioides*) varieties (Green and Red) and *Dracaena sanderiana* 'Gold' were irradiated with green light intensities of 50 and 100 $\mu molm^{-2}s^{-1}$ for 12 hours per day using LED lamps (peak wavelength: 519 nm) under controlled natural light conditions. There was a control group without supplemental light. According to the results, supplemental green light improved the photosynthetic performance and plant growth parameters (leaf number, leaf area, fresh and dry weight) compared to the control group. The performance index, a chlorophyll fluorescence-derived parameter, was high ($p<0.05$) in treatments with green light in all species, while chlorophyll and anthocyanin levels were higher in the control group. No significant differences were observed between the two light intensities in the assessed parameters. Based on the results, it can be concluded that green light supplementation positively impacts the growth and photosynthetic performance of the studied plant species.

Keywords: Chlorophyll fluorescence, LED, Performance index, Supplementary green light

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Effects of Methyl Jasmonate on Product Synthesis of *Gyrinops walla* Shoots Under Solid Culture

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Gyrinops walla which is commonly known as "Wallapatta" is an agarwood producing endemic plant to Sri Lanka. The production of agarwood occurs as responses to external damages that happen to the *G. walla* plant. Agarwood is an expensive constituent in perfumery and cosmetic industry. In-vitro propagation of *G. walla* has been identified as a better alternative for the sustainable harvesting and agarwood production due to the rare presence of natural agarwood and its high price. Furthermore, different elicitors have been identified to induce artificial agarwood production. This study was carried out to identify the effects of different concentration of methyl jasmonate (MeJA) as an elicitor on the growth and the product synthesis of *G. walla* under solid cultures. Murashige and Skoog (MS) medium supplemented with 1.0 mg/L Benzylaminopurine (BAP), 0.1 mg/L Indolebutric Acid (IBA), 100 mg/L Myoinositol, 40 g/L sucrose and 2.0 g/L Phytagel either with 0, 0.1, 1, 10, and 100 µmol MeJA were used as the treatments. Approximately 0.5 g of *G. walla* shoots were cultured in one unit and growth measurements were obtained at weekly intervals. Results showed significant differences between treatments for the growth at α=0.05 probability level ($P < 0.0001$). Among the treatments 0.1 µmol MeJA showed highest growth rate (0.0354 g/days) and lowest cell doubling time (19.58 days). Based on the Thin Layer Chromatography fingerprint profile, all the tissue cultured samples showed the presence of similar compounds in the agarwood at Rf= 0.96, 0.93, 0.86, 0.79 and 0.50, and all the samples elicited with MeJA had more compounds. Most of the compounds produced at 0.1 µmol MeJA treatment had thicker bands compared to all the other treatments. Therefore, it can be concluded that MeJA can be used as an elicitor for promoting the growth and product synthesis of *G. walla.*

Keywords: Agarwood, Thin layer chromatography

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Efficacy of African Marigold (*Tagetes erecta* L.) in Cabbage Insect Pest Management in Sri Lanka

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Cabbage (*Brassica oleracea* var. *capitata*) cultivation in Sri Lanka relies heavily on synthetic insecticides, leading to lower profits and increased environmental risks. Therefore, exploring alternative insect pest management strategies remains beneficial. This study investigated African marigold (*Tagetes erecta*)-based insect pest management strategies, focusing on the control of major leaf eating caterpillar pests of cabbage in Sri Lanka. The experiment was conducted as a Randomized Complete Block Design with three replicates and five treatments. Those included; untreated cabbage crops (control), cabbage treated with Department of Agriculture recommended synthetic insecticides, cabbage treated with marigold water extract (50 g fresh weight/1L), and cabbage intercropped with marigold using additive and replacement series. The research farm at Mahailluppallama sub-campus, Faculty of Agriculture, University of Peradeniya located in the DL1b agro-ecological region was used for the experiment from late 2023 to early 2024. Results showed that synthetic insecticides and additive intercropping reduced the caterpillar pest abundance by 62.8% compared to the control, whereas replacement intercropping reduced it by 22.1%. In contrast, the marigold water extract significantly increased ($P<0.05$) the caterpillar pest abundance showing its ineffectiveness against cabbage leaf eating caterpillar control. Moreover, the abundance of beneficial insects was significantly increased by additive and replacement intercropping (86% and 80%, respectively) while was significantly decreased by the use of synthetic insecticides (−72%). Marigold water extract demonstrated no significant differences in beneficial insect abundance with the control. Cabbage growth showed no significant variation across treatments, confirming intercropping had no negative impact on cabbage growth. When the cost and benefit were considered, additive intercropping was preferred over replacement intercropping due to the higher cash crop plant density leading to a higher yield. Therefore, marigold additive intercropping presents a valuable agronomic mechanism for cabbage insect pest management in Sri Lanka.

Keywords: Additive intercropping, Beneficial insects, Replacement intercropping

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Enhancement of Product Synthesis of Gyrinops Walla Shoot Cultures by Elicitation with Salicylic Acid Under Liquid Culture System

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Gyrinops walla (*walla patta*) is a plant species, which can produce a resinous compound known as 'Agarwood'. The tissue culture technique can be applied for product synthesis and rapid multiplication. This study was carried out to Identify the correct time of application of salicylic acid (SA) for maximum product synthesis from shoot cultures of *G. walla* under *in-vitro* conditions. *Gyrinops walla* shoots were grown in full-strength MS (Murashige and Skoog) medium supplemented with 1 mg/L of BAP+ 0.1 mg/L of IBA without a solidifying agent and the effect of different times of Salicylic acid application on product synthesis was investigated. Thin Layer Chromatography (TLC) technique was used to find out the phytochemical constituents of ethyl acetate extracts of natural agarwood, control, and elicited shoots. Liquid culture medium was incorporated with 1000 µmol SA on the fifth week (T1), seventh week (T2), eighth week (T3), and ninth week (T4) after culturing. After the tenth week, all treated, and control samples were harvested and freeze-dried. Samples and agarwood were extracted, and TLC was performed. TLC results of samples revealed that the synthesis of chemical constituents was higher in elicited shoots than in non-elicited shoots. Similar compounds present in all treatments including control and agarwood extract at Rf values of 0.31 and 0.75 could be used as possible markers for *G. walla*. Then statistical analysis was performed using the TLC scores. The medium supplemented with 1000 µmol of SA on the seventh week (T2) showed significantly ($p<0.05$) the highest presence of chemical compounds followed by T1 and T3 compared to the control (T5). TLC fingerprint profile revealed proved the presence of similar phytochemicals in shoot cultures and agarwood extracts. Thus, it can be concluded that there is a possibility to produce similar compounds that are present in natural agarwood through shoot cultures.

Keywords: Agarwood, *Gyrinops walla*, Liquid culture, Salicylic acid, Thin layer chromatography

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Enhancing Seed Germination and Seedling Growth of *Solanum virginianum* L. (Katuwelbatu)

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Solanum virginianum L. (Katuwelbatu) is an important medicinal herb in Ayurvedic medicine. The present study was conducted to evaluate the impact of different types of growing media (substrate) and *Trichoderma* inoculation on seed germination and seedlings growth of Katuwelbatu. Seedling growth performance of Katuwelbatu in four different growing media comprised of compost 1 (Produced by Link Natural Product (Pvt) Ltd.)+sand+ soil (2:1:1) (M1- control), compost 1+ half burnt paddy husk (1:1) (M2), compost 2 (commercially available1)+ half burnt paddy husk (1:1) (M3), compost 3 (commercially available 2)+ half burnt paddy husk (1:1) (M4) with and without the application of *Trichoderma* inoculum (T1 and T2, respectively), were investigated. Seed germination and seedling growth of Katuwelbatu and substrate parameters were measured. Results showed that the germination percentage of Katuwelbatu in different growing media was significantly ($p<0.01$) different. M2 growing medium showed significantly ($p<0.05$) higher plant growth concerning the shoot dry weight, shoot length, and root dry weight than the growing medium M3 and M4. Application of *Trichoderma* (T1) showed a significant ($p<0.05$) increase in root dry weight and reduction in leaf nitrogen content. When considering the bio-control effect of the *Trichoderma* application, the M3 growing medium can be selected as the best-growing medium for *Trichoderma* application. Hence, growing medium M2 could be selected as a cost-effective alternative growing medium to replace the M1 growing medium used at the farm for Katuwelbatu seedling production.

Keywords: Compost, Growing media, *Solanum virginianum* L, *Trichoderma*

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Evaluating Different Coir-based Substrate Mixtures on The Growth of Salad Cucumber (*Cucumis sativus*) in Protected Agriculture under Varied Fertigation Frequencies

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A study was conducted to assess the effects of five coir-based growing media made with coir dust and coir chips (100% coir dust, 70% coir dust + 30% coir chips, 50% coir dust + 50% coir chips, 30% coir dust + 70% coir chips, and 100% coir chips) on the growth and yield of salad cucumber (*Cucumis sativus*) under four fertigation frequencies: daily fertigation with two splits (I1), daily fertigation with four splits (I2), fertigation at one-day intervals with two splits (I3), and fertigation at one-day intervals with four splits (I4). Water content at saturation (WCS), particle size distribution (PSD), bulk density (BD) of each coir-based growing media were determined. The volume of water drained from each growing media at the four fertigation frequencies was measured. Vine height, number of leaves, time to flowering initiation, as well as number of fruits and total fruit weight per plant per harvesting cycle were recorded. Significant differences ($P<0.05$) in PSD and BD among growth media resulted in varying volumes of drained water, indicating differences in water and nutrient loss. A significant ($P<0.05$) interaction between growth media and fertigation frequency on most parameters indicated that the effect of coir-substrate mixture on salad cucumber growth and yield was influenced by the fertigation frequency. Growth media with 100% chips exhibited significantly ($P<0.05$) inferior vegetative growth and yield across all fertigation frequencies. The growth media containing 50% coir dust + 50% coir chips resulted the highest significant salad cucumber yield when subjected to fertigation frequency I1, while the mixture with 70% coir dust + 30% coir chips also demonstrated comparable yield at fertigation frequency I2. These findings highlight the need for customized horticultural strategies, optimizing both fertigation schedules and substrate selection to enhance salad cucumber yield.

Keywords: Coir-based substrate, Fertigation, Salad cucumber

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Evaluation of Different Fruit Peel Powders as a Fertilizer Supplement in Growing Okra

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A balanced fertilizer application is needed to maintain high yields in crop production. Integrated fertilizer management is an effective way to achieve this. Fruit peels are a freely available material. This experiment was conducted to evaluate the efficacy of using fruit peel as a fertilizer supplement. Okra variety MI-5 was used as the indicator crop in this research study. Under the treatments recommended fertilizer quantities were partly replaced using different fruit peel powders. The experiment was conducted at the University Experimental Station Dodangolla, Kundasale. There were ten experimental treatments, which were arranged in a Complete Randomized Design with three replicates. Treatments are Recommended fertilizer (T1), No fertilizer (T2), 75%T1 + Banana peel powder 0.5tha^{-1} (T3), 50%T1+Banana peel powder 0.5tha^{-1}(T4), 25%T1+Banana peel powder 0.5tha^{-1}(T5), 100%Banana peel powder 0.5tha^{-1} (T6), 75%T1+Pomelo peel powder 0.5tha^{-1}(T7), 50%T1+Pomelo peel powder 0.5tha^{-1} (T8), 25% Pomelo peel powder 0.5tha^{-1}(T9), 100% Pomelo peel powder 0.5tha^{-1} (T10). Results showed that growth and yield components were significantly affected by the experimental treatments ($P<0.05$). The highest plant height was recorded under T1, T3, T7, T8 and T9 treatments. The highest stem girth was observed from T1, T3, T4, T5, T8 and T9 treatments. The highest relative chlorophyll content was observed from T1, T5, T7 and T9 treatments. T4 treatment yielded the highest fresh weight and dry weight of pods. The highest leaf dry weight was obtained from the T8 treatment. The highest root dry weight was obtained from the T1, T7 and T8 treatments. The highest stem dry weight was obtained from the T7 and T8 treatments. The longest pods were observed from the T3 treatment. The combination of inorganic fertilizer with dried fruit peel powders reduced the requirement of chemical fertilizers.

Keywords: Fruit peel powders, Minimizing the use of chemical fertilizer, Okra, Organic fertilizer supplements, Sustainable agriculture

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Evaluation of Different Trench Composting Methods used by the Vegetable Farmers in Nuwara Eliya Area

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This study evaluated trench composting methods used by vegetable farmers in the Nuwara Eliya area through a combined questionnaire-based survey and agronomic experiment. A questionnaire-based survey was conducted with 37 vegetable farms in Meepilmana, Kandapola, Ragala, Seetha Eliya, Hawa Eliya, and the Apple farm Mahakudugala areas. Based on the survey results, trench composting methods were categorized as utilizing sole application poultry manure, cattle manure, *Tithonia* (green manure), or combinations of Tithonia with cow manure or poultry manure. Subsequently, nutrient budgets were derived from survey outcomes and the Department of Agriculture recommendation for leek (Allium ampeloprasum) cultivation for specifying treatments. The field experiment was conducted at Manthreethenna in Ragala, Upcountry intermediate zone belonging to 7°01'27"N 80°52'31"E coordinates. Long summer leek (Allium ampeloprasum) was used as the model cop considering the farmer practices. Soil parameters such as total and available nitrogen, available phosphorus, exchangeable potassium, total carbon, pH, and electrical conductivity (EC) were measured, and soil C: N ratios were calculated. Plant parameters measured included shoot height, plant dry weight, nitrogen, phosphorus, and potassium content. Statistical analyses, employing repeated measures ANOVA with a significance level of $P < 0.05$ and the least significant difference, were applied for data interpretation. Results suggest that the combined application of poultry manure and cattle manure with *Tithonia* yields more favourable outcomes in terms of sustainability and soil health compared to sole applications. This study provides insights into nutrient dynamics within the trenches composting systems and offers practical guidance for farmers in Nuwara Eliya to better plan their agricultural practices and manage their soils.

Keywords: Nutrient dynamics, Poultry and cattle manure, *Tithonia*, Trench composting, Vegetable farming in Nuwara Eliya

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Evaluation of Millet Species for Their Resilience to Nitrogen and Moisture Co-limited Conditions

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Crop productivity has been very susceptible to a variety of biotic and abiotic challenges, which are expected to worsen as a result of global climate change. Among abiotic stresses, water and nitrogen (N) co-limited conditions impose a major impact on crop growth and yield. In light of rising agricultural expenses and abiotic stresses with an increasing global population to feed, millets have enormous potential for improving nutrition and food security. Therefore, this study was conducted with the aim of investigating the growth and yield responses of different millet species cultivated under drought and N-deficit conditions. A pot experiment was conducted in a glass house as a three-factor factorial in a completely randomized design. Three millet species (finger millet, foxtail millet, and proso millet) were cultivated under two moisture levels (80% moisture of the field capacity as well-water treatment and, 40% moisture of the field capacity as drought treatment) and two N levels (no-N application and with-N application to the recommendation of the Department of Agriculture, Sri Lanka). Tissue N accumulation of finger millet was comparatively lower ($P<0.05$) than in other two millets whereas N-use efficiency of finger millet increased compared to foxtail millet and proso millet. Root dry weight and root mass ratio of finger millet had a greater increase ($P<0.05$) than those of other two millet varieties. All three millet varieties produced similar panicle dry weights irrespective of the moisture level indicating their drought tolerance ability. However, N-limited conditions resulted a significant ($P<0.05$) yield reduction in finger millet and foxtail millet whereas proso millet was able to maintain similar panicle dry weight irrespective of the N availability under drought conditions and well-watered condition. Results confirm that all three millet species possess tolerance ability to drought stress while only proso millet can well-adapt to moisture and N co-limited conditions.

Keywords: Drought stress, Millet, Nitrogen limitation, Nitrogen uptake

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Evaluation of Plant Growth Promoting Attributes and Abiotic Stress Tolerance of Native Rhizobial Symbionts of Green Manure Crops (*Gliricidia sepium* & *Mimosa pudica*) G rown in Dry Zone, Sri Lanka

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Gliricidia sepium and *Mimosa pudica* are commonly found non-edible legumes used as green manure crops in the dry zone of Sri Lanka. This study was carried out to evaluate the potential of using the symbiotic rhizobia of the root nodules of these two legumes as biofertilizers in crop legume cultivation. Root nodule symbiotic rhizobia were isolated from the root nodules of *G. sepium* and *M. pudica* collected from 7 regions (Mahagalkadawala, Pandulagama, Maradankadawala, Kekirawa, Somapura, Dehiattakandiya, and Polonnaruwa) in the dry zone of Sri Lanka. A total of 28 rhizobial isolates were purified and screened for their plant growth-promoting traits i.e., nitrogen fixation, phosphate solubilization, and Indole acetic acid production. Eleven isolates were tested positive for the three traits. These 11 isolates were then tested for their tolerance for abiotic stress conditions i.e. extreme pH, temperature, and drought. Isolates DAGLR1, DAGLR2, DAMMR2, GGGLR2, and GGGLR3 showed the best tolerance for higher temperature conditions (25-45 ^{0}C). Isolates, PNGLR1 and PGGLR3 showed higher tolerance for acidic conditions, while DAMMR2 and GGGLR2 could tolerate basic conditions. GGGLR3 had the best tolerance for all the pH conditions tested. DAMMR2, GGGLR3, DAMMR1, DAGLR1, DAGLR2, and PNGLR1 isolates showed the highest tolerance for drought conditions (2-10% PEG concentration). Out of 28 isolates, DAMMR2 and GGGLR3 could be considered the best isolates which have higher abiotic stress tolerance and growth-promoting abilities. Additionally, the isolates, GGGLR3 and DAMMR2 exhibited antagonistic effects against the soil-born phytopathogen *Fusarium* spp. In conclusion, the isolates DAMMR2 and GGGLR3 have the potential to be utilized as a robust and efficient biofertilizer with plant pathogenic fungicidal effects upon further testing on crop legume cultivations in the dry zone of Sri Lanka.

Keywords: Antagonism, Dry zone, Green manure crops, Growth-promoting attributes, *Rhizobium* stress tolerance

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Evaluation of Quality of Kitchen Waste Compost Produced Using Black Soldier Fly Larvae (*Hermetia illucens*) and Bokashi Method

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Composting stands out as an effective recycling method for harnessing the rich nutritional content found in kitchen waste. Black Soldier Fly Larvae (BSFL) offers an appealing waste management approach, generating bio fertilizers in the process. This study aims to evaluate the quality of kitchen waste compost produced using BSFL Larvae (*Hermetia illucens*) and the Bokashi method, alongside assessing their chemical maturity. The treatments comprising traditional compost (T1), BSFL larvae compost (T2), and Bokashi compost (T3) were composed of a mixture of vegetable waste, fruit waste, bakery waste, and cooked rice in equal proportions (1:1:1:1 ratio). Weekly measurements were taken for temperature, electrical conductivity, and pH across all treatments ($P < 0.05$). After 45 days, measurements were taken for total nitrogen (N), available nitrogen, exchangeable potassium (K), available phosphorus (P), and organic carbon (OC) ($P < 0.05$). In treatment T2, there was a significant increase in the levels of total nitrogen (N), available nitrogen (NH_4^+ and NO_3^-), and exchangeable potassium (K) compared to treatments T1 and T3. Furthermore, all treatments demonstrated enhanced nutrient content relative to the initially added raw kitchen waste materials. This indicates the efficacy of the composting processes in enriching the nutrient profile of the final compost products. The seed germination rate was evaluated using radish seeds *(Raphanus sativus*) with 25% and 50% compost extraction ($P < 0.05$) to evaluate the maturity and phytotoxicity of compost. Higher compost concentration negatively affected radish seed germination and led to phytotoxicity. Treatment T2 demonstrated the highest quality compost among all treatments. Treatments T2 and T3 exhibited shorter composting periods compared to T1. The efficiency of T2 was observed to be low, potentially attributed to the type of Effective Microorganisms (EM) utilized in the experiment. Moreover, the pre-composting of T3 appeared to demand the presence of soil microbes for further decomposition due to low pH conditions.

Keywords: Bokashi Compost, BSFL compost, Compost quality, Phytotoxicity of compost, Recycling kitchen waste

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Evaluation of the Effects of Wavelength and Intensity of LED Lights Powered by Photovoltaics on Growth and Physiological Performance of Nursery Tea and Foliage Plants

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Agrophotovoltaics (APV) offers harnessing renewable solar energy harvesting in agriculture as a viable solution, minimizing the demand for energy generated through burning fossil fuel. The present study investigated the effects of an LED lighting system powered by solar photovoltaics on the growth and quality of nursery tea (cultivars TRI 3072 and TRI 2043) and foliage plants (*Dracaena sanderiana* 'Gold' and 'White' varieties) compared to that under blue and black shade nets. The (i) light spectrum quality and intensity and (ii) air temperature and humidity were measured by a spectroradiometer (SpectraPen mini, PSI) and using sensors respectively. Portable photosynthesis meter (LI-6400, Li-Cor Inc., USA) and fluorescence meter (Fluor Pen, FP 100) were used for photosynthesis rate and Chlorophyll fluorescence measurements. The contents of leaf chlorophyll, anthocyanin, polyphenol and leaf greenness, growth and total dry weights were also measured. The light spectrum under the blue and black nettings ranged between 317 nm to 886 nm, while a peak around 450 nm was observed under the APV system. Results showed that the Performance Index (PI) and stomatal conductance were significantly higher in plants under the APV system compared to other treatments. However, the rate of photosynthesis did not show consistent results with the treatments. Chlorophyll *a* was significantly higher under black shade net compared to other treatments, and the total chlorophyll was higher under APV. Increased anthocyanin content under black netting only in cultivar TRI 2043 and polyphenol content under blue netting in TRI 2043 were also evident. Although performance of photosynthetic light reactions improved as shown by PI of both tea and *Dracaena* under APV, total dry weight was significantly higher under blue net compared to other treatments in tea and Dracaena. None of the treatments showed significant differences in leaf greenness, leaf area, and plant height of tea and *Dracaena*.

Keywords: Chlorophyll fluorescence, Foliage plants, LED light system, Nursery tea, Photosynthesis, Photovoltaic system
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Evaluation of the Grain Quality Parameters of Selected Traditional and Improved Rice Varieties in Sri Lanka

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Traditional rice varieties (*Oryza sativa* L.) grown in Sri Lanka has high demand in the consumer market due to their health benefits. This study focused on identifying the most comparable red and white traditional rice varieties to selected improved rice varieties while providing information on characteristics of "Nipponbare" a *Japonica* rice variety. Significant differences were observed ($P<0.05$) in the milling quality of red and white varieties except bran percentage. Head rice percentages ranged between 25 to 77% for red rice and 61 to 75% for white rice varieties. The broken rice percentages varied from 0 to 47% for red rice and 1 to 44% for white rice varieties, while Nipponbare exhibited a 48.77±0.88% head rice and 20.78±1.10% broken rice percentage. The size varied from short, intermediate to long, while the shape varied from round, oblong to medium for both red and white rice varieties. Appearance quality parameters such as surface area, volume, geometric diameter, equivalent diameter, sphericity, aspect ratio, and thousand kernel weight were significantly different ($P<0.05$) for both red and white rice varieties, whereas bulk density, true density, and porosity were not significantly different ($P>0.05$). Gelatinization temperature ranged from intermediate to high except for At 362 improved rice variety. Selected rice varieties were classified as hard gel consistency and high amylose content, except for Nipponbare. Cooking parameters, such as the elongation ratio, cooked length-to-breadth ratio, water uptake, volume expansion ratio, and minimum cooking time, were significantly different ($P<0.05$) for both red and white rice varieties. *Sulai, Rathkanda, Maawee*, and *Kalu Heenati* (red rice), and *Rathal, Suduru Samba, Suwandel, Kahawunu* (white rice) were identified as the most comparable rice varieties to improved rice varieties. "Nipponbare" showed similar milling characteristics to improved white varieties but intermediate cooking characteristics in comparison with traditional and improved varieties.

Keywords: Grain quality, Improved rice varieties, Japonica variety, Traditional rice varieties

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Evaluation of Yield Performance of Marigold (*Tagetes erecta* L.) Varieties to Introduce into the Sri Lankan Floriculture Industry

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Marigold (*Tagetes erecta* L.) is a multifunctional ornamental plant belonging to the family Asteraceae and it has great potential for value addition. However, the growers are unaware of the varieties that have desirable vegetative and reproductive characters, high yield potential, and better quality parameters. The present study aimed to evaluate the yield performance of Marigold (*Tagetes erecta* L.) varieties to introduce into the Sri Lankan floriculture industry. A field experiment was conducted at the Royal Botanic Gardens, Peradeniya. The experiment consisted of two distinct trials (Experiment 1 and Experiment 2) and both were laid out in Randomized Complete Block Design with three replicates. Experiment 1 comprises ten Marigold varieties, while Experiment 2 consists of nine Marigold varieties. All the varieties showed significant ($p<0.05$) variations for vegetative and reproductive measurements. Principal component analysis (PCA) and cluster analysis of characters revealed a homogenous grouping of varieties. In Experiment 1, the result revealed that the varieties V3 and V6 recorded higher results ($p<0.05$) for of a single flower, flower duration, number of flowers per plant, flower yield per plant (V6-917.30±9.67 g ^{a} and V3-840.71±10.56g ^{b}) and flower yield per m^{-2} when compared with the other varieties. In Experiment 2, the result revealed that the verities M4 and M7 recorded the higher result ($p<0.05$) for fresh flower weight of a single flower, the average diameter of a single flower, number of flowers per plant (M4-663.71 ±30.56 g ^{a} and M7-527.98 ±30.32 g ^{b}) and flower yield per plant and flower yield per m^{-2}. Thus, Marigold varieties of V3, V6, M4 and M7 can be recommended for commercial cultivation in Sri Lanka.

Keywords: Evaluation, Marigold, Varieties, Yield

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Examination of Interaction Among Selected Host Plants, Spiraling Whitefly, and *Axinoscymnus puttarudriahi* to Facilitate Mass Rearing of the Predator

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Axinoscymnus puttarudriahi (Coccinellidae) is a predator of *Aleurodicus disperses* (spiraling whitefly). Predator mass rearing requires the multiplication of host insects and host plants. Objective of the study was to identify a suitable host plant for rearing of spiraling whiteflies and to identify the relationship between whitefly egg density and predator oviposition. Cassava (Kiri kawadi), tomato (Thilina), cucumber (Kalpitiya white), and radish (Beeralu) were used as host plants for culturing spiraling whiteflies. Predator oviposition was examined in relation to whitefly egg density (2-12 eggs/cm^2). Further, morphological characterization of whitefly and predator was done. *A. disperses* has white, powdery wings held as tent-like position over the body at rest. body is flat and oval-shap. Length of body, antennae, forewing, and hindwing were 2.2±0.1, 0.7±0.1, 2.4±0.1, and 1.7±0.1 mm respectively. There was a significant difference in total whitefly production among host plants at 30 day. Highest whitefly adults, puparium, nymphs, eggs, and egg masses were found on cassava. *A. puttarudriahi* adult was 1.5±0.1 mm long, 1.0±0.1 mm wide, the gap between eyes was 0.2±0.1 mm. The length of the forewing and thorax were 1.1±0.1 and 0.3±0.1 mm respectively. Length of fore, middle and hind legs were 0.9±0.1, 1.1±0.3 and 1.3±0.1 mm respectively. Adult is black with yellowish brown spot on the elytra, yellowish brown head, and thorax. There was a significant relation between whitefly egg density and oviposition of *A. puttarudriahi*. The oviposition rate was varied between 1– 4 per day per female with whitefly egg density. The highest oviposition 4.1±1.1was found when on 50-60 whitefly eggs per arena. For the mass rearing of *A. puttarudriahi*, cassava is a suitable host plant for rearing spiraling whitefly. High whitefly egg density increases the predator oviposition. This information is useful in designing a mass production protocol.

Keywords: *Axinoscymnus puttarudriahi*, Casava, Oviposition, Spiraling whitefly

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Exploring Soil Moisture and Nutrient Status of a Subsurface Drip Irrigated Coconut (*Cocos nucifera* L.) Cultivation

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This study was carried out in a coconut estate in Kuliyapitya to assess the effectiveness of subsurface drip irrigation with fertigation (SDI+FG) in comparison to rain-fed and manual fertilizer application (RF+MFA). Soil moisture distribution, soil and crop nutrient status of SDI+FG and RF+MFA areas were studied while considering yield variability. After three hours of irrigation, soil vertical section at distance of 25 cm from a dripper of a high yielding plant was wetted (gravimetric moisture content, Θg = 3.3%) in a very small circular area measuring 5 cm in diameter. This indicated that the SDI system has little potential to provide irrigation water beyond 25 cm from the dripper. The wetting front was not extended to 25 cm in the soils of low yielding plant. The soil cross section at 15 cm revealed a larger elliptical wetted area (Θg = 13.3%, 30 cm × 10 cm) in soils of both high and low yielding plants. At 5 cm from the dripper, much larger area was wetted (Θg=19.3%). These results indicated that the wetting front of drippers would extend maximum up to 15 cm under SDI. Moreover, it was observed that SDI has caused the growth of roots within wetted area around drippers, making plants more susceptible for drought stress. Nutrient status in soil was higher in RF+MFA compared to SDI+FG around high yielding plants. However, leaf nutrient status was similar under both management and exceeded sufficient ranges. Given that SDI+FG have cut down fertilizer application by 30%, this approach has resulted in better fertilizer use efficiency. This study indicated that FG has outperformed MFA. However, supply of water has been restricted to a small soil volume around drippers leading to less moisture availability in drier periods. Thus, assuring adequate supply of water through the SDI system is essential.

Keywords: Coconut, Drip irrigation, Fertigation, Plant nutrients, Soil moisture, Yield

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Exploring the Effects of Parental Drought Priming & Soil Basal Application of a Superabsorbent Polymer on the Growth & Yield Performances of Bg 314 in Drought

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Drought stress memory imprints (SMIPs) established by plant stress acclimation are known to be passed down to subsequent generations. Soil application of super absorbent polymers (SAPs) may further stimulate SMIP mediated drought tolerance strategies. This study aimed to investigate individual and cumulative impacts of both aspects on key morphophysiological responses of a designated drought tolerant rice variety under drought. The study was conducted as a three-factor factorial experiment: (1) Parental priming (P); P+ (seeds of Bg 314 plants underwent drought acclimation in the last season) and P-, (2) SAP; SAP+ (50kg ha^{-1}) and SAP-, (3) Water treatment; drought (80-50% field capacity; FC) and control (above FC) using three replicates (n=18) in a completely randomized design. Plant height, leaf area, and leaf/ tiller numbers were recorded at two weeks intervals throughout the drought treatment. Two sets of measurements (i.e. M1; between maximum tillering and panicle initiation, M2; between grain filling and maturity) included: photosynthetic gas exchange, fluorescence, dark respiration, electrolyte leakage (EL), relative water content (RWC), chlorophyll content (Chltot), dry weights of separate shoot parts, and water-use efficiency (WUEy). Yield parameters including 1000 grain weight (TGW), panicle number, and yield, remaining soil moisture content, and root dry weight at two depths (RDWt; 0-40 cm, RDWd; 40-75 cm) were recorded at harvest. It was salient to note that SAP enhanced the adaptive responses of dehydration tolerance traits (i.e. RWC and EL) while SMIP supported growth and yield adjustments (i.e. Chltot, LA, and yield) of the test plants under imposed drought. At least one main effect was significant for most traits measured at M2 ($p<0.05$) but at M1 ($p>0.05$). The combined effects of P+ and SAP+ were significant only for EL, Chltot, RWC, RDWd, WUEy, and TGW at $p<0.05$. Results demonstrate the positive effects of combining SMIPs with SAP soil application for improving drought tolerance of rice.

Keywords: Drought tolerance, Parental priming, Rice, Stress memory, Super absorbent polymer

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Exploring the Potential of *Rhizobium* Inoculation for Productivity Enhancement of Maize-Mung bean Intercropping System under Varying Nitrogen Availability

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Cereal-legume intercropping has historically been a sustainable practice in agriculture because of the advantages of biological nitrogen (N) fixation of legumes in intercropping systems to increase the biomass production of intercropped cereal. However, it still remains unclear about how the interspecific interactions of cereal-legume intercrops impact N_2 fixation ability of the legume, N transfer to cereals, and crop yields in intercropping system. This study was conducted to examine the productivity performance of maize-mung bean intercropping system in response to *Rhizobium* inoculation of mung bean under varying N availability. A field experiment was conducted at University Experimental Station, Dodangolla as a split plot design. Nitrogen application was considered as the main plot factor while crop combination and *Rhizobium* inoculation were regarded as sub plot factors. There were two N levels as, (i) no N fertilizer application and (ii) application of N as per the recommendation of the Department of Agriculture, Sri Lanka. Maize monocropping, mung bean monocropping with *Rhizobium* inoculation, mung bean monocropping without *Rhizobium* inoculation, maize-mung bean intercropping with *Rhizobium* inoculation and maize-mung bean intercropping without *Rhizobium* inoculation were five treatment combinations imposed under each N level. Only the N level was identified to have a significant ($P<0.05$) impact on plant dry matter content, plant N uptake, plant N use efficiency, and cob yield of maize. For the same parameters, mung bean had not a significant response to N application. Maize-mung bean intercropping system did not result interspecific facilitation of N uptake by maize. Similarly, *Rhizobium* inoculation or intercropping treatment could not result yield advantage of any individual crops in the present study. Intercropping or *rhizobium* inoculation might not be advantageous in short-run for yield improvement of maize in maize-mung bean intercropping system under limited-N availability. It should be recorded here that the heavy rainfall that occurred soon after *Rhizobium* inoculation might have had hindered the inoculation effect.

Keywords: Interspecific facilitation, Nitrogen uptake, Nitrogen use efficiency, *Rhizobium* inoculation, System productivity

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Fatty Acid Profile and Growth Performance of Black Soldier Fly Larvae (*Hermetia illucens*) Grown on Pre-Treated Seaweed (*Kappaphycus alvarezii*)

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Despite being a promising feed source for animals, black soldier fly larvae (*Hermetia illucens*; BSFL) are poor in omega-3 contents. Omega-3 rich substrates can be used to improve the omega-3 content in BSFL, but such substrates also cause poor larval performance. Therefore, this study evaluated the effect of feeding pre-treated seaweed (*Kappaphycus alvarezii)* on fatty acid profile and performance of BSFL. Eight substrates were prepared using poultry manure as the basal ingredient: a substrate containing 100% poultry manure; a substrate containing 67% untreated seaweed and six substrates containing 67% pre-treated seaweed in six different methods including Allzyme® treated at 1.5% (w/w) and 2% (w/w), fermented with 10% (v/v) and 15% (v/v) *Saccharomyces cerevisiae*, microwaved at 800 W for 2 and 3 minutes. A total of 6 days-old 9600 BSFL were randomly distributed into 24 plastic containers (400 larvae per container) and fed with one of the eight substrates for 14 days (n=3). At the beginning and end of the experiment, weights of larvae were recorded. Proximate and fatty acid compositions of substrates and BSFL were measured. Inclusion of both untreated and pre-treated seaweed in substrates enriched omega-3 in BSFL. The highest ($p<0.05$) EPA and DHA contents were observed in BSFL fed seaweed microwaved for 2 minutes and untreated seaweed, respectively. Pre-treated seaweed except enzyme-treated seaweed at 2%, increased ($p<0.05$) EPA contents in BSFL than untreated treatment. The BSFL fed seaweed showed lower ($p<0.05$) body weight gain, bioconversion efficiency, nitrogen conversion efficiency than those fed 100% poultry manure. However, in comparison with pretreated seaweed, enzyme-treated seaweed at 2% caused higher ($p<0.05$) body weight gain compare to the microwave 3 minutes while other performance were same. In conclusion, pre-treatment of *K. alvarezii* with enzymes, fermentation and microwave can increase the capacity of seaweeds to increase EPA content in BSFL without compromising the performance.

Keywords: Black soldier fly larvae, Larval performance, Omega-3 enrichment, Pre-treatment, Seaweed

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Genotypic Differences in Cardinal Temperatures for *in vitro* Pollen Germination of Exotic Coconut Crosses

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The study investigated genotypic differences in cardinal temperatures for *in-vitro* pollen germination of selected exotic coconut crosses, aiming to address the challenges posed by high temperature stress. Given the significance of coconut cultivation in Sri Lanka and its global economic importance, understanding the response of coconut varieties to high temperatures is crucial. In this study, two experiments were conducted to evaluate pollen germination of various coconut varieties. The first experiment assessed in-vitro pollen germination at room temperature over 24 hours, while the second examined germination across a range of temperatures (22°C to 38°C) and cardinal temperatures (T_{min}, T_{opt}, and T_{max}) for *in-vitro* pollen germination was determined. Results indicated variations in cardinal temperatures among coconut varieties, with T_{min} ranging from 19.2°C to 20.6°C, T_{opt} from 25.5°C to 30.2°C, and T_{max} from 33.8°C to 38.8°C. No significant differences ($p=0.05$) were observed in cardinal temperatures among varieties. However, variations were noted in percentage pollen germination (%PG) at T_{opt}, with some varieties showing significantly higher or lower ($p<0.05$) germination rates. Specifically, varieties TRIT and RIT exhibited significantly higher %PG at T_{opt} compared to others, suggesting their potential suitability for cultivation and future breeding programs respectively. Conversely, variety MRD displayed the significantly lowest ($p<0.05$) % PG (8.1±1.1) at T_{opt} raising concerns for using for the future breeding programs. The findings suggest that certain coconut varieties, particularly RIT, exhibit favorable traits for withstanding high temperature stress during pollen germination. These results provide valuable insights for breeding programs aiming to develop coconut varieties resilient to adverse climatic conditions, ultimately enhancing coconut production and sustainability.

Keywords: Cardinal temperatures, Coconut, Incubation, Pollen germination

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Green Manure Effects of Sunn Hemp and Horse Gram on Growth and Yield of Okra under Organic Management Practices

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In organic agriculture, the restriction on synthetic fertilizers poses a significant challenge in soil enrichment. Therefore, green manure, notably Sunn hemp (SH; *Crotalaria juncea* L.) and Horse gram (HG; *Macrotyloma uniflorum* (Lam.) Verdc.), could be a promising alternative for this. However, knowledge on effects of these two green manure crops on the next cash crop is still scarce in South Asia, including Sri Lanka. Therefore, this study was conducted at the Organic Research Field, Mahailluppallama Sub Campus, Faculty of Agriculture, University of Peradeniya, Sri Lanka, during the *Maha* season of 2023-24 to identify the green manure effects of SH and HG on cash crop okra (*Abelmoschus esculentus* L.) growth and yield performances. Three treatments were employed; sunn hemp (T1) and horse gram (T2) as green manure, and no green manure (T3) as the control. Treatments were arranged in an RCBD across four blocks. After establishing T1 and T2 in the field, they were incorporated into soil as T1 at 50% flowering stage and T2 at the 10th week after seed sowing. One-week after green manure incorporation, okra was seeded across all three treatments. Soil parameters (pH, EC, P, K, Ca, N, OM%, CEC) were assessed weekly up to six weeks after green manure incorporation and growth and yield parameters of okra were measured with time. The results revealed that T1 producing significantly higher ($p<0.05$) green manure dry biomass (6,995 kg ha^{-1}) compared to T2 (1507 kg ha^{-1}). Soil assessments yielded significantly greater organic matter and nitrogen contents in T1. Significantly greater plant dry weight, leaf area and yield of okra were recorded in T1 compared to T2. Therefore, it can be concluded that sunn hemp performs better as a green manure compared to horse gram under organic farming practices.

Keywords: Green manure, Horse gram, Okra, Sunn hemp

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Growth and Yield Response of Soybean and Mung-bean as Influenced by *Rhizobium* Inoculation under Moisture-limited Conditions

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Nitrogen (N) is one of the most significant plant growth-limiting nutrients in agricultural soils, and its deficiency is usually remedied using nitrogenous fertilizers. Water scarcity further reduces crop yields and is a major factor restricting the production of grain legumes, especially in dry regions. Biological N_2 fixation is considered important to sustain crop productivity while reducing N fertilizer inputs into cropping lands. The aim of the study was to assess the impact of *Rhizobium* inoculation on the growth and yield responses of soybean (*Glycine max* L.) and mung-bean (*Vigna radiata* L.) cultivated under drought conditions. In a pot experiment, two crop species were grown as *Rhizobium*-inoculated and non-inoculated under two moisture regimes (well-watered and drought) in a completely randomized design. Soil moisture in well-watered and drought conditions was maintained at 80% and 40% of field capacity, respectively. *Bradyrhizobium japonicum* and *Rhizobium* sp. inocula were used for soybean and mung bean, respectively. Plant dry weight, number of nodules per plant, N uptake, use efficiency of acquired N, and grain yield of two crop species were measured. Mung-bean produced a greater nodule number compared to soybean. In both crops, plant dry matter accumulation and nitrogen uptake significantly ($P<0.05$) reduced in response to drought conditions. However, mung-bean recorded a similar grain dry weight both under well-watered and drought conditions indicating the yield advantage from mung-bean under drought-prone lands compared to soybean, of which, significant ($P<0.05$) reduction of grain dry weight was recorded. Results further indicate that the *Rhizobium* inoculation can result in improvement in plant growth, N uptake, and yield of two grain legumes only under well-watered conditions. From the results, it can be concluded that, mung-bean exhibits drought tolerance ability resulting a yield advantage under drought conditions, and *Rhizobium* inoculation could not support N nutrition and yield improvement of mung-bean and soybean under moisture limitation. Further studies under field conditions are needed to confirm this result.

Keywords: Drought, Nitrogen uptake, Nitrogen use efficiency, *Rhizobium* inoculation

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Identification of Dehydration Stress-responsive Alternative Splicing Events in Rice

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Alternative splicing is a gene regulatory mechanism that produces multiple transcripts from a single gene, and it causes proteome complexity and phenotype diversity. Plants show alternative splicing in response to external and internal cues for their growth and development. Rice is a staple food in many countries and is crucial for food security and the economy. Dehydration stress is one of the major environmental stresses affecting rice crop yield. This study focuses on bioinformatics analysis of dehydration stress-responsive alternative splicing events in rice to identify potential candidates for future crop improvements. Dehydration stress-related RNA-seq datasets were retried from NCBI-SRA to understand the dynamics of alternative splicing in rice. Transcriptome alignment and isoform quantification were done using Kallisto in the Galaxy platform. Isoform switch analysis was done using IsoformSwitchAnalyzeR in R studio. This study identified alternative spliced genes and the most abundant alternative splicing events in response to dehydration stress induced by polyethylene glycol and drought in Nipponbare. Alternative splicing differences between 2 cultivars, Nipponbare and Liayoan, varied, and only five common genes were shown to have alternative splicing in both cultivars under the same dehydration stress conditions.

Keywords: Alternative splicing, Dehydration stress, Rice

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Identifying the Effects of *Kappaphycus alvarezii* Seaweed as an Effective Source of Fertilizer for Salad Cucumber

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The present greenhouse study aimed identifying the effects of *Kappaphycus alvarezii* seaweed (SW) as an effective source of fertilizer for salad cucumber (*Cucumis sativus*). The specific objective was to identify the possibility of replacing N or K in Albert fertilizer (the standard fertilizer used in greenhouse cultivations) by seaweed. The study was conducted at the Mahailluppallama Sub-campus located in the dry zone of Sri Lanka following a completely randomized design with 3 replicates and 5 treatments. The treatments were; T1: Recommended levels of Albert fertilizer (control), T2: 100% replacement of N in Albert by seaweed, T3: 100% replacement of K, T4: 50% replacement of N and, T5: 50% replacement of K by seaweed. Significant increases were observed in plant growth parameters such as leaf chlorophyll content, vine length, stem diameter, and leaf area per plant in T4 and T5 compared to the other three treatments. Compared to T1, the fertilizer prepared using seaweed demonstrated a positive effect on the growth and yield of salad cucumber. The highest ($P<0.05$) total fruit yield of 1.6 kg/plant was recorded in T4. Additionally, T4 yielded the highest total number of fruits per plant observed up to the ninth weeks after planting. The concentration of antioxidants in fruits was significantly higher in T3 (1260 µg/g) and, the highest percentage of total soluble solids was observed in both T4 and T5 compared to T1. No significant differences were observed in polyphenol and vitamin C contents among the treatments. Overall findings suggest that, supplying a combination of 50% of Albert's solution plus *Kappaphycus alvarezii* seaweed for replacing the rest 50% (in terms of N or K), could serve as an effective alternative for sustainable cultivation of salad cucumber while enhancing the biochemical composition of the fruits and reducing the cost of Albert fertilizer by 50%.

Keywords: Albert fertilizer, Greenhouse cultivation, Seaweed fertilizer

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Identifying the Potential of Black Soldier Fly Frass (BSFF) to be Used as a Fertilizer

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Black Soldier Fly (BSF) frass is a potentially sustainable alternative for conventional fertilizers in cultivating crops. In this study, the effects of BSF frass, and vermicompost as organic fertilizers were compared with synthetic fertilizers on the growth and yield of Okra (*Abelmoschus esculentus*) and Radish (*Raphanus sativus*). Two separate experiments were conducted, one each for each crop. The study was conducted in a greenhouse at the Mahailluppallama sub-campus, Faculty of Agriculture, University of Peradeniya from December 2023 to March 2024. There were six treatments as NPK fertilizer according to the department of agriculture (DOA) recommendation (T1), BSF frass to replace 100% K (T2), 75% K (T3), and 50% K (T4), Vermicompost to replace 100% K (T5) and No fertilizer (T6). In all the treatments except T6, the rest of the nutrients (N and P) were supplied as per the DOA recommended levels using synthetic fertilizers. The results revealed that, BSF frass treatments in okra, especially BSF frass replacing 100% K, showed either similar or better growth results ($P<0.05$) compared to the DOA recommended T1. However, complete replacement of K synthetic fertilizer by BSF frass significantly reduced pod yield in okra. For radish, no significant differences were observed in root fresh weight among treatments, indicating that even 100% replacement of BSF frass provides results similar to the DOA recommended fertilizer treatment. These findings suggest that BSF frass as well as vermicompost can replace synthetic K fertilizer use in root vegetable cultivations without affecting the yield. However, complete replacement of synthetic K fertilizer by BSF frass may reduce fruit yields in fruit vegetables. Therefore, BSF frass can be recommended as an environmentally friendly alternative for synthetic K fertilizers especially for enhancing the vegetative growth of vegetable crops.

Keywords: BSF frass, Okra, Radish, Synthetic fertilizer, Vermicompost

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Impact of Burying of Pruning on Shoot Growth, Yield and Soil Improvements in TRI 4049 Cultivar under Low Country Wet Zone Conditions

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Continuous cultivation of tea in Sri Lanka has led to significant degradation in soil quality over the decades. The incorporation of organic matter has been identified as a viable solution for enhancing soil quality. Tea plants are routinely pruned to stimulate vegetative growth; producing organic material that can serve as a soil amendment to improve physical, chemical, and biological properties. This study, conducted at Field No. 1 of St. Joachim Estate, Tea Research Institute, Rathnapura, aimed to assess the impact of burying of pruning, each with four replicates. Soil samples were collected at two depth levels (0-15 cm and 15-30 cm) from a field where pruning burial had been done one year ago. The samples were then analyzed for soil bulk density, pH, carbon content, total nitrogen content, available phosphorus content, available potassium content, cation exchange capacity, and microbial carbon biomass content. Regular weekly harvesting was conducted, and fresh yield weights were recorded separately. Shoot composition was evaluated immediately before plucking. Results revealed significant differences ($p<0.05$) in soil carbon content at both depth levels, total nitrogen content, available phosphorous content, and bulk density at the 0-15 cm depth, soil pH at the 15-30 cm depth in response to burying of pruning. However, no significant differences ($p=0.05$) were observed in terms of cation exchange capacity and microbial carbon biomass content at both soil depths. The improvements in soil properties resulted in a 66% increase in fresh yield ($p<0.05$) when compared to non-buried sites. Overall, the findings indicate that burying of pruning can enhance the fresh yield of tea by improving soil's physical, chemical, and biological properties. Therefore, adopting the practice of burying chopped pruning as a soil amendment in tea fields is recommended to sustainably improve soil conditions and optimize fresh yield.

Keywords: Burying of pruning, Fresh tea yield, Shoot composition, Soil properties

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Impact of Glyphosate and MCPA on Selected Soil Quality Parameters of an Ultisol

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This study investigated the impact of Glyphosate and MCPA on selected soil quality parameters of an Ultisol soil scape in the Dodangolla experimental farm. Twelve research plots (1.5 m × 1.5 m) were arranged in three blocks in a non-cultivated weed-infested land (Giant mimosa and Guinea grass). Three weed control treatments: Glyphosate (44 L/ha) and MCPA (12 L/ha) applied, and manually cut, were established in each block including a control treatment. Physical properties namely, bulk density (BD), saturated hydraulic conductivity, and wet aggregate stability (WAS) were measured in the surface soil (0-5 cm), at 0,10,14,19, and 25 days after application (DAA) and soil penetrometer measurements were taken at 25DAA. In parallel, microbial properties (microbial respiration, total bacterial and fungal abundance) were measured in macrocosms representing each treatment. A significant difference in penetration resistance (PSI) was observed between glyphosate-treated (96) and control (140) plots. Furthermore, penetration resistance of glyphosate-treated plots was not significantly different from the manually weed-cut plot (116). Compared to the initial condition, BD and WAS values reduced by 19.8%, and 33.4%, respectively by 14DAA of glyphosate indicating glyphosate application tends to loosen the soil. In parallel, microbial respiration also increased by 10DAA in glyphosate treatment indicating a higher microbial activity than other treatments. Total bacterial count exhibited a notable increase of 16.4% by the 10DAA but converged toward the initial value of 5.5 Log CFU kg^{-1} dry soils by the end of the study. Although not statistically significant, fungal population exhibited an ascending trend by the 10DAA in the MCPA and manually cut treatment plots, whereas both glyphosate and control treatments demonstrated a declining trend. Subsequently, in the latter part of the observation period, the MCPA and manually cut treatments decreased, while the other two treatments increased. These findings demonstrate that glyphosate application influences soil physical and microbiological properties.

Keywords: Glyphosate, MCPA, Microbiological properties, Physical properties, Soil penetration resistance

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Influence of Biochar and Lime on Nitrogen Fixing and Phosphorus Solubilizing Bacteria in Cattle Dung Amendment Banana Pseudostem Vermicompost Prepared by *Eisenia fetida*

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An open dumping of solid waste requires appropriate lands with proper management to avoid environmental and health hazards. Vermicomposting is one of the environmentally beneficial methods for turning organic waste into manure. This study focused on evaluating the vermicomposting of *Eisenia fetida* using pre-composted banana pseudo-stem with cow dung (1:1, w/w) (control), along with three amendments, namely 0.5% (w/w) lime (L), 4% (w/w) biochar (B), and 0.5% (w/w) lime + 4% biochar (LB) over a 30-day period. The physicochemical properties such as pH, Electrical Conductivity (EC), and temperature were monitored throughout the process. Results showed no significant differences of those parameters among the treatment groups. However, the highest ($P<0.05$) available nitrogen level was observed in treatment B at the beginning and after 15 days (0.11% DM, 0.14% DM, respectively), whereas treatment LB showed the highest DM (0.26%) after 30 days. High counts ($P<0.05$) of *Azosprillium* and *Azotobacter* spp. were recorded in vermicompost samples from treatments B and LB compared to those of other treatments at day 0, whereas those counts were highest ($P<0.05$) in treatment LB after 15 days. The highest ($P<0.05$) level of phosphorus-solubilizing bacteria was recorded in vermicompost samples of treatment LB after 15 days. Conversely, the lowest ($P<0.05$) coliform counts (8.74±0.02 log CFU/g) were found in LB after 30 days, indicating reduction of the presence of potential pathogenic microbes. Additionally, the highest reproduction rate of *Eisenia fetida* was observed in treatment LB and B. The germination index of *Vigna radiata* was higher ($P<0.05$) in treatment LB (109.59±10.52) than in treatment L (64.85±5.32). The current study revealed that 4% (w/w) biochar and 0.5% (w/w) lime amendment in vermicomposting of banana pseudostem and cow dung (1:1, w/w) is suitable for obtaining vermicompost with high nutrient contents and desirable properties.

Keywords: Banana pseudostem, Biochar, *Eisenia fetida*, Lime, Vermicompost

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Influence of Varying Nitrogen and Water Supply on Source-Sink Relations in Two Rice Varieties with Different Sink Capacities

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Rice is the staple food for over half of the global population. Increasing nitrogen (N) supply could increase rice yields by increasing both source and sink capacities. In contrast, drought decreases rice yields by decreasing source and/or sink capacities. The objective of this experiment was to determine the interactive effects of N supply and drought on source-sink relations of two rice varieties, *viz.* Bg252 and Ld253, which differed in grain size. Plants were grown in 10 L plastic bags in a rain-sheltered planthouse in a three-factor factorial treatment structure in a randomized complete block design with six blocks. There were two varieties, three N levels, *viz*. 127.5 (Sub-optimal), 225 (Optimal) and 382.5 (Supra-optimal) kg ha^{-1}, three water treatments, *viz.* well-watered and water-stress (50% field capacity) imposed at vegetative and reproductive stages. Increasing N supply significantly ($p<0.05$) increased the source capacity, as measured by leaf and root dry weights, in both varieties in both well-watered and drought treatments. In contrast, water stress did not consistently decrease ($p>0.05$) the source capacity, where the large-seeded variety, Ld253 was less-sensitive to water stress than the small-seeded variety, Bg252. Increasing N supply increased sink capacity, measured as the number of grains per hill, at two water levels. However, water stress decreased sink capacity at all N levels. Individual grain weight was not sensitive to N supply but was reduced by water stress at reproductive stage in Bg252, but not in Ld253. Increasing N supply increased total plant N uptake whereas water stress at both stages decreased N uptake in both varieties. Increasing N supply increased grain yield in the large-seeded variety but not in the small-seeded variety. In contrast, drought decreased grain yield in both varieties. It is concluded that large-seeded rice varieties have the potential to achieve higher yields by overcoming the sink limitation.

Keywords: Drought, Nitrogen, Sink capacity, Source capacity, Yield

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Introducing a Bio Enriched C7 Jiffy Pellet by Incorporating a Selected Group of Beneficial Fungi for Healthy Nursery Seedling Production

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Coir is a freely available as a by-product of the coconut cultivations. In the world coir industry, Sri Lanka plays a significant role. Coir provides a habitat for a wide range of economically significant flora and fauna for plant growth. In the world, there are attempts to produce value-added products using coir and as growing media. The main purpose of this study was to develop a jiffy pellet that is enriched with selected groups of *Trichoderma* spp., a bio controlling agent and *Glomus* spp., an arbuscular mycorrhizal fungi in order to produce healthy vegetable nursery seedlings. The efficacy of the selected beneficial fungal consortium was tested in terms of their physiological plant growth-promoting ability and response to performance with a soil-borne phyto pathogen (*Fusarium* spp.) Tomato (*Lycopersicon esculentum* Mill.) was used as the test crop. In order to determine the optimal mixing ratio of coir and beneficial fungal consortium, two weight-to-weight ratios were selected (1:4 and 1:8). This was done to evaluate the performance of the beneficial fungal consortium at different population densities. Tomato seeds were grown in each treatment under both conditions, with grow medium infected with *Fusarium* spp. and without. The success rate of plant growth and substrate parameters were measured. Results showed that the mixing ratio in the treatments affected the physiological trait. The germination percentage, shoot dry weight, and leaf chlorophyll content of each seedling grown in the two different mixing ratios were measured. The overall results indicated that the overall performance of the 1:8 mixing ratio was significantly ($P>0.05$) higher than that of the 1:4 ratio and the control treatments even under pathogenic conditions in the grow medium. Hence, 1:8 is the most suitable mixing ratio between coir and beneficial fungal consortium, this finding can be used to develop the bio-enriched C7 Jiffy pellet.

Keywords: Arbuscular mycorrhizal fungi, Bio controlling agents, C7 Jiffy pellets, Nursery seedling production.

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Investigating the Persistency of *Metarhizium* Spores on Cabbage Plants in an Open Environment

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Fungi based microbial pesticides shows a great potential for insect pest control, particularly *Metarhizium* formulations. Application of *Metarhizium* spore based formulations is very limited due to poor understanding of longevity and persistence of spores. This research study aimed to investigate the persistency of *Metarhizium* spores on cabbage plants in an open environment. The *Metarhizium* was isolated from infected lepidopteran larvae, collected in a cabbage field in Thalathuoya. Fungal morphology confirmed the identity of the fungus as *Metarhizium*. Spore concentrations were measured using a hemocytometer at x4, x10 and x40 magnification. Natural loss of spore after application was measured by recovering the spores from cabbage foliage at 1-14-day period. Similarly, spore loss under simulated rainfall (1, 2 and 3 mm) was also measured. Further, spore loss when spore mixture was formulated with teepol, coconut oil and Gum Arabic at three concentrations was evaluated. Spore loss was significant ($p<0.05$) along the time, it was 21% at day 10 and progressively increased to 40% at day 14. Spore loss had significant ($p<0.05$) relationship with rainfall, it was 8, 18 and 39% at 1, 3 and 5 mm rainfall respectively. When spore solution was formulated with sticky adjuvant, there was a significant difference ($p<0.05$) among treatments and interaction between treatments and concentrations. This study revealed a higher rate of spore loss after the 10th day, suggesting the need of a repeat application spore solution. Furthermore, rainfall contributed for spore loss which increased with increasing rainfall. Spore loss can be minimized by adding a sticky adjuvant such as Gum Arabic at 0.1% concentration.

Keywords: Cabbage, Formulation, *Metarhizium*, Persistency, Spore

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Laboratory Evaluation of Selected Botanicals Against Aphid (*Myzus persicae*)

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Insecticide use is a common practice for efficient and effective suppression of insect populations. It negatively affects human and environmental health; hence, demands alternate approaches. Use of botanicals is a potential option. Objective of the study was to evaluate efficacy of three botanical extracts and their combinations compared to a synthetic insecticide against *M. persicae.* Neem (N), *Azadirachta indica* (T_1), West-Indian lantana (L), *Lantana camara* (T_2) and Malabar Nut (M), *Adhatoda vasica* (T_3) and Thiocyclam-50% (w/w) SP (Evisect S) (T_8) were used. Leaves of Lantana and Malabar nut were harvested, air dried and grounded. Neem seeds were purchased and grounded. Botanical powder (0.5, 5, 15, and 25 g) was soaked in 50 mL for 24hours to prepare 1, 10, 30, and 50% concentrations for evaluation. *M. persicae* was obtained from a laboratory culture. Botanical combinations were prepared taking equal proportions of N:L (T_4), N:A (T_5), A:L (T_6), N:A:L (T_7). Water was used for the control. Efficacy was evaluated by introducing 1 mL of the botanical solution onto a filter paper in a Petri dish followed by an introduction of 30 aphids. Mortality was measured at 24hr. There was a significant difference ($p<0.05$) in corrected mortality among treatments. Mean corrected mortalities of T_1-T_8 were 26.4±4.5, 31.6±5.8, 31.2±0.9, 31.5±2.6, 37.7±3.1, 29.4±3.6, 31.3±4.3 and 60.6±1.7 respectively. Neem (T_1) showed an increasing mortality (13.4-40.6%) with increasing concentrations at the range of 1-50%. That of in Lantana (T_2) and Malabar Nut (T_3) were 7.1-64.6% and 4.5-61.5% respectively. The interaction between concentrations and treatments was also significant ($p<0.05$). Botanicals and mixtures showed variable synergistic and antagonistic effects at different concentrations, and no clear trend was detected. Thiocyclam produced twice the mean mortality of the botanicals. Though botanicals were less effective, the use of botanicals is a potential strategy for ecological pest management.

Keywords: *Azadirachta*, Botanicals, *Lantana*, Mortality, *Myzus persicae*

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Management Practices Affecting the Productivity and Welfare of Selected Varieties of Guppy: A Case Study in an Ornamental Fish Breeding Station in Sri Lanka

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Out of the freshwater aquarium fish species exported from Sri Lanka, 60 – 70% consist of fancy guppies. Evaluation of existing practices and standards within a commercial ornamental fish industry is important to maintain the production cycle and welfare needs of guppy fish. Guppies should reach a salable size at 81 days after birth for efficient production in the commercial industry. However, in one of the main commercial fish breeding centers, it was reported that the center could not reach a salable size in 81 days. Investigating the possible causes for the situation reported, the existing management practices were studied, and data such as stocking density, male-female sorting date, tank changing date, survival rate, as well as water quality parameters (pH, NO_2, NH_3 and Temperature) were assessed. Data were analyzed using the SPSS program. Results found that one production cycle consists of 120 days on average. Most of the problems were observed at the nursery stage. The mean value of the time duration of the nursery tank, Grow Out I tank and Grow out II tank were 53.5 ± 0.8 days, 34.6 + 1.76 and 34.1 ± 2.9 days, respectively. These values showed a significant deviation ($P<0.05$) from the NAQDA resolution. High stocking density, collection of day one fry during a few days from the same tank and making competition among them during the nursery stage, and problems in feeding management were identified as main courses of growth delay. Survival rate was less than the expected rate in both nurseries and grow out stages. No water quality defects were found during the study period. According to the employee, the mortality of fish is high in the rainy season. The reasons for this observation could not attribute to any of the findings of the present study period, and it needs further investigation.

Keywords: Guppy fish, Production cycle, Management practices

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Microorganisms Isolated from Diseases in Selected Plant Species in Riverstone Region of Knuckles Conserved Forest in Sri Lanka

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The Knuckles Forest Range is a biodiversity hotspot found in Sri Lanka's central highland, and Riverston is a region located in the Knuckles Mountain Range located between the districts of Matale and Kandy. The present study was conducted to identify the fungal species that cause plant diseases in the Riverston area. A disease survey was conducted to find out the prevalence of different plant diseases in tree species based on signs and symptoms. Morphological identification of isolated microorganisms was done by culturing the diseased specimens on suitable media, followed by observing the colony characteristics and spore morphology of the isolated microorganisms. Diseases were found in *Syzygium* sp., *Neolitsea cassia*, *Elettaria cardamomum, Clidemia hirta, Macaranga peltata, Bambusa vulgaris, Camellia sinensis, Mikania micrantha, Ficus religiosa, Osbeckia octandra, Mangifera zeylanica, Ehretia microphylla, Coffea* spp., *Andropogon* sp., etc. Microorganisms isolated were *Botryodiplodea theobromae* from leaf spots of *Neolitsea cassia*, *Colletotrichum* spp. from leaf spots of *Elettaria cardamomum*, *Phomopsis sp*. from blight of *Macaranga peltata, Rhizoctonia solani* from sheath blight of *Andropogon* sp., *Phomopsis* spp. from leaf spots of *Rubus moluccanus*, *Exobasidium vexans* from blister blight of *Camellia sinensis* and *Botryodiplodea* sp. from the dieback of *Syzygium* sp. According to the survey, the specimen showed an 80% incidence of leaf spot, 13% of blight, 6% of rust, 6% of blister blight, 13% of dieback, 6% of tip burning and 6% of canker diseases. Leaf spot is the most prevalent issue in the study area. The present study provides information on the prevalence of plant diseases and causal pathogens in a biological hotspot.

Keywords: Biodiversity hotspot, Diseases, Knuckles forest range, Phytopathogenic fungi

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Microplastics in Follicular Fluid of Goats and Their Potential Impact on the Ovary: A pilot study

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Microplastics (MPs) are pervasive environmental contaminants affecting all living organisms, ranging in size from 1 μm to 5 mm. These contaminants are categorized into primary MPs, intentionally produced for specific uses, and secondary MPs, resulting from the breakdown of larger plastic items. While most of the MP research focuses on aquatic ecosystems, studies concerning terrestrial animals, particularly about reproductive health, remain scarce. This preliminary investigation was designed to detect the presence of MPs in the follicular fluid (FF) of goat ovaries using a Fourier Transform Infrared (FTIR) spectroscopy. Our findings confirmed the presence of MPs in the FF samples. Furthermore, Hematoxylin and Eosin (H&E) staining revealed abnormalities, including polycystic ovary syndrome (PCOS), thecoma, cysts of the surface epithelial-stromal (SES), cystadenoma of the SES, and hormone-active persistent corpora lutea (CL) which have been lined with plasticizers exposure in other species. These results suggest the potential for MPs to bioaccumulation posing a risk to reproductive health. Therefore, our pilot data warrant further research on the impact of MP pollution on reproductive health.

Keywords: FTIR, Goat, Microplastics, Ovarian follicular fluid, Ovary

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Modeling Approach to Optimize the Nitrogen Fertilizer Rates for Rice Variety, Bg 300 in Dry and Intermediate Zones of Sri Lanka and Projecting Fertilizer Rates for Future Climate Scenarios

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Rice (*Oryza sativa* L.), particularly the variety Bg 300, is popular in Sri Lanka. The current nitrogen fertilizer recommendations are not based on climate variability, leading to suboptimal yields and environmental repercussions. This study aims to address this gap by utilizing the APSIM crop simulation model to optimize nitrogen fertilizer rates for var. Bg 300 in dry and intermediate zones of Sri Lanka (during *Maha* Season). The research encompasses a comprehensive methodology involving the setup of the APSIM model, incorporation of management practices, utilization of relevant data for model evaluation, and scenario analysis. By conducting simulation experiments with 625 nitrogen management scenarios, utilizing 30 years of past weather data, and projecting future climate scenarios, the study seeks to delineate optimal nitrogen management regimes for the target zones. According to simulation results, in the dry zone, the Bg 300 variety exhibits a median rice yield of 4305.2 kg/ ha for the *Maha* season with a leaching value of 61.95 kg/ ha for the present climatic conditions, with an optimum nitrogen recommendation of 200 kg/ ha. Projections for 2050 and 2100 suggest increased yields (4529.1 kg/ ha), accompanied by optimal nitrogen rates of 150 kg/ha with a leaching value of 120.5 kg/ ha. Similarly, in the intermediate zone, the study reveals a median rice yield of 4407.1 kg/ ha for the *Maha*, with an optimal nitrogen recommendation of 175 kg/ ha. In the present climatic conditions leaching value predicted for the intermediate zone was 32 kg/ ha. Future climate scenarios predict enhanced yields of 4591.2 kg/ ha and optimal nitrogen rates of 175 kg/ha for both 2050 and 2100 with a leaching value of 73.5 kg/ ha. These findings underscore the crucial need for tailored nitrogen management strategies to address climate-induced fluctuations, ensuring sustainable rice production in Sri Lanka's diverse climatic zones. In conclusion, the study highlights the imperative of integrating climatic conditions into fertilizer rate decisions for rice cultivation, safeguarding food security and environmental sustainability.

Keywords: APSIM model, Bg 300, Climate change, Nitrogen fertilizer, Rice

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Morphological and Molecular Characterization of Coffee (*Coffea arabica* and *Coffea canephora*) Germplasm

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Coffee is a popular beverage worldwide. Commercial coffee production relies mainly on two species *Coffea arabica* L. and *Coffea canephora* Pierre. Despite being an introduced crop, Sri Lanka hosts a diverse coffee germplasm that could be effectively utilized in genetic improvement programs. The current study focused on characterizing a selected panel of Sri Lankan coffee germplasm by morphological and molecular methods. The panel consisted of 60 mature coffee plants including 20 *C. arabica* and 40 *C. canephora* sampled from several geographical locations in Kandy and Matale districts. Morphological characterization was done with 42 characters consisting of 19 quantitative and 23 qualitative traits based on standard descriptors developed by the International Plant Genetic Resource Institute. Molecular characterization was performed at two SSR loci; *AJ250254* and *AJ250257*. Of the 42 morphological characters, only 29 characters were polymorphic and hence were considered for further analysis. Principal component analysis for quantitative characters revealed the capturing of 92% of the variation among the genotypes by the first principal component (PC1). The highest contributors to the PC1 were leaf length and leaf width. Further, the hierarchical cluster analysis performed on the quantitative characters grouped the genotypes into three clusters at a 50% similarity cut-off. The Simple Sequence Repeat markers captured a high allelic diversity among the genotypes, recording a total of seven alleles as four and three at marker loci *AJ250254* and *AJ250257,* respectively. Neither of the markers amplified alleles unique to *C. arabica* or to *C. canephora*. No association could be observed between the morphological parameters and the reported alleles. In conclusion, findings revealed prominent variations in leaf length and width among the studied coffee genotypes and the SSR markers *AJ250254* and *AJ250257* captured the allelic diversity of coffee.

Keywords: Coffee germplasm, Genetic diversity, Morphological characterization, Principal component analysis, SSR markers

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Morphological and Molecular Characterization of Different Ecotypes of *Bergera koenigii* L. (Curry Leaf) From Selected Localities in Sri Lanka

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The curry leaf (*Bergera koenigii* L.) holds cultural and culinary significance in South Asian cuisine, particularly in Sri Lanka, thriving in various ecotypes across diverse agroecological zones. *Wal-karapincha* (*Micromelum minutum* var. *ceylanicum* B.C. Stone), *Mee-gon karapincha* (*Clausena indica* (Dalzell) Oliv.), and *Beheth karapincha* are considered varieties of *B. koenigii* though their varietal status remains uncertain. Hence, a phylogenetic assessment is important for understanding the evolutionary relationship among these taxa. Despite the significance of *B. koenigii*, a comprehensive understanding of the morphological and molecular diversity of curry leaf ecotypes in Sri Lanka is lacking. This study aimed to bridge this gap by morphological and molecular characterizing seven selected ecotypes from different regions, representing dry, intermediate, and wet agroecological zones. Morphological analysis, based on 22 vegetative traits, revealed two distinct clustering patterns among the ecotypes, notably, Dambulla and Ritigala clustered together. Wild populations of *B. koenigii* were analyzed using two ISSR primers. A total of 87 fragments were amplified, out of which, 59 were polymorphic revealing 67.82% polymorphism across the accessions. The UPGMA tree, based on Jaccard's similarity coefficient generated from the ISSR band data showed two distinct clusters. Notably, the Kurunegala ecotype stood apart, showing genetic dissimilarity from other samples. The population clustering in the dendrogram did not match their geographic locations as well as with their morphological clustering. Conducting PCR on *matK* barcode region for putative varieties and one *B. koenigii* sample revealed three distinct, strongly supported clades in IQTree analysis. Notably, *B. koenigii*, Beheth karapincha are closely related to *Clausena* species while *M. minutum* and *Murraya* species stand apart. These outcomes suggest the aforementioned varieties are separate species, warranting further investigation. The results of the present study are important to understanding the genetic diversity of curry leaf facilitating the improvement of desirable traits in commercial cultivars.

Keywords: *Bergera koenigii*, Ecotypes, Genetic diversity, Phylogeny

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Morphological And Molecular Evaluation of Yield Parameters of a Panel of Recommended Rice Cultivars

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Rice (*Oryza sativa* L.) is a widely grown staple crop around the world. With the rising population growth, increasing rice yields by breeding has become crucial. In this study, a molecular and morphological evaluation was done on the yield parameters and selected agronomic characteristics of 15 rice cultivars comprising the top 10 recommended rice cultivars and five international and advanced rice lines planted at Rice Research and Development Institute, Bathalegoda, Sri Lanka. Sixteen yield and agronomic parameters were recorded and subjected to principal component and regression analyses using Minitab statistical software. The molecular evaluation was performed at SSR marker RM142, which is recorded to be a locus associated with the amylose content of rice. Results revealed a significant positive correlation between number of panicles and the number of spikelets per panicle with yield. Among the studied candidates, cultivars that mature in 4 months displayed positive correlations of most of the scored parameters with yield. The advanced variety Bg 17-245 was identified to outperform most of the top 10 varieties tested, which is novel information derived from this study. The trait associated with the RM142 marker was monomorphic among all the plants, highlighting the importance of using additional yield-specific molecular markers. This research demonstrates the influence of morphological characteristics on the yield of rice. The results have the potential to aid in future rice breeding strategies.

Keywords: Agronomic Correlation, Molecular traits, Morphological traits, Rice, Yield Parameters

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Morphological and Molecular Identification of Some Economically Important Shrimp Species in Western Coast of Sri Lanka

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Shrimps are an economically valuable fishery resource in Sri Lanka. The identification of economically important shrimp species that can be found in Sri Lanka is important for the sustainable utilization of this resource. In this study, it was aimed to identify shrimp species using morphological methods as well as molecular methods. Special emphasis was given to shrimp species, which could not be identified using morphology only. External features were used for the morphological study and DNA barcoding was used to identify different species based on their mitochondrial COI gene sequences. The shrimp samples were collected from major shrimp fishery operating places in western coast of Sri Lanka. *Penaeus indicus, Penaeus monodon, Penaeus semisulcatus, Penaeus marginatus, Penaeus vannamei, Macrobrachium rude, Macrobrachium equidens, Metapenaeus monoceros, Metapenaeus moyebi, Parapenaeopsis coromendelica* were identified morphologically. Out of these, sequencing was carried out for 2 of which identification features were ambiguous: *Parapenaeopsis coromendelica* and *Macrobrachium rude*. The sample identified morphologically as *P. coromendelica*, which was collected from Negombo, had been confirmed to be that species. While, the species identified morphologically as *M. rude*, which was collected from Elakanda, was identified with similarities as *Macrobrachium lar*. The NCBI accession numbers of the sequences are PP440258 and PP440261 respectively. Previous records of *M.lar* has not been located in Sri Lanka. This study shows the importance of combining molecular methods with morphological identification for the identification of species of shrimp when the morphological features of a particular shrimp is ambiguous.

Keywords: DNA barcoding, *Macrobrachium*, Morphological identification, *Penaeus*, Shrimp

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Morphological Characterization of *Osbeckia octandra* (Heen Bovitiya)

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This study aimed to characterize the morphological variations among *Osbeckia octandra* plant populations in Sri Lanka while distinguishing it from other *Osbekia species.* Specimens from the National Herbarium and data from the Bandaranayake Memorial Ayurvedic Research Institute, alongside present research from vbarious places, helped identify unique traits separating *Osbeckia octandra* from *Osbeckia aspera* and *Melastoma malabathricum.* Data collected from twenty different locations across Sri Lanka, using a descriptor list, comprised nineteen qualitative and seven quantitative morphological characters. Principal Component Analysis (PCA) was employed to reduce dataset dimensionality and extract significant Principal Components (PCs), followed by cluster analysis using the Single linkage algorithm and Euclidean similarity measure. This approach revealed three distinct clusters based on leaf dimensions: Cluster 1 with leaf lengths ranging from 45 mm to 50 mm and leaf widths ranging from 13 mm to 14 mm, Cluster 2 with leaf lengths ranging from 58 mm to 61 mm and leaf widths ranging from 12 mm to 14 mm, and Cluster 3 with leaf lengths ranging from 62 mm to 70 mm and leaf widths ranging from 17 mm to 23 mm. Furthermore, geographic information highlighted the distribution of these clusters across different regions. Notably, PC1 and PC2 emerged as significant contributors to clustering, representing leaf length and width, respectively. For easy identification of *Osbeckia* species, a dichotomous key was developed. These findings provide valuable insights into the morphological diversity and geographic distribution of *Osbeckia octandra* populations, offering implications for future research on plant diversity, adaptation, conservation efforts, chemical analysis, and use for medicinal purposes.

Keywords: Cluster analysis, Geographic distribution, Morphological variations, *Osbeckia octandra*, Sri Lanka

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Optimum Substrate and Moisture Content for Black Soldier Fly Larvae Self- Harvesting Unit for Backyard Poultry

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The black soldier fly larvae (BSFL) are considered an excellent source of protein for backyard poultry. However, manual harvesting of BSFL is labor-intensive, time-consuming, and prone to contamination with the substrate. This study aimed to design a BSFL self-harvesting unit (SHU) for backyard poultry. Three SHUs were designed (Exp1), and the SHU with the highest BSFL harvest was selected as the experimental unit for Exp2 and Exp3. In Exp2, the influence of substrate type and moisture content (MC) on BSFL yield from SHU was examined in a 3 × 3 factorial arrangement (two-way ANOVA, 3 replicates/treatment, 250 BSFL/replicate), evaluating 3 types of substrates (100% vegetable waste (VW), 50% VW + 50% poultry manure, and 50% VW + 50% swine manure) and 3 MCs (75%, 85%, and 95%). In Exp2, the maximum self-harvest/replicate was reported from VW×75% MC and hence identified as optimal for SHU and used in Exp3. However, the maximum harvest of VW×75% MC was obtained at d 22 with 11.87% chitin (w/w), which exceeded the digestible chitin level for poultry (7.5%, w/w). Therefore, to maximise the BSFL harvest with a low level of chitin, the optimum age of BSFL for increasing MC in SHU was investigated in Exp3 (one-way ANOVA, 3 replicates/treatment, 250 BSFL/replicate), by rearing BSFL on VW with 75% MC up to 12 d of age, followed by an increase of MC to 90% on d 12, 14, 16, and 18. In Exp.3, the highest BSFL harvest ($P<0.05$) was reported on d 17, followed by MC increment on d 16 and resulted in 7.2% chitin, which is lower than the maximum digestible chitin for poultry. These findings suggest that the maximum harvest of BSFL with lower chitin can be obtained from the proposed SHU using VW with 75%MC and implementing d 16 moisture increment.

Keywords: Backyard poultry, Black soldier fly larvae, Moisture content, Self-harvesting, Substrate

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Performance of *Myzus persicae* (Hemiptera: Aphididae) on Common Chili Varities in Sri Lanka

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The aphid, *Myzus persicae* (Hemiptera: Aphididae), poses a significant threat to chilli (*Capsicum annuum* L.) cultivation in Sri Lanka by causing direct damage to plants and transmitting non-persistent viruses. This study aimed to assess the performance of *M. persicae* on five common chilli varieties (MI 2, KA 2, Waraniya, Galkiriyagama, and MICH Hy1) in Sri Lanka and to analyze the density and structure of leaf trichomes across these varieties. To study the effects of different varieties of chili on the life performance parameters of *M. persicae*, one-day-old aphids were reared on the above varieties of chili and the life performances of aphids were recorded daily. The leaves ' trichome structure and density (cm^{-2}) were examined using a light microscope equipped with a Dino eye. The results indicate that aphids exhibited significant differences in life performance parameters among the chilli varieties tested. Aphids feeding on the Galkiriyagama selection displayed longer development times (7.2 days, $P<0.005$), shorter adult longevity (20.7 days, $P<0.005$), reduced fecundity (36.1, $P<0.005$), and a lower intrinsic rate of increase (0.372, $P<0.005$). Additionally, Galkiriyagama selection exhibited lower nymphal survival (47%) and adult survival (11%) rates, along with decreased daily fecundity. Moderate performances were observed for aphids on MICH HY1. No significant differences were noted in the lifespan of aphids across the experimental varieties. Analysis of trichomes identified glandular trichomes mainly located along the midrib. No trichomes were observed on the surfaces of the leaves across all varieties under the magnification of x200. Galkiriyagama variety exhibited significantly higher trichome density (6.870 cm^{-2}, $P<0.005$) than other varieties, while MICH HY1 displayed moderate trichome density. Overall, these findings illuminate the varied responses of *M. persicae* infestation across different chili varieties.

Keywords: Aphid performance, Chili, Galkiriyagama selection, *Myzus persicae*

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Polyphenol-Rich Sugarcane Extract (Polygain™) Supplementation in Broiler Chicken Diets Containing Oxidized Rice Bran: Impact on Growth Performance and Meat Quality

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This study was conducted to evaluate the effect of polyphenol-rich sugarcane extract (Polygain™) supplementation on growth performance and meat quality of broiler chicken fed rice polish stored for extended periods. A total of 120, Cobb 500 day-old chicks were randomly assigned into five treatment groups (n=4, 6 birds per replicate). Four groups were fed with one of the four iso-energetic and iso-nitrogenous experimental diets: Control: diet with rice polish (DWRP) stored for <24 h (CD); DWRP stored for 30 days (RP); DWRP stored for 30 days and 0.02% Bultylated Hydroxytoluene (BHT) (RP+BHT); DWRP stored for 30 days and 0.1% polyphenol-rich sugarcane extract (Polygain™) (RP+PO_{Diet}). The fifth group was fed with RP and supplied 5 mL/L Polygain™ with water (RP+PO_{Water}). Experimental period was 35 days. Weekly weights and daily feed intake of birds were recorded. After slaughtering, weights and lengths of digestive tract organs were measured, and breast muscle was stored at 4 °C until meat quality and sensory evaluations. Thiobarbituric Acid Reactive Substances (TBARS) value of starter feed was lower in the diet that contained Polygain™ in 2nd week, while finisher feeds of RP+BHT and RP+PO_{Diet} showed lower ($p<0.05$) in 5th week. Birds fed with RP+BHT, RP+PO_{Diet} and RP+PO_{Water} showed higher ($p<0.05$) live weight, weight gain and feed intake in 3rd week. In 4th week final body weight was higher ($P<0.05$) in birds fed with diets RP+BHT and RP+PO than other groups. There were no significant differences in relative digestive tract lengths and weights, meat pH and colour among groups. Water holding capacity (WHC) was highest ($p<0.05$) in meat from RP+BHT group. One-week post slaughtering, meat TBARS value was lowest ($P<0.05$) in meat from RP+BHT. WHC of week one was significantly lower ($P<0.05$) in meat of groups supplied with antioxidants. In sensory evaluation, meat from birds fed BHT and Polygain™ received higher scores for texture and overall acceptability. In conclusion, supplementation of Polygain™ through feed and water had a positive impact on growth performance and sensory aspects of meat in broiler chicken when fed rice polish stored for extended periods.

Keywords: Antioxidant, Broiler chicken, Growth performance, Meat quality, Polyphenol-rich Sugarcane Extract (Polygain™), Rice polish

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Production of Full Fat Black Soldier Fly Larvae Meal (BSFLM) (*Hermetia illucens*): Impact of Blanching and Drying Duration on Quality Attributes

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The impact of blanching and drying durations on the quality attributes of full-fat BSFLM was examined in a 2 x 4 factorial design, evaluating 2 processing methods (control and blanching for 30 s in boiling water), and 4 drying durations (48, 54, 60, 66 h) at 60°C in a hot air oven. The larvae (14 d old, 12.75 mm length, 0.06 g weight), fed a 1:1 ratio of poultry manure and vegetable waste were used to produce 8 experimental BSFLM (3 replicates/processing × drying duration). Physico-chemical attributes of all 8 BSFLM were analysed at d 0. From the results, BSFLM with optimum processing × drying duration was selected, and pH, color, secondary oxidation, and microbial presence were analysed at d 15 and 30. Significant interactions between the processing method and drying duration were observed for DM, crude fiber, pH, and coliform, yeast and mold counts ($P< 0.05$). Control samples exhibited a higher ($P<0.05$) DM (94.07% vs 81.67%) and pH (8.06 vs 7.76) compared to blanched samples. A significant fivefold decrease in secondary oxidation levels in blanched samples compared to the control [15.30 vs 2.85 malonaldehyde (mg/kg)] suggested the potential efficacy of blanching as a pre-treatment to mitigate oxidation during drying. Furthermore, the processing method had a significant main effect on color parameters ($P<0.05$). The highest lightness value was reported in control (3.34), conversely, the highest yellowness (11.62) and chroma value (12.52) were obtained with blanched samples ($P<0.05$). Considering low secondary oxidation and zero microbial counts at d 0, blanching + drying for 66 h at 60°C was selected as optimal BSFLM, in which pH increased (from 8.10 to 8.36; $P<0.05$) while secondary oxidation and color remained consistent during storage up to 30 days. In addition, no coliform and yeast and mold were detected during the storage.

Keywords: Black soldier, Blanching, Drying duration, Fly larvae, Quality attributes

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Reduction of Urea and Triple Super Phosphate Fertilizer Application on Initial Growth of Maize in Maize-Stylosanthes Mix-Stand Forage Crop

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Ensuring year-round forage availability is crucial for ruminant livestock production, with hybrid fodder maize (*Zea mays*) being a globally cultivated feed. The integration of maize-legume mix-stand forage offers the potential to reduce fertilizer requirements while maintaining herbage yield and quality. This study investigated the impact of a low rate of urea and TSP in a urea-TSP-MOP fertilizer mixture on the early growth of maize in a maize-Stylosanthes (*Stylosanthes guianensis*) mix-stand forage in the mid-country intermediate zone. Two-week-old Stylosanthes seedlings were transplanted with hybrid fodder maize seeds into grower bags (seed/bag). Eight fertilizer treatments, varying urea and TSP rates in combination with the recommended MOP level, were tested using a complete randomized design. The recommended rate of urea-TSP-MOP (425:100:50 kg/ha) for maize served as the control. Data were collected from six randomly selected maize plants, recording plant height and the number of leaves at six-day intervals. A significant ($P < 0.05$) effect of fertilizer rate on plant height and the number of leaves was observed. Maize plants were uprooted in the seventh week, and roots were washed to remove adhering soil. Leaves, stems, and roots were dried at 65°C and weighed. Although a 10% reduction in urea application from the recommended rate did not significantly affect ($P>0.05$) the leaves and stem weights of maize, the fertilizer treatment without TSP recorded a significantly ($P<0.05$) lower root weight at 7 weeks. There was no evidence of a significant ($P>0.05$) effect of the reduction in fertilizer rate on the leaf-to-stem ratio of maize. The results indicate that a 10% reduction in urea and TSP fertilizer application from the recommended rate will not hinder the initial growth of hybrid fodder maize in maize-Stylosanthes mix-stand forage culture in the mid-country intermediate zone.

Keywords: Leaf weight, Root weight, Stem weight

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Reduction of Urea and Triple Super Phosphate Fertilizer Application on Initial Growth of Sorghum in Sorghum- Stylosanthes Mix Stand Forage Crop

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The cultivation of hybrid fodder Sorghum (*Sorghum bicolor*) faces challenges due to increased fertilizer requirements. Stylosanthes (*Stylosanthes guianensis*) emerges as an ideal fodder legume in tropical climates. This study investigated the impact of reduced urea and TSP application rates on the initial growth of sorghum in sorghum–Stylosanthes mix-stand forage culture in the low country dry zone. Sorghum seeds were planted in grower bags, while Stylosanthes seeds were sown in a nursery. After 14 days, 12 Stylosanthes seedlings were transplanted into each grower bag. The experiment followed a Complete Randomized Design, with eight rates of urea and TSP, along with the recommended rate of MOP fertilizer mixtures, applied to sorghum–Stylosanthes mix-stand crops at 12 and 28 days after seeding. The control group received the recommended urea, TSP, and MOP fertilizer rate for sorghum (198:62:37 kg/ha). Data were collected from six randomly selected sorghum plants, measuring plant height and leaves number at 8-day intervals. At 7 weeks, sorghum plants were uprooted, and their stems, leaves, and roots were washed. They were dried at 65°C and weighed. A significant ($P<0.05$) effect of urea and TSP fertilizer reduction on plant height from 16 to 48 days and leaf number from 24 to 40 days was observed. The stem and root weights were significantly not affected ($P>0.05$) by a 10 % reduction in urea application from the recommended rate. However, a 20 % reduction in both urea and TSP had significantly ($P<0.05$) decreased the root weight. The experimented fertilizer application rates did not have a significant effect ($P>0.05$) on leaf weight and the leaf-to-stem ratio of sorghum. The results conclude that a 10 % reduction in urea and TSP fertilizer application from the recommended rate will not adversely affect the initial growth of hybrid fodder sorghum in sorghum–Stylosanthes mix-stand forage culture.

Keywords: Leaf weight, Root weight, Stem weight

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Response of Rice Varieties to Foliar Application of Zinc Sulphate at Panicle Initiation and Magnesium Sulphate at Late Booting

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The impact of Zn and Mg on the growth physiology of 46 rice varieties was investigated in a field experiment conducted at the Rice Research and Development Institute (RRDI), Batalagoda, Sri Lanka. The study was done in a Split plot design with three replicates during the *Maha* season 2023/24 (October to February). Foliar applications of $ZnSO_4$ (1.5%) at panicle initiation (PI) and $MgSO_4$ (1.5%) at late booting (LB) of the rice crop were made separately or in combination, supplementing the recommendation dosages of N (Urea), P (Triple super phosphate) and K (Muriate of potash) fertilizers. The control plot received only the recommended fertilizer. The leaf greenness (LG; SPAD reading), leaf and canopy angles, Photosynthetically Active Radiation (PAR) absorbed by the canopy, plant height, leaf width and length, Leaf Area Index (LAI), plant dry weight, Net Assimilation Rate (NAR), Chloroplast density in flag leaf (CD), number of panicles per plant, total number of grains per plant, filled grain percentage, thousand-grain weight, yield per plant, and nitrogen productivity (NP) were measured/estimated. Data were analyzed using ANOVA and treatment means were compared using the Least Significant Difference. Foliar application of $ZnSO_4$ increased NP ($P<0.05$) in new-improved varieties (NIVs) At303, Bg352, Bg370, Bg374, Bg380, and Bw400 and traditional variety '*Pokkali*', while $MgSO_4$ increased the CD ($P<0.05$) in NIVs At303, At405, Bg300, Bg304, Bg352, Bg357, Bg358, Bg366, Bg369, Bg374, Bg380 and Bw400. Foliar application of $ZnSO_4$ or $MgSO_4$ enhanced LG, NAR, CD, number grains per plant, N-productivity and yield in most rice varieties. Combined application of $ZnSO_4$ at PI and $MgSO_4$ at LB stages improved growth and yield of At303, Bg300, Bg352, Bg357, Bg358, Bg366 and Bg370. Results revealed that foliar supplement of $ZnSO_4$ and $MgSO_4$ increases the yield performance of many rice varieties. Further studies at different rice-growing regions in Sri Lanka are recommended.

Keywords: Chloroplast density, Crop physiology, Foliar application, *Oryza sativa*, $ZnSO_4$ and $MgSO_4$

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Response of Rice Variety Bg300 to the Addition of Magnesium and Zinc under Saline Conditions

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A pot experiment was conducted in the glass house of the Department of Crop Science, Faculty of Agriculture, University of Peradeniya during the period from December 2023 to March 2024 with the objective of identifying the performances of Bg300 rice variety to the addition of Zn and Mg grown under saline conditions. Nutrients were applied as six treatments: control (NPK) (T1), NPK + $MgSO_4$ (T2), NPK + $ZnSO_4$ (T3), NPK + $MgSO_4$ + $ZnSO_4$ (T4), NPK + NaCl (T5), and NPK + $MgSO_4$ + $ZnSO_4$ + NaCl (T6) with eight replicates in a completely randomized design. Soil used was originally low in nitrogen, phosphorus, potassium, and specially zinc and magnesium. The application rates of Zn and Mg were 10 kg/ha while the rates of urea, triple super phosphate, and muriate of potash were 225, 55, and 60 kg/ha, respectively. The rate of plant growth and yield determining variables were measured. The number of tillers per plant, plant dry weight, and plant height were increased significantly ($P<0.05$) with the application of Zn and/or Mg compared to the control. However, the induced salinity had reduced the plant growth compared to the control. The treatment with both Zn and Mg supplemented (T4) had the highest growth. Therefore, the application of both Zn and Mg can be recommended for the areas showing their deficiency in improving the growth of Bg300.

Keywords: Fertilizers, Growth response, Micronutrients, Soil salinity, Yield performance

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Response to Selective Breeding of Two Guppy Varieties *(Poecilia reticulata)* at Ornamental Fish Breeding Center, Rambadagalla

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The ornamental fish industry, mainly featured by guppy fish *(Poecilia reticulata*), is expanding due to diversity of color variants it produces, which is facilitated by uncombersome breeding. Traditional selective breeding relies on subjective judgments of economically important traits, leading to inconsistencies in quality and valuation. This study introduces a systematic approach to refine selection strategies, evaluating the efficacy of backcrossing by employing scientifically backed breeding processes to mitigate biases and enhance accuracy. A crossbred guppy fish (F_1) population has been established from parental breeds (golden tuxedo ♀ and red blonde ♂) which have been selected based on traditional screening methods. The subsequent backcross breeding step involved assessing F_1 and backcrossed fish populations using a digital tool. Accordingly, the color intensity of target areas was assessed using Fiji (2.09) software which processes signals of brightness, color saturation and redness of the object. Ten F_1 females, out of twenty in the breeding stock, and F_1 females were selected for backcross breeding based on their intensity values. Using colour intensity measurements, backcross females and F_1 females were compared for color characteristics, namely redness, saturation, and brightness of red colour in target body areas. The results revealed significant differences ($P<0.05$) between the two groups where the backcrossed females exhibited higher redness, saturation, and brightness values than those of F_1 females. These findings confirmed the success of the selective breeding program adopted in backcrossing to improve the desirable traits in breeding process. Evaluation of the traits variability of F_1 population exhibited that there was a considerable variation within F_1 generation, suggesting color segregation in F_1 as a result of low purity levels of parental breeds (golden tuxedo and red blonde). The study also helped in establishing an unbiased color scoring system based on digital image capturing system for future use in the fish breeding station.

Keywords: Backcrossing, Guppy fish, Image screening, Selective breeding

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Root Foraging Capacity of Millet Species in Response to Spatially Heterogeneous Nutrient Availability and its Impact on Nutrient Uptake and Yield

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Nutrient distribution in soil is heterogeneous which makes root foraging capacity a promising trait for successful patch exploitation for nutrient uptake. Whether the root system of different millet species has the plasticity to adjust with nutrient availability and its influence on growth and nutrient uptake remains unclear. Therefore, the aim of this study was to investigate the root growth plasticity of three millet species when nutrients are heterogeneously distributed in soil profile. A pot experiment was conducted in a complete randomized design in a greenhouse with three millet species (finger millet, foxtail millet, and proso millet) and two patterns of nutrient distribution in soil creating nutrient rich and nutrient poor soil layers across the soil profile in pot. The two nutrient distribution patterns were, (i) nutrient-limited soil in the whole pot as nutrient homogeneous condition and (ii) nutrient-poor soil in one half along the vertical axis and nutrient-rich soil in other half of the pot as nutrient heterogeneous condition. The impact of soil nutrient heterogeneity on plant growth, nutrient uptake, yield and root foraging precision were investigated. Three millet species invested more root dry matter to nutrient-poor part compared to nutrient-rich medium when the plants are grown under nutrient heterogeneity where half of the pot along vertical axis was filled with nutrient-poor soil while other half contained nutrient-rich soil. Panicle dry weight and shoot dry weight of three millet varieties were significantly different ($P<0.05$). Nutrient distribution pattern had no impact on shoot and panicle dry matter accumulation of each millet species. Nutrient uptake was greater when millets are grown in nutrient heterogeneous conditions compared to nutrient homogenous medium. When grown under nutrient heterogeneity, none of the millet species could precisely forage nutrient-rich half of the pot indicating the lower root foraging precision of three millet species.

Keywords: Millets, Nutrient heterogeneity, Nutrient uptake, Root foraging precision

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Substituting the Fishmeal by Commercial Cricket Meals in Swordtail (*Xiphophorus helleri*) Diet: Pertinence to Growth, Colouration, Salinity Tolerance and Histopathological Alterations

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Fish feed has become one of the significant determinants of aquaculture due to its high price and the issues of accessing locally produced quality fishmeal (FM). Insect meals are becoming a sustainable alternative to FM and can be produced locally. Therefore, this experiment was performed with swordtail fish (SF) (*Xiphophorus helleri*) to check the possibility of substituting fishmeal by cricket meals in swordtail fish diet without affecting growth**,** colouration, salinity tolerance and histopathological alterations**.** The Red Velvet strain of SF was allocated in 12 fish tanks, with 15 fish in each. The duration of the experiment was 68 days. FM of the control (T1) was replaced by three commercial cricket meals (house cricket (T2), field cricket (T3), and ground cricket (T4)). This study confirmed that FM could be replaced by the researched cricket meals in swordtail fish diet without affecting weight, colouration, and salinity tolerance. There was no significant difference in initial and final body weights, weight gain, relative weight gain and the specific growth rate of fish among four treatments. Since the survival rate was high, the tested three cricket meals were not a limiting factor for the survival of SF. The colouration tests reviled no significant difference in the colour of the fish fry fed with four different diets. There was no significant difference in the cumulative stress values obtained. The hepatic slides showed minor fatty liver alterations as: T1 = T4 > T3 >T2 confirming the lowest in T2. Finally, the results of this study revealed that cricket meals are a suitable alternative to FM in the SF diet. Nevertheless, further studies are required to overcome the fatty liver condition.

Keywords: Cricket meal, Fishmeal, Swordtail fish

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Suitability Assessment of Nutmeg Peel Extract to Control Postharvest Pathogens of Banana

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Crown rot, anthracnose and finger rot are major postharvest diseases of banana, which cause significant economic losses. The present study aimed to explore the antimicrobial properties of nutmeg peel extract against the postharvest pathogens of banana as an alternative and bioeconomical approach to presently-used synthetic fungicides for the management of postharvest diseases. *Colletotrichum musae*, *Fusarium* sp., *Penicillium* sp., and two unidentified fungi (i.e. S5 and S11) were isolated from 'Amban' and 'Kolikuttu' varieties exhibiting crown rot symptoms. Pathogenicity of the fungal isolates was confirmed by Koch's postulates. A 50% (V/V) dilution of the aqueous nutmeg peel extract obtained by grinding 100 g of nutmeg peel was sterilized by autoclaving and was tested against the fungal isolates by poison food method to determine the fungal colony growth inhibition. All the isolates except *Penicillium* sp. showed a colony growth inhibition ranging from 10.5-79%. Reduction of colony growth inhibition was significant ($P<0.05$) for *C. musae*, *Fusarium* sp. and S11 isolates compared to growth under non-treated conditions. When tested on a representative plant pathogenic bacterium, *Xanthomonas* sp., the autoclaved undiluted nutmeg peel extract exhibited antibacterial properties. These findings showed the antifungal and antibacterial properties possessed by nutmeg peel extract even after sterilization by autoclaving, hence, reveal its potential as a commercial bio-pesticide.

Keywords: Anthracnose, Bactericidal activity, Crown rot, Finger rot, Fungicidal activity

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The Effect of Salicylic Acid on Growth, Shelf Life, and Bio-Active Compounds Present in Lettuce (*Lactuca sativa* L.)

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Lettuce (*Lactuca sativa* L.) is a vital leafy vegetable, primarily consumed as fresh or in salad mixes. It is an excellent source of phytochemicals and is renowned for its functional properties around the globe. Elicitation for biosynthesis of bioactive compounds can improve crop production by enhancing nutraceutical and nutritional quality. Salicylic acid (SA) is a naturally occurring plant phenolic compound which stimulates plant growth and defense responses under stress conditions and enhances the production of secondary metabolites. In this study, 100 ppm SA was applied at three distinct stages of plant growth: on the 35th, 42nd, and 49th days after planting, and a control group was maintained without applying SA for comparison. Total phenolic compounds by the Folin-Ciocalteu method, vitamin C content by 2,6-dichlorophenol-Indophenol visual method, and antioxidant activity by DPPH free radical scavenging activity were assessed to evaluate the content and the stability of these functional compounds. Concentrations of chlorophyll a, chlorophyll b, and carotenoids, and weight loss during the storage were further assessed. The analysis was performed immediately after harvest and seven days after room temperature and refrigerated storage conditions. Findings suggest that carotenoids present in green lettuce exhibit greater stability at refrigerated (4ºC) conditions compared to storage at room temperature. Vitamin C content in two storage conditions was significantly higher ($P<0.05$) in plants treated with SA on the 49th day (T3), and showed a lesser decrease during storage at both room temperature and 4°C, indicating enhanced stability of vitamin C in treated lettuce. Total polyphenol content was also higher in T3 in all stages, while the increment of antioxidant activity was identified in all three treatments. DPPH free radical scavenging activity was greatly influenced by the total phenolic content of the lettuce as a notable correlation was observed between polyphenols and antioxidant activity at harvest.

Keywords: Bioactive compounds, Elicitation, Functional properties, Salicylic acid, Secondary metabolites

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The Effect of Vitamin (A and D) Enriched *Moina macrocopa* Diet on Growth, Survival and Colour Enhancement of Guppy (*Poecilia reticulata*) During Nursery Period

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Guppy (*Poecilia reticulata*) is one of most demanded ornamental fish species around the world. Sri Lanka has been one of the main exporters of guppies for past 10-15 years. Guppy's vibrant colour is important to make them demand. Therefore, it is required to investigate ways to improve the ornamental value of guppy through nutrition. Effect of vitamin A and D on colour enhancement, growth and survival was assessed in this experiment. Experiment was conducted at NAQDA, ornamental fish breeding and training center, Rambodagalla. Vitamins were fed through vitamin enriched *Moina macrocopa* which is widely used as a live feed in guppy farming. A pre-trial was conducted to decide the optimum vitamin A and D concentrations to enrich *Moina macrocopa*. Survival of Moina in a series of vitamin concentrations was evaluated. Concentrations of 0.09 µg & 0.07 µg per liter of Moina were decided for vitamin A and D respectively. Day- old golden tuxedo fry were fed with vitamin enriched Moina and analyzed for above parameters. The guppies treated with vitamin A-enriched Moina exhibited the highest color intensity ($P<0.05$), followed by the combined treatment of vitamin A and D, which showed the second-highest color intensity ($P<0.05$). Vitamin A treatment showed the highest ($P<0.05$) average weight gain (63.81±4.75 mg). The combination of vitamin A and D showed the significantly lowest survival rate (59.05±0.19%) of guppies, while vitamin A, vitamin D, and the control showed survival rates of 86.67±0.287%, 89.52±0.318%, and 87.62±0.296%, respectively ($P<0.05$). Vitamin A enriched *Moina macrocopa* diet can be used to improve colour intensity and the growth of golden tuxedo guppy fry during nursery period. However, Vitamin A+D combination enriched *Moina macrocopa* must not be fed to golden tuxedo guppy fry since it causes to lower survival rate during their nursery period.

Keywords: Guppy, *Moina macrocopa*, Ornamental fish, Vitamin A, Vitamin D

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Unravelling the Contents of Polyphenols, Antioxidants, and Heavy Metals of Cocoa Beans from Selected Major Cocoa Growing Regions in Sri Lanka

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The cocoa bean, prized for its unique chemical composition, particularly due to its high polyphenol content, has recently become the focus of research due to the health benefits attributed to its antioxidant properties. However, the potential contamination of cocoa beans with heavy metals such as cadmium (Cd) and lead (Pb) poses significant health risks, underscoring a major concern in cocoa consumption. This study was designed to investigate the polyphenol content, antioxidant activity, and heavy metal levels in cocoa beans from six leading cocoa-growing regions of Sri Lanka. Employing spectrophotometric methods (Folin-Ciocalteu's reagent for total polyphenol content and aluminium chloride solution for total flavonoid content) alongside the DPPH assay for antioxidant activity, and Atomic Absorption Spectrophotometry for heavy metal content, the research revealed significant variations ($P<0.05$) in the measured parameters across different regions. Total polyphenol content was found to range from 82.24±5.65 mg GAE/g to 117.47±4.35 mg GAE/g, while total flavonoid content varied from 0.35±0.06 mg RE/g to 0.58±0.02 mg RE/g. Additionally, ascorbic acid equivalent DPPH activity showed significant disparities, ranging from 187.7±68.9 mg/L to 1380.7±150.1 mg/L, highlighting the influence of geographic location on the bioactive compounds in cocoa. Regarding heavy metal contamination, the cadmium content in the cocoa samples varied from 0.03±0.01 mg/L to 0.75±0.07 mg/L, with the lead content ranging from 0.009±0.0001 mg/L to 0.04±0.01 mg/L. Notably, the cadmium level in samples from the Monaragala district was marginally above the European Union's maximum permissible limit, although the lead content in all samples remained below these thresholds. These findings underline the need for targeted intervention strategies to reduce heavy metal contamination in Sri Lankan cocoa, ensuring the safety and health benefits of this vital raw material in the chocolate industry.

Keywords: Antioxidants, Cocoa beans, Flavonoids, Heavy metals, Polyphenols

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Will Chili be Having an Advantage when Horse Gram is Used as a Cover Crop or a Green Manure Crop

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Growing cash crops alongside with legumes provide nitrogen-rich solutions reducing the dependency on inorganic fertilizers for crop cultivation. This study was conducted using a Randomized Complete Block Design with three replicates at the research field at Mahailluppallama sub-campus, Faculty of Agriculture, University of Peradeniya during *Maha* season 2023-2024. Horse gram (*Macrotyloma uniflorum* (Lam.) Verdc.) variety ANKG-black was used with chili (*Capsicum annuum* L.) variety MICH-HY-1 as the cash crop. In the experiment, horse gram was used either as a cover crop (CC) or green manure (GM), to evaluate which approach would be better for chili. In CC treatment, chili was grown together with horse gram for nine weeks, and in GM treatment, chili was transplanted onto the plots to which previously grown nine weeks old horse gram was incorporated. As for control, chili crop was maintained without CC or GM. Each of above treatments (control, horse gram CC, and horse gram GM) had 2 levels; one without the addition of any external nutrient inputs, and the other with the addition of Department of Agriculture recommended fertilizer inputs for the cash crop. Therefore, all together there were six treatment combinations present. The soil was analyzed initially, at GM incorporation, and weekly after GM incorporation. Available nitrogen and organic matter contents in soil were significantly higher ($P<0.05$) after GM incorporation compared to initial conditions. The growth, and yield in chili was highest in GM+fertilizer added treatment. When considering the yield of the first pick and plant height, the non-fertilized green manure treatment had similar values to that of the fertilized control. Therefore, the incorporation of horse gram GM together with Department of Agriculture recommended fertilizer can improve both growth and yield in chili cultivations.

Keywords: Cover crop, Green manure, Legume, Organic matter

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Technological Interventions and Applications in Agriculture

Application of Multispectral Unman Areal Vehicle (UAV) Images for Precision Nitrogen Management in Rice (*Oryza sativa* L.)

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Excessive use of nitrogen (N) fertilizer harms the environment and increases the cost of crop production. To mitigate these adverse effects on rice growth, employing unmanned aerial vehicles (UAVs) with multispectral imagery analysis capabilities has emerged as a promising strategy. Hence, the UAV technology was used to predict leaf nitrogen content (LN) in Rice (*Oryza sativa* L.) variety, Bg 374) Multispectral imagery of rice canopies, subjected to varying doses of N fertilizer (0%, 25%, 50%, 75%, 100%, and 125% of Urea as recommended by DOA), in a field experiment was captured at after planting. Each treatment was replicated twice, and leaf samples were collected during drone image acquisition to measure N content using the Kjeldahl method. The images were used to calculate 12 vegetation indices (VIs) using Pix4D Field Software (version 1.10). The correlation analysis pinpointed the Green Chlorophyll Index (GCI) as the most robust VI for predicting LN (r = 0.79), closely followed by the Ratio Vegetation Index (RVI) and Normalized Green Red Difference Index (NGRDI) (r = 0.78 and 0.77, respectively). Subsequently, three machine learning (ML) models were evaluated for their potential to predict LN status using the most correlated VI. The Support Vector Regression (SVR) and Simple Linear Regression (SLR) models were effective prediction models, with Coefficients of Determination (R^2) values of 0.82 and 0.81, respectively, and Root Mean Square Error (RMSE) values of 2.86 and 2.70. The Random Forest (RF) model exhibited the highest predictive performance on the validation dataset, with an R^2 of 0.74 and the lowest RMSE of 2.60. This suggests that RF is the most suitable among the tested models to predict LN in rice. The selected RF-trained model and GCI values can be used to predict the leaf N content for precision N application in rice.

Keywords: Machine learning models, Multispectral imagery (MI), Rice leaf nitrogen, Vegetation indices (VIs)

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Asserting Optimum Pyrolysis Parameters in Producing Biochar from Common Green Bamboo

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Bambusa vulgaris Schrad. ex J. C. Wendl. (Common green bamboo) is a rapidly growing bamboo species that can be found in various agroecological zones of Sri Lanka. In contrast to the widespread use of yellow bamboo in the construction and furniture industries, common green bamboo remains an underutilized biomass resource in Sri Lanka due to its heavy stem structure. The emerging technology of manufacturing biochar from organic biomass has versatile applications in soil improvement, environmental remediation, and carbon sequestration. This research focuses on determining the optimal pyrolysis conditions for producing bamboo biochar in order to address these challenges and harness the material and energy recovery potential of bamboo. The study investigated the optimum pyrolysis temperature and residence time required to produce biochar from bamboo, while analyzing its physicochemical properties to determine the best parameters. The optimum pyrolysis conditions were assessed using a mini-pyrolizer, where varying temperatures and residence times were tested. The pyrolysis study revealed that the biochar yield varied with pyrolysis temperature and residence time. Notably, a temperature of 400°C and a residence time of 60 minutes yielded the highest biochar mass recovery. Proximate analysis of the produced biochar indicated a range of fixed carbon content (1% - 13%) and volatile material content (65% - 90%), highlighting the influence of temperature on material loss during pyrolysis. To ascertain the optimum conditions for industrial level biochar manufacturing, the experiment was upscaled using a double-barrel pyrolysis reactor. The upscaled experiment demonstrated a biochar mass recovery of 31.6% at a temperature of 500±60°C and a residence time of 90 minutes. The experiment concluded that pyrolysis of common green bamboo into biochar can be proposed as an alternative use for this abundant resource.

Keywords: Biochar, Common green bamboo, Pyrolysis

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Assessment and Mapping of an Irrigation Command Area Performance Using GIS and Remote Sensing – A study in *Thuruwila* Irrigation System

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Spatial diversity of an irrigation command area can occur due to multiple factors. Objective of this study was to assess the spatial diversity of the irrigation command area of *Thuruwila* tank located in the North Central province of Sri Lanka in which water is used for irrigation and drinking purposes. To assess the spatial diversity, Landsat OLI and Sentinel 2A multi temporal satellite image derived Normalized Difference Vegetation Index (NDVI) and Normalized Difference Water Index (NDWI) representing *Yala* and *Maha* seasons were used. Primary data with respect to the field conditions and management practices were acquired using a field survey and a questionnaire survey with the farmers. Rainfall data for the period of 2016 - 2023 was analyzed to identify season variability of rainfall. A water balance for the tank was calculated considering the conditions before 2005; prior to water diversion for drinking purpose and after 2005 in which the system has been augmented with Mahaweli water. Results reveal that the system is dominated by paddy cultivation. NDVI and NDWI indices provide an insight to the diversity exist in the command area. The ground conditions visible in the satellite derived indices are compatible with the seasonal rainfall amounts which represent wet and dry conditions. The system water balances before and after water diversion were calculated for 2002 and 2019. In conclusion, *Thuruwila* irrigation system does not show a considerable performance diversity as per the satellite image derived indices. The system water balance suggests that the irrigation system has sufficient water for cultivation. However, it is suggested to use high spatial resolution satellite data to identify the spatial diversity in detail coupled with field surveys. Seasonal water balance does not provide an accurate situation of water availability hence dynamic water balance calculation for the system is recommended.

Keywords: GIS, NDVI, NDWI, Remote sensing, Spatial diversity

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Assessment of a Medium-Scale Feed Mill for the Production of Compound Feed Pellets for Dairy Cattle Feeding

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Ensuring the provision of high-quality compound feed at the most competitive price is a critical prerequisite for the successful operation of feed milling for dairy cattle feeding. This study aimed to assess a medium-scale commercial feed mill to enhance compound feed manufacturing processes, with the objective of producing nutritionally balanced and cost-effective compound feed pellets for dairy cattle feeding. The research methodology involved a SWOT analysis of the milling operation through on-site observations, discussions with factory staff, and the examination of secondary data related to the supply chain of raw materials, milling operation, marketing, and other pertinent factors. Samples of raw materials available for compound feed pellet production and two pellet products of the factory (General feed, High yield feed) were analyzed for proximate composition, *in vitro* organic matter digestibility (OMD), and *in vitro* metabolizable energy (ME). Subsequently, considering the availability, nutritive value, and price of the raw materials, as well as the nutritive value of currently produced pellet products and targeted nutritive value of pellets, five alternative formulae were proposed for the production of compound feed pellet for dairy cattle feeding. The pellets were then produced following the proposed five formulae alone with the two existing formulae (General feed, High yield feed) those served as controls. Finished pellets of the seven formulae were analyzed for their nutritive value. The newly formulated pellets were found to be matched with the expected nutritive value, and financially justified. Inconsistent raw material supply, poor record-keeping practices, improper storage of raw materials and finished products, inefficient machinery and ad hock milling protocols were found to be the major logistical faults of the feed mill. Poor quality control of raw materials and imbalanced rations were identified as the major causes for the production of poor-quality dairy cattle pellets at the feed mill.

Keywords: Feed formulae, Milling protocols, Quality, Raw materials

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Assessment of Hydrological Impacts (Flooding) Due to Conversion of Paddy Land to Other Land Uses - A Study in *Ihala* and *Pahala Eriyagama* Area in *Kandy* District

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Conversion of paddy lands into other land uses is common in Sri Lanka due to multiple factors including urbanization. These changes bring unacceptable hydrological impacts in the watersheds such as flash floods. This study was conducted to assess the hydrological impacts of the conversion of paddy lands to other land uses in a small watershed located in the *Ihala* and *Pahala Eriyagama* areas near *Peradeniya* in *Kandy* district of Sri Lanka. Land use changes were identified using satellite imagery and Geographical Information Systems (GIS). Rainfall data, topographic information, and field survey data were used to assess the flood risk in the area. A questionnaire survey was conducted using a selected group of residents to understand the impacts of land use conversion and flooding incidences. The study reveals a significant drop in paddy lands from 22.34 ha in 2003 to 5.24 ha in 2023. The time of concentration of the watershed was calculated as 46.07 minutes. The estimated peak rate of runoff for the year 2003 was 1.89 m^3/s. However, in 2023, this rate has significantly increased to 7.9 m^3/s. Rainfall analysis using the Innovative Trend Analysis method revealed an increasing trend of rainfall in the period of 2009-2023 compared to the period of 1994-2008. The questionnaire survey among the residents revealed the occurrence of land use changes and flood risk in the area. Field observations and measurements identified the problems associated with the drainage canal in which the capacity is not adequate to remove the runoff during high rainfall events. All these findings emphasize the importance of mitigating flood risk through preventing conversion of paddy lands to other land uses since they help to absorb and release flood water gradually. The capacity of the drainage system should be enhanced by cleaning, reconstructing, and expanding the main canal to ensure effective water flow.

Keywords: Flood risk, GIS, Land use conversion, Paddy lands, Remote Sensing

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Assessment of Selected Material Composites for Permeable Reactive Barrier (PRB) System to Treat Wastewater Contaminated With Personal Care Products: Hair-dye

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Water is the core factor in the function of living organisms all over the world. Nevertheless, the degradation of water quality is at an alarming rate in Sri Lanka. The freshwater and groundwater ecosystems are threatened drastically due to the wastewater generated from the increased use of personal care products at the salons. The conventional methods are not effective in removing the contamination that is presented in the effluent from the salons. Thus, the Permeable Reactive Barrier (PRB) is a system that is designed in the subsurface of the soil and allows passing the contaminated water. Then the reactive material in the system reduces the contaminations or pollutants in the wastewater and sends out the purified water. Biochar and bricks are natural products that can be used as absorption material for PRB systems due to their sustainability, long-term usage, and ease of removal of heavy metals such as Pb and Cr. In this study, 7 different bricks and biochar combinations were subjected to the test such as Biochar 100% + Bricks 0%, Biochar 75% + Bricks 25%, Biochar 65% + Bricks 35%, Biochar 50% + Bricks 50%, Biochar 35% + Bricks 65%, Biochar 25% + Bricks 75% and Biochar 0% + Bricks 75%. As per the result of the survey it can be noted that Bellose is the most used hair dye brand in the salons of *Peradeniya*. It is identified that hydraulic conductivity and Nitrate removal efficiency were significantly different ($p<0.05$) among the treatments. Analysis results indicated that 100% brick and 100% biochar have high hydraulic conductivity. 75% of bricks and 25% of biochar combinations have higher removal efficiency of Nitrate. Thus, the best combination to develop the PRB system in the salons of *Peradeniya* is 75% bricks and 25% biochar.

Keywords: Biochar, Bricks, Hair-dye, Removal efficiency, Wastewater

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Assessment of Spatial and Temporal Variation of Tea Yield using GIS Technology

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The tea sector plays a vital role in the economy of Sri Lanka, which has and far-reaching effects on social and cultural spheres. The incorporation of GIS technology is a better approach for improving the tea sector ensuring the productivity and sustainability. This study was conducted to identify long term spatial and temporal variations of the yields in the tea (*Camellia sinensis*) fields in St. Coombs Estate, Talawakele, using GIS technologies and to assess soil quality parameters affecting the variation of tea yield. A digital map of the estate was developed using the mapping tools of ArcGIS and Google earth pro application. After that a tea digital database was generated by compiling estate data on yield, cultivar distribution, age of the tea stands, dates of pruning, and fertilizer applications. To compare yields, the average monthly yield for each year in the pruning cycle was used. Results were visualized through map layers created in ArcGIS. Several maps were developed on the spatial distribution of productivity, age of tea stands, type of the tea stands and temporal variability of yield related to the estate. Maps revealed a relationship between the type of tea stand and the productivity. Based on the results, low and high yielding fields were identified, and soil samples were taken from those fields were analysed for soil quality parameters, namely pH, EC, exchangeable potassium, available phosphorus, organic carbon, bulk density and texture. Among them a significant difference was identified for exchangeable potassium ($P<0.05$), Clay% ($P<0.05$) and organic carbon ($P<0.1$). This study enabled the assessment of crop performance through GIS technology revelling relationship between the type of tea stand and the productivity among the fields. The exchangeable potassium, organic carbon and clay% were associated with crop performance.

Keywords: GIS, Spatial variability, Temporal variability, Tea yield, Soil quality

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Assessment of Treatment Performance in Response to Plant Species: Implications for Design and Management Practices in Floating Treatment Wetland (FTW) in *Beira* Lake, Sri Lanka

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Urban lakes play a pivotal role in the ecological and aesthetic well-being of urban environments, reflecting the characteristics and activities of their respective catchment areas. However, most urban lakes are polluted due to anthropogenic activities. Floating treatment wetland (FTW) is an innovative nature-based solution designed to enhance water quality in various aquatic environments. The performance of FTWs is affected by the plant selection, system design and management practices. Hence, the selection of plants assumes paramount importance in optimizing the performance of FTWs. 4 types of plants, *Canna indica*, *Heliconia densiflora*, *Hanguana malayana* and *Zantedeschia aethiopica* were assessed by planting in floating frames in *Beira* Lake, Colombo and evaluated weekly by the growth and the phosphorus removal for 8 weeks. The biofilm attached to the roots were morphologically screened by culturing at the laboratory. Social acceptance of the different plants was also assessed by a questioner survey. Based on the comparative analysis of plant performance, *Canna indica* showed the highest plant growth rate and exhibited the greatest microbial diversity in biofilm. *Hanguana malayana* had the highest phosphorus content in the plant and *Zantedeschia aethiopica* was the most preferred plant by the people. Negative correlation was shown between total dry weight and shoot phosphorus content in *Canna indica* and *Zantedeschia aethiopica* while *Hanguana malayana* was shown a positive relationship. Furthermore, with the potential for improved acclimation, there is an opportunity for further cultivation of *Zantedeschia aethiopica* and *Hanguana malayana* in FTWs.

Keywords: Beira lake, Biofilm, Floating treatment wetland, Phosphorus, Plants

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Compressed Biodegradable Pellets Using *Eichhornia crassipes* for Nursery Seedlings

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Eichhornia crassipes is a water weed that dominates in water bodies worldwide. Its utilization not only solves problems but also provides economic benefits. For nursery seedlings requires a growing medium that is cheap, easily accessible, and sustainable. Therefore, the production of a substitute medium using *Eichhornia crassipes* plants becomes very intriguing. The research was conducted by processing compressed biodegradable pellets based on Different *Eichhornia crassipes* plant parts ratios for nursery seedligs.The study used a Completely Randomized Design with 20 treatments and 4 replications, as control (C) Coco peat 100%, stems 100%(T1),roots 100%(T2),leaves 100%(T3),stem 50% + root 50%(T4),stem 66.67% + roots 33.3%(T5), stem 33.3%+root 66.67%(T6),stem 75%+ roots 25%(T7),stem 25%+ roots 75%(T8),stem 50%+ leaves 50%(T9),leaves 66.7%+ stem 33.3%(T10),leaves 33.3%+ stem 66.7%(T11),stem 75%+ leaves 25%(T12),stem 25%+ leaves 75%(T13),leaves 50%+roots 50%(T14),leaves 67.3%+ roots 33.3%(T15), leaves 33.3%+roots 67.3%(T16),leaves 75%+ roots 25%(T17),leaves 25%+roots 75%(T18),stem 33.3%+ leaves 33.3%+roots33.3%(T19). The results of the study showed that the treatments with *Eichhornia crassipes* have significance difference of the medium bulk density, water holding capacity, pH value, and EC value when compare with control test (100% cocopeat). The highest water holding capacity was obtained from the T2. All water holding capacities was higher than the control tests water holding capacity. Highest bulk density was obtained from control test. Among other treatments highest bulk density was obtained from T4 and lowest was obtained from T12. Lowest pH value was obtained from control test. Highest pH value was obtained from T3.Between all treatments no significant difference of shoot length. Highest shoot weight was obtained from T16 and between other treatments no significant differences. Highest root weight was obtained from T5. T2 (T9 (Stems: Leaves 1:1), T10 (Leaves: Stems 2:1), T16 (Leaves: Roots 1:2), T17 (Leaves: Roots 3:1), T18 (Leaves: Roots 1:3) and T19 (Leaves: Stems: Roots 1:1:1) showed the best performances. So these compositions are preferable to making pellets (Roots 100%). T9, T10 and T17 can further be investigated (as the stem and root dry weight out-turn is low). This indicates that compressed biodegradable pellets as a growing medium for nursery seedlings using *Eichhornia crassipes* has great potential as a growth medium for nursery seedlings

Keywords: Compressed pellets, *Eichhornia crassipes*, Nursery seedlings

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Decolouration of Piperine Powder Extracted from Black Pepper Using Activated Carbon

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The transparent whitish colour of piperine is a good quality parameter identified by the food industry. Piperine extracted from black pepper has a distinct greenish appearance due to contamination with chlorophyll during extraction. This research aimed to decolour piperine powder extracted from black pepper by utilizing activated carbon. Activated carbon treatments were done to piperine at different combinations of time and temperature. Piperine (10 ml) treated with 3 g of activated carbon at 30°C for 10 min resulted in a 94.196±0.358^{a}% reduction of chlorophyll. However, it caused a 95.120±0.490^{a} % reduction in piperine yield, which is not desirable. After further testing, 1 g of activated carbon per 10 ml of extract at the same temperature and time resulted in a 57.240±0.268^{a} % reduction of chlorophyll and only a 6.917±0.353^{a}% reduction in piperine yield compared to the control. This was deemed the optimal treatment combination. Then 1 g of activated carbon washed with 80% ethyl acetate and 20% hexane was used at the same above conditions. This resulted in a 48.341±0.290^{a}% reduction of chlorophyll compared to the control, with only a 1.0511±0.072^{b}% reduction in piperine yield. The piperine content in both control and activated carbon treated piperine powder (92.2$\pm$0.616^{a} and 91.836 $\pm$ 0.357^{a} respectively) was not significantly different (P>0.05). Additionally, the lightness value for the activated carbon-treated sample was higher than that of the control. Overall, the results of this study could offer practical solutions to reduce chlorophyll content in piperine powder while improving its visual appearance.

Keywords: Activated carbon, Piperine powder, Chlorophyll, Decoloration

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Design and Development of a Cloud-Based Automated System with Artificial Intelligence for a Spice Dehumidifier

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Reducing the moisture content of raw materials before milling has several advantages in spice milling industry. It reduces the energy required for milling, increases the throughput and the fineness of the powder. The majority of industries use traditional ways to reduce the moisture content of raw materials such as using solar energy. Raw material drying using dehumidified air was considered in this research as a better way of controlling the raw material moisture content before milling. To produce low relative humidity air, dehumidification of air using heat pumps was implemented. A chamber with 4 heat pumps each having a capacity of 1.05506 kW was used to achieve the target of producing low-humidity air for drying raw materials. Operation and control of the air dehumidification unit manually is impossible due to the complexity of operational parameters. To streamline operations and enhance efficiency, an Arduino-based control system was implemented and powered by IoT components for data transmission to the cloud using ESP8266 NodeMCU DEVKIT 1.0 (Espressif Systems) modules. The IoT system showed acceptable performance indicators, including throughput of 538±33.56 pps and a Packet Loss Rate (PLR) of 0.72 ± 0.094%, and with a slightly higher boot time. Using collected data and collaborating with *Ruhunu* Foods, a machine learning model was developed to predict operational hours based on ambient conditions, initial and required moisture contents, and particle size of the raw material. Evaluation via t-test indicated no significant ($P>0.05$) difference between predicted and actual operational hours, proving the model's efficacy. The cloud based IoT system efficiently visualizes real-time data on a user-friendly interface, facilitating monitoring and control. Except for the slight boot time delay, the system's overall performance proves its suitability for dehumidification process. This study offers a scalable approach for industry applications while improving the automation of spice processing operations.

Keywords: Cloud-based automated system, Machine learning, Predictive model, Real-time monitoring, Spice dehumidifier

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Design, Fabrication and Testing of a Paddy Collecting and Bagging Machine for Sun Drying on Cement Floors

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Sun drying is the traditional and the most popular low-cost grain drying method used by farmers and small-scale millers. It involves drying on the floor, collection using a wooden board and filing into bags. This is a labour and time-consuming tedious work. Therefore, a paddy collecting and bagging machine was designed, fabricated, and tested for its performance on collection and bagging operations on cement floors. The paddy collecting and bagging machine had the following major components; auger collector, conveyor lift belt, wheels, handle and a bag holder. Grains on the floor are pushed into the auger when the front collector pan is pushed forward and then the two front augers convey them towards the center. These augers feed a steady flow of paddy onto the belt conveyor located at the center of the auger axil. Then the paddy conveyed by the augers is conveyed and lifted using a modified belt conveyor to fill the gunny bag placed on the stage. Both the auger collector and the conveyor belt were powered by an engine. Power transmission from the engine to the auger and the belt drive were done by using belt and pulleys. The machine collection process was compared with the traditional manual collection for its cost and collection efficiency. The paddy collection and bagging machine had a collection efficiency of 77% with a collection capacity of 4.3 t/h at a rotational speed of 650 rpm whereas the manual collection efficiency was 96% with the capacity of 1.8 t/h. The collection cost with the machine and traditional methods were Rs. 0.15 and 0.17, respectively. The grain damage was not significant under both methods. The machine needs further modifications to the front collection mechanism to increase the collection efficiency and to reduce the cost of collection further.

Keywords: Collection capacity, Collection efficiency, Machine collection, Paddy grain damage, Sun drying

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Designing an Arduino-based Automated Robotic Device to Detect the Leaf Water Content Non-Destructively in Rice

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Leaf water content (RWC) is a reliable parameter to estimate the stress impacts and water requirements of rice. As the typical, cost-effective RWC measurements are destructive and inefficient, this study was conducted to design a robotic device for non-destructive RWC measurements. AutoCAD software was used to design the basic 3D printed structure of the robot along with an Arduino UNO microcontroller, Arduino MKR1000 board, and a data logger. A MK2-type robotic arm was attached to the base of the robot with an Arduino-compatible leaf sensor connected at the gripper. Four sets (n=6-12, each) of real-time readings (i.e., voltage of direct current; VDC) were automatically recorded in the fully expanded youngest leaf of a representative tiller of well-maintained potted rice plants using the device as the first attempt. Data sets were then subjected to a manual calibration against four concurrent destructive RWC data sets (LWC) that were estimated using: LWC= (FW-DW)/ (TW-DW) ×100, where FW, DW, and TW are the leaf fresh weight, dry weight and turgid weight (soaking fresh leaf pieces in distilled water at 4 °C in the dark for 24 hours), respectively. Pearson Correlation analysis revealed that two datasets (n=12 each) obtained at the vegetative stage of rice had an inversely proportional relationship between VDC and LWC ($r=0.7$; $p<0.05$), while a directly proportional relationship ($r=0.8$; $p<0.05$) was observed between two data sets collected at the reproductive stage (n=12 and 6). All four graphs had variable slopes that can be accounted for the variability of the data sets (i.e., VDC and LWC ranged from 3800-3900 and 70-90%, respectively) and the differences between the leaf thickness of vegetative and reproductive tillers of the test rice plants. Results warrant further research for calibrating VDC readings against LWC with larger and more variable samples prior to recommending the device for wider applications.

Keywords: Arduino, Leaf water content, Non-destructive, Rice, Robot

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Development and Evaluation of Bioplastic Composite: Valorisation of Pharmaceutical Gelatin Residue

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The pressing need to reduce plastic pollution has prompted the creation of ecologically friendly substitutes made from renewable materials. This study optimized pharmaceutical gelatine residue for eco-friendly, sustainable bioplastic composite utilizing corn oil reinforced with either cassava or corn or rice starch with detailed property characterization of the bioplastic composites. Fourier-transform infrared (FTIR) spectroscopy was employed to investigate the starch and gelatine interaction, revealing intense signals corresponding to polysaccharides (O-H, C-O, C-H) and proteins (amide I/II). Weaker bands were observed in corn and rice formulations, indicating lower biopolymer content. Thermogravimetric analysis (TGA) unveiled a substantial inorganic residue (~1.5%, 700°C) for cassava, attributed to mineral fillers enhancing thermal stability and biodegradability, while corn and rice composites left minimal residues (<0.5%). Scanning electron microscopy (SEM) showcased a smooth, homogeneous surface morphology for cassava bioplastics, suggesting excellent component integration. In contrast, corn sample exhibited a rougher, porous microstructure indicative of phase separation, while the rice composite displayed an intermediate texture. Mechanical testing demonstrated superior hardness ($P<0.05$) for cassava bioplastics (57.2 N) compared to corn (37.5 N) and rice (33.0 N) composites. Cassava bioplastics exhibited the lowest ($P<0.05$) water absorption (139.8%) after 24 h of immersion, outperforming corn (200.3%) and rice (198.9%) bioplastics. Biodegradability assessment indicated accelerated degradation for cassava (67.0% after 7 days), surpassing corn (47.7%) and rice (51.8%) formulations. The optimized composition, microstructural homogeneity, enhanced mechanical properties, low water sensitivity, and promoted biodegradability highlight the potential of cassava-based bioplastics as high-performance, environmentally sustainable alternative leveraging for plastics. This investigation supports the effective bioplastic production process of pharmaceutical gelatine residue and cassava starch to create turnable composites to fight plastic pollution.

Keywords: Eco-friendly, FTIR, Starch, Sustainable, TGA

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Development and Optimization of a Rapid Method for the Objective Detection of Rice Husk Adulteration in White Rice Polish

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This research focused on developing a rapid method to identify adulterations in rice polish (RP), encompassing 3 phases. In the first phase a qualitative survey was conducted to recognize common adulterants and techniques employed to detect adulterants by self-mixers and feed suppliers in the Kurunegala area. The respondents relied on subjective methods based on sensory attributes to identify adulteration of RP, and the need for objective lab analyses was justified. During the second phase, ash and crude fiber (%) in RP samples from diverse locations were analyzed using one-way ANOVA. A significant variation ($P < 0.05$) in ash and crude fiber, suggested the potential influence of adulteration. The third phase aimed to develop a rapid laboratory method to detect rice husk adulteration in RP since the normal detection technique involves ashing which is time-consuming. A series of adulterations were developed through controlled adulteration of pure white RP samples with varying concentrations of rice husks as the adulterant. The samples underwent digestion with piranha solution [conc. sulfuric acid and hydrogen peroxide (3:1)] that digests organic matter rapidly, followed by Molybdosilicate colorimetric analysis using an Ultraviolet-visible (UV-Vis) spectrophotometer. First, a standard curve was developed for obtaining silica concentrations for observed absorbance values. Results indicated a gradual increase in absorbance and yellow color up to 5% adulteration, beyond which a reduction was observed; hence, the method's applicability up to 5% adulteration with rice husks was established. Additionally, samples from different geographical regions were analyzed, and yellow color development was observed only in white RP. The reddish and brown colour development in red and parboiled RP samples, respectively, that might mask the yellow color, silica concentration could be obtained using a UV-Vis spectrophotometer. This study introduces a rapid method to detect white RP samples adulterated within the range of 0- 5% rice husk.

Keywords: Adulteration, Piranha, Rapid method, Rice polish, UV-Vis Spectrophotometer

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Development of a Rapid Polymerase Chain Reaction (PCR)-Based Protocol for Direct Detection of *Salmonella* Contamination in Raw Broiler Chicken Meat and Chevon

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Bacterial cross-contaminations of food are serious public health concerns and the traditional microbial culture-based techniques for identifying *Salmonella* are laborious and take several days to produce results. Moreover, available rapid commercial quantitative polymerase chain reaction (qPCR) kits-based methods are expensive to use in the local settings. Therefore, in this study, we aimed to develop a rapid microbial culture and PCR combined protocol for direct detection of *Salmonella* contamination in raw broiler chicken meat and chevon samples. A 284-bp DNA fragment was amplified using previously described *Salmonella invA* gene-specific primers. The minimal cell concentration and time required for positive PCR results was determined by using a *Salmonella enteritidis* as a standard reference strain. The limits of detection and the duration of incubation were also estimated using spiked broiler chicken meat samples. Finally, the field level samples (10 chevon and 5 poultry samples) were used to verify the detection along with biochemical identification tests and Xylose Lysine Desoxycholate agar (XLD) plating as well. Based on our results, minimum detection of *Salmonella* cell concentration was 10^3 cells/mL and reduced the assay time to 24 h, compared to the International Organization for Standardization (ISO) procedure of 5-7 days.

Keywords: *invA* gene, Meat, Polymerase chain reaction (PCR), Rapid detection, *Salmonella enteritidis*

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Development of a Web Tool for Implementation of ISO 22000:2018 for the Cake Industry

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This study introduces an innovative web tool designed to streamline the implementation of the ISO 22000:2018 standard within the cake industry, addressing the high costs associated with food safety management system implementation. The development of a web tool aimed at aiding the cake industry's compliance with ISO 22000:2018 standards was initiated at Perera and Sons' Bakers Limited, based in Rajagiriya, Sri Lanka. The research involved utilizing a variety of software tools for different design aspects, with a focus on front-end development using the React framework for the User Interface. This approach integrated HTML code within JavaScript for all tool components. The development environment was established with Node.js and Node Package Manager, supported by Visual Studio Code for the Integrated Development Environment, and styled using Cascading Style Sheets. Upon completing the web tool's development, a beta version was launched and tested by the quality assurance department and food safety team at Perera and Sons' Bakers, comprising twelve members. This test phase included an unannounced pre-evaluation followed by a training on the standard and the web tool, and an unannounced post-evaluation. Key features of this web tool include pre-configured templates and checklists tailored to the cake industry's requirements for ISO 22000:2018 compliance, offering interactive guidance and a step-by-step implementation process. It also features a centralized document management system. User experience and interface evaluations showed significant improvements post-training, with average scores rising to 88.3%, a 14.4% increase from the pre-evaluation scores, highlighting improvements in navigation and user-friendliness. The successful development and evaluation of this web tool marks a significant step forward in assisting the cake industry with ISO 22000:2018 compliance, by providing easy-to-access guidance, resources, and support. The tool enables businesses to improve their food safety practices, reduce risks, and maintain consumer trust in the safety and quality of their cake products.

Keywords: Cake industry, Food Safety Management System, Hazard analysis, User experience, Web tool

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Development of an Artificial Intelligence Based Image Processing System for Industrial Sorting of Big Onion

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Sorting onions for the retail market is an important processing operation for fetching a good price. Onion sorting is traditionally reliant on human labour and this process can now be significantly enhanced through the application of machine learning techniques in AI for image processing. In recent years, the emergence of numerous Python modules has facilitated the development of image processing techniques. This study investigates the synergistic potential of combining OpenCV (community developed and managed library with the major contribution from Intel) and TensorFlow (owned by Google LLC.) modules to optimize the sorting process of big onion in an industrial scale. The classification of onions into distinct categories: good quality, double bulbs, rotten, and sprouted, serves as the foundation of this research. Training data consisted of images captured using a Raspberry Pi camera module integrated with a Raspberry Pi single-board computer. This setup enabled the collection of diverse and representative images necessary for effective model training. Transfer learning using SSD MobileNet V2 (MobileNet Single Shot Detector Version2) owned by TensorFlow Object Detection API by Google LLC. was employed to develop the classification model. A TensorFlow object detection model was developed by transfer learning through SSD MobileNet V2 model and the developed model was converted to a TensorFlow Lite model to ensure seamless operation on devices like Raspberry Pi. The developed model was evaluated for its accuracy using mean Average Precision (mAP) and F1-Score values. Overall mAP is used to evaluate the localization and classification accuracy and was 77.94% for the developed model. F1-Score, which is the weighted harmonic mean of recall and precision, gave an overall value of 0.82.

Keywords: Big onion, Image processing, Raspberry Pi, TensorFlow

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Effect of Atmospheric Non-Thermal Plasma on Physical and Rheological Properties of Tom EJC Mango (*Mangifera indica*) Fruit Powder

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Gliding arc discharge plasma (GAD) is one of the atmospheric non-thermal plasma used for microbial inactivation and surface modification of food materials. Although mango fruit powder is in high demand, it presents several challenges during handling, processing, packaging, and storage. The study investigated the effect of GAD plasma treatment on the physical and rheological characteristics of TJC mango variety (*Mangifera indica*) fruit powder obtained from hot air drying, freeze drying, and spray drying techniques. Hot air-dried, freeze-dried, and spray-dried mango powders were given 0, 5, 10, and 15 min GAD plasma treatments during the experiment. Mango powders were evaluated for their water activity, color, wetting time, solubility, viscosity, density, porosity, and flowability. The application of GAD plasma treatments decreased the water activity of the mango powders irrespective of drying treatments. Additionally, the color of the powders changed with increasing GAD plasma treatment time. The solubility of hot air-dried, freeze-dried, and spray-dried mango powders was improved with the GAD plasma treatment. The average particle diameter of hot air-dried mango powders increased with increasing GAD plasma treatment time. Furthermore, the surface roughness of the GAD plasma-treated hot air-dried, freeze-dried, and spray-dried mango powders increased with treatment time. The bulk and tapped densities of the powder samples were also increased with the GAD treatments time, while leading to a decrease in their porosity. Excellent flowability was observed in hot air-dried mango powders after GAD plasma treatment, but the flowability for spray-dried mango powders treated with GAD plasma was significantly low ($P<0.05$). Overall, the results indicated that the GAD plasma treatment is a promising technology for modifying the surface characteristics of mango fruit powders.

Keywords: Mango powder, GAD, Plasma, Hot air drying, Spray drying, Freeze drying

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Effect of Solar Radiation Window and Bio-carrier on Floating Treatment Wetland (FTW) in *Beira* Lake, Sri Lanka

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Beira lake, located in the heart of Colombo, Sri Lanka, plays a pivotal role in the city's cultural, historical, and economic landscape. However, rapid urbanization and unchecked anthropogenic activities have led to significant degradation of the lake's ecological health and water quality. To address these challenges, floating treatment wetlands (FTWs) have emerged as an innovative solution. This study aims to enhance FTW performance in Beira Lake by allowing solar radiation to penetrate the lake at the middle of the 8 x 4.5 m wetland unit and bio-carrier (biochar) on biofilm formation and phosphate removal by *Canna indica* plants. Dissolved oxygen (DO) was measured in 4 locations of FTW units at 4 water depths, weekly during the daytime for 6 weeks. Plant dry matter and phosphorous content were measured at the first and sixth week of planting. The research findings reveal dynamic variations in DO levels, particularly influenced by daytime, depth, and the presence of solar radiation windows. DO was zero below 60 cm depth and early morning hours in all FTW units. Analysis of DO profile at different depths and locations within FTW structures demonstrates significant variations between control and treatment groups, highlighting the efficacy of structural components in modulating DO variation. The incorporation of biochar alongside solar radiation windows promotes enhanced plant growth and phosphorus retention, indicating the potential benefits of biochar biocarrier in FTW designs. Microbial diversity analysis further underscores the influence of treatment conditions on biofilm composition and dynamics. Gram staining reveals distinct characteristics of bacterial strains isolated from different treatment structures, emphasizing the need for comprehensive bacterial isolation and further testing to elucidate treatment effects on biofilm development. Based on these findings, recommendations are proposed to enhance FTW stability and effectiveness. Strategies include optimizing the arrangement of solar radiation windows and conducting comprehensive bacterial isolation to accurately assess treatment effects on biofilm growth.

Keywords: *Beira* lake, Bio-carrier, Floating treatment wetlands (FTWs), Solar radiation window

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Efficacy of Newly Formulated Disinfectant Against Planktonic and Biofilm Bacteria

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The increasing prevalence of microbial infections among livestock and cross contaminations in the food processing sector is largely due to poor hygiene and disinfection failures. Disinfectants are commonly used to eradicate microorganisms in these settings; however, their effectiveness need to be tested before recommending. Thus, this study was conducted to evaluate the efficiency of a newly formulated disinfectant expected to be commercially launched. Firstly, to confirm the labelled concentration (0.5-2.0%) and contact time (30 minutes) are effective, reference strains of *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 29213) were used. A broth microdilution assay was conducted to determine the minimum inhibitory concentration (MIC_{50}), minimum biofilm inhibitory concentration ($MBIC_{50}$), minimum biofilm eradication concentration ($MBEC_{50}$). Then the colony forming units (CFU/mL) in each selected reference strain was assessed with the treatments. The results showed that the disinfectant was effective against *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 29213), with MIC_{50} values of 0.125% v/v and 0.25% v/v, respectively. The $MBIC_{50}$ and $MBEC_{50}$ values against *Escherichia coli* (ATCC 25922) were 1.0% v/v and 2.0% v/v, respectively. The study found that the bacterial counts were significantly reduced *($p<0.05$)* in a concentration-dependent manner. The results also showed that biofilm form *of Escherichia coli* required higher disinfectant concentrations to inhibit, indicating increased resistance. Further, the study revealed a time-dependent reduction in bacterial growth, with a significant reduction *($p<0.05$)* observed after 30 minutes. In conclusion, our findings suggest that the product is effective as a disinfectant even lower concentration than stipulated.*This supported from Starvet Biotechnologies Pvt. Ltd.*

Keywords: Biofilm, Disinfectant, *Escherichia coli*, Minimum inhibitory concentration (MIC_{50}), *Staphylococcus aureus*

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Evaluating the Potential Use of UAV-Based Multispectral Imagery for Detection of Nitrogen Status in Maize to Enhance Precision Fertilization in Sustainable Agriculture

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Precision fertilizer management using Unmanned Aerial Vehicles (UAVs) enables site-specific nutrient management. This study evaluated the potential of UAV-based multispectral imagery (MI) to predict the leaf-nitrogen (Leaf-N) content of Maize (*Zea mays* L.). Multispectral imagery of canopy cover of the variety MI Maize Hybrid 01 was captured at different dosages of N (0%, 25%, 50%, 75%, and 100% from the recommendation of the Department of Agriculture) at V6 (28 DAP), V12 (42 DAP), and Panicle Initiation (PI) (50 DAP) stages in the maize phenology cycle. The effectiveness of two Machine Learning (ML) models; Random Forest (RF) and Support Vector Regression (SVR), and Linear Regression (LR) were evaluated for predicting Leaf-N status using the vegetation index which had the highest correlation to leaf N content as the predictor variable. The Difference Vegetation Index (DVI) was the highly correlated VI to the leaf N content (r =0.78). Thus, the DVI was selected as a predictor variable for ML models based on the power of correlation. Data with Leaf-N content and respective DVI values were split, the three models were trained using the training data set (80%), and performance was evaluated using the remaining validation data set (20%). The RF model showed the highest R^2 (0.63) and the lowest RMSE (3.5 mg N g^{-1}) and, thus, provided better predictions than the LR and SVR models. The selected RF-trained model can be utilized to predict Leaf-N content based on DVI values derived from UAV images captured at different growth stages of Maize, thereby ensuring precision-N application. Further model improvement is suggested to enhance the accuracy of Leaf-N predictions by incorporating more observed Leaf-N data points with higher variability.

Keywords: Machine learning, Nitrogen management, Precision agriculture, Random forests model, Unmanned aerial vehicles (UAVs), *Zea mays*

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Evaluation of Pulsing Solutions in Improving the Postharvest Quality of Cut Gerbera Flowers during Export Simulation

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The experiment aimed to optimize pulsing solutions for enhancing Gerbera cut flower quality during transportation under room temperature (25±2ºC) and cold storage (15±2ºC). Sixteen treatments were evaluated in a Completely Randomized Design with three replicates for each temperature condition, revealing significant differences ($p \leq 0.05$) in various parameters crucial for postharvest quality. Under room temperature conditions, the 3% sucrose solution, and 3% fructose + 1% citric acid solution were most effective, yielding the highest vase life (7 days), flower quality, and stable pH within 12 days. Conversely, cold storage favored the 3% glucose solution, demonstrating the highest vase life (8 days) and quality, along with reduced neck bending and stable pH. Notably, the 3% glucose + 1% citric acid solution exhibited the highest soluble solids content under both storage conditions, indicating its potential to maintain flower freshness. However, the 1% salicylic acid solution showed the lowest solution uptake and colony-forming units, suggesting limited efficacy in preserving flower quality. Maximum electrolyte leakage occurred with the 3% fructose + 1% salicylic acid solution under room temperature and the 1% salicylic acid solution under cold conditions, highlighting potential detrimental effects on flower cellular integrity. Correlation analysis revealed positive associations between solution uptake and vase life, neck bending and b* values, and flower quality and neck bending at room temperature, while negative correlations were observed between various quality attributes and parameters, including vase life, neck bending, color, electrolyte leakage, weight change, and solution uptake. Under cold conditions, positive correlations were noted among flower diameter, color parameters, and solution uptake, while negative correlations existed with neck bending and quality attributes.

Keywords: Acids, pH, Storage temperature, Sugars, Vase life

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Feasibility Analysis of Used Cooking Oil as an Alternative Fuel Source and Designing of a Hybrid Stove

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The objective of this study was to evaluate the feasibility of used cooking oil (UCO) as a fuel source and developing a hybrid cooking stove to utilize UCO. The study was conducted using used palm oil (UPO) at different stages based on total polar material (TPM) percentage. UPO having 3, 9, 20 and 30% of TPM were evaluated for different properties including viscosity, smoke point, flash point, fire point, and gross heat of combustion (GHC). Prototypes of the hybrid stove using both LPG and palm oil were developed and performance was evaluated using palm oil (TPM of 30%) based on emissions. The selected stove was tested with UPOs having different TPM levels (3, 9, 20 and 30%) for emissions and efficiency based on the water boiling test. The TPM level of UPO has a significant effect ($p<0.05$) on all the tested properties except GHC. Smoke, flash and fire points decreased with increasing TPM. The stove giving the lowest emissions of carbon monoxide (CO) and hydrocarbons was selected. It gave lower emissions of CO and hydrocarbons with increasing the TPM content of oils with the lowest at 30% of TPM. Efficiency also increased with increasing levels of TPM. The LPG consumption was reduced by 37.5% in the hybrid mode. In conclusion, UPO can be utilized with LPG in hybrid mode as a fuel in the developed stove.

Keywords: Hybrid cooking stove, Total polar materials (TPM), Used cooking oil (UCO), Liquid petroleum gas (LPG), Flash-point

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Heliostats for Urban Gardening – The Impact of Mirror-Reflecting Light on the Growth of Floriculture Plants

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In urbanization and sustainable development, incorporating greenery into high-rise buildings, especially in cities. Ensuring enough light for plant growth in these settings, especially during extended periods of low light, remains a significant challenge. Thus, this study explored the use of heliostats to deliver a controlled dosage of light (morning light- 7.30a.m. to 12noon) to test plant species (*Alternanthera* sp. and *Torenia fournieri*) and examines the impact of mirror-reflecting light on their growth. Growth parameters including leaf area, root length, dry weight, root mass ratio, shoot mass ratio, leaf area ratio, rate of leaf photosynthesis, plant height, number of leaves, number of flower buds, and flowers were evaluated. 03treatments were employed: heliostat, direct sunlight, and shade conditions, utilizing both destructive and non-destructive data collection methods. Light intensity measurements were measured using a Spectrapen mini device at 30-minute intervals over three days from 7:30 a.m. to 4:00 p.m. at each treatment location. The results revealed significant differences($p<0.05$) in dry matter accumulation and root development among the two plant species under different treatments (shade condition<heliostats<direct sunlight). Plants subjected to shade conditions exhibited significantly very lowest and slowest growth compared to heliostats and direct sunlight-treated plants. Notably, heliostats-treated *T.fournieri* plants exhibited significant differences($p<0.05$) in flower production, featuring a short root system and the highest leaf area. Heliostats-treated *Alternanthera* sp. exhibited broad leaves with significant differences($p<0.05$) in the highest leaf thickness, achieving the highest leaf area ratio. Heliostats-treated *Alternanthera* sp. recorded significant differences($p<0.05$) in the highest photosynthesis rate compared to direct sunlight-treated plants. In conclusion, heliostats offer a promising solution for enhancing plant growth in urban environments. By providing a light dosage, approximately 04hours daily, heliostats positively impact plant growth. Thus, heliostats would be a tool with significant potential to be used for green walls and green leafy plants in sun-limiting urban settings.

Keywords: Green wall, Heliostats, Mirror reflected light, Plant growth, Urban gardening

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Identification of Optimum Seed Drying Periods for Moisture Reduction in Selected Crop Species

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Seed drying is essential for preserving seed viability by removing moisture, facilitating long-term storage, and conserving genetic resources for the future. The optimum seed drying periods for *Oryza sativa* including var. BG374 and var. Pachchaperumal, *Zea mays*, *Vigna mungo*, *Vigna radiata*, *Glycine max*, *Solanum lycopersicum*, *Abelmoschus esculentus*, *Vigna unguiculata* and *Eleusine coracana* were investigated. The experiment was conducted in the Plant Genetic Resources Center (PGRC) in Gannoruwa, Sri Lanka on the drying time required to achieve 5% moisture for the selected crop species. The seed samples were transferred to a drying room (16 °C with 25% RH) and then relocated to the cabinet (17 °C with 20% RH). Seed moisture content, germination percentage, viability, and vigor were evaluated throughout the drying period. The samples were transferred to a medium-term storage room (5 °C). The impact of the drying period across species-specific differences in survival time was not significant ($p=1.0000$) except for *Vigna radiata* ($p=0.9993$). The impact of moisture content on germination across crop species revealed that the moisture reduction of *S. lycopersicum*, *V. radiata*, and *G. max* had a significant influence on germination ($p<0.0001$), while *V. unguiculata*, *V. mungo*, *E. coracana*, and *O. sativa* (var. BG 374) showing higher probabilities. The effects of moisture on seed viability revealed no significant effects on *V. unguiculata*, *Z. mays* L., *V. mungo* and *E. coracana* compared to '*Pachchaperumal*', while *V. radiata*, *A. esculentus*, *S. lycopersicum*, *G. max*. and *O. sativa* (BG 374) exhibited statistically significant impact ($p<0.001$). Diverse response was observed from the crop species tested to moisture reduction, necessitating tailored drying methods for preserving seed quality during storage. This perspective is crucial for effective seed conservation efforts.

Keywords: Drying period, Germination, Moisture, Seed drying, Viability

We acknowledge the research assistance provided by the Plant Genetic Resource Center, Gannoruwa, Peradeniya, Sri Lanka.

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Investigating the Effects of Soil Incorporation of a Superabsorbent Polymer on Drought Tolerance Properties of Two Rice Varieties With or Without an Organic Matter Supplementation

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Superabsorbent polymer (SAP) application is a sustainable soil amendment method for relieving drought impacts on crops. Combining SAPs and organic matter (compost; COM) may boost dehydration tolerance (DT) capacity of rice. This study was conducted in two experiments to: (E1) explore the effects of SAPs on DT strategies of Bg314 (a drought tolerant rice variety) and Bg352 (a general rice variety) and (E2) examine the cumulative impact of both SAP (50 kg ha^{-1}) and COM (COM: Soil=1.5:2.5) on DT of Bg314. In both experiments, similar drought cycles were imposed (i.e. 70-40% field capacity; FC) while control plants were kept above FC. Two sets of morpho-physiological measurements including photosynthetic gas exchange (GE), chlorophyll fluorescence (CF), electrolyte leakage (EL), relative water content (RWC), and chlorophyll content (Chl) were taken between maximum tillering and panicle initiation (M1) and between grain filling and maturity (M2). Yield, thousand grain weight (TGW), plant dry weight (PDW), water-use efficiency (WUE), soil moisture content (SMC), and root dry weight at two depths (RDWt; 0-40 cm, RDWd; 40-75 cm) were recorded at harvest. In both experiments, SAP effect was significant ($p<0.05$) for most traits at M2 irrespective of the variety or COM. In E1, SAP significantly ($p<0.05$) increased RWC, SMC, RDWt, and WUE and decreased EL in both varieties under drought. Similar effects were seen for Bg314 in E2 with an increase in RWC (i.e. average RWC1 and RWC2; 85% and 90%, respectively) and decrease in EL (i.e. average EL1 and EL2; 12% and 4%, respectively). In E2, SAP had a significant effect ($p<0.05$) on GE of Bg314 under drought. However, SAP effect was not significant for CF, Chl, PDW, growth, and yield or TGW in both experiments. Results demonstrate that SAP stimulates rice DT and SAP and COM together improves DT, WUE, and GE in rice under drought.

Keywords: Dehydration tolerance, Drought, Organic matter, Superabsorbent polymer, Water-use efficiency

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Investigating the Impact of Smart Sprinkler Irrigation System Over Manual Sprinkler System on Maize Crop Performance with Crop Model Scenario Analysis for Precision Water Management

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Using IoT irrigation systems and developing simulations like crop model APSIM, there is a capability of optimizing water use in agriculture, enhancing yields while minimizing wastage. A study was conducted to calibrate a new IoT based smart sprinkler irrigation system and to automate the system between field capacity and management allowable depletion level of maize while investigating the crop performance with a manual sprinkler system. The drawbacks of IoT system and further developmental requirements were also identified. Finally, irrigation scenarios were analyzed using APSIM software to find more effective irrigation approaches. The study was done as a field experiment at Field Crop Research and Development Institute, Mahailuppallama during *Maha* season in a randomized complete block design with two treatments: smart sprinkler system and manual sprinkler system. According to the calibration of the IoT system, system set up values were identified as 86 and 75 which represent the field capacity and management allowable depletion levels respectively. Water consumption was higher in the manual sprinkler system than smart sprinkler system. Water productivity was higher in the smart sprinkler system. Treatment effects were not significantly different ($p>0.05$) to the plant height, SPAD values, stem diameter, leaf area index, number of leaves and plant dry weight at the tasselling stage. Best irrigation scenarios were identified as either applying 7.68 mm once in two days, or applying 80mm at sowing, jointing, tasseling stages, or adding 90 mm 5 times within the season.

Keywords: APSIM, IoT irrigation, Irrigation scenarios, Sprinkler irrigation, Soil moisture sensors

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Modelling Annual Plastic Material Flow in Up-country Vegetable Farming Systems of Sri Lanka

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The utilization of agricultural plastics in the farming practices of Sri Lanka provides certain benefits; however, it also gives rise to environmental concerns. The improper management of these materials presents various challenges. The mitigation of impacts requires the implementation of regulatory measures and effective management techniques. Nevertheless, Sri Lanka currently lacks comprehensive frameworks for the management of agricultural plastics. To ensure sustainability, it is crucial to adopt data-driven strategies. The promotion of a sustainable approach can be accomplished through the utilization of modelling techniques and evidence-based decision-making. The primary aim of the present study is to develop a model that illustrates the flow of plastic in Upcountry vegetable farming systems in Sri Lanka. This involves collecting data and utilizing the STAN® software for modelling purposes. The selection of sampling areas, specifically *Kandy, Nuwara Eliya, Badulla, Matale, Jaffna*, and *Puttalam*, was based on a comprehensive analysis of secondary data. A total of 429 farmers were interviewed, including 45 onsite quantification surveys. The primary sources of plastic inflow were identified as irrigation pipes, fertilizer packaging, crop covering materials, and transportation and storage packages, while off-site reuse and open disposal were found to be the primary outflows. The remaining plastic materials were classified as storages, either onsite open disposal or burial, and estimated using Material Flow Analysis. The model revealed that the flow of plastic in upcountry vegetable farm fields ranged from 31.9 to 222 kg/ha/year, with the *Jaffna* district exhibiting the lowest agricultural plastic inflow and *Nuwara Eliya* showing the highest agricultural plastic inflow.

Keywords: Agricultural plastics, Material flow analysis, Upcountry vegetable farming systems

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Morphological and Molecular Characterization of Old Tea Genetic Resources in Sri Lanka

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Narrow genetic diversity of cultivated tea in Sri Lanka is a critical issue that needs to be addressed by introducing diverse genetic material into the tea breeding programme. This study was carried out to determine the genetic diversity of Sri Lankan old tea genetic resources. A total of 95 tea accessions including 65 from the Tea Research Institute of Sri Lanka (TRISL) and 30 from Hakgala Botanical Garden belonging to nine tea populations were characterized using 16 morphological descriptors and 8 transcription factor-derived simple sequence repeat (TF-SSR) markers. The Shannon's diversity index calculated using morphological data, recorded the highest value for immature shoot colour (H' = 1.3) followed by internodal length (H' = 0.99). Three main clusters (A, B and C) were recognized based on the dendrogram constructed from UPGMA clustering in NTSYS-pc software. Cluster A included only one tea accession from Hakgala population. Cluster B consisted of 54 tea accessions having mainly China-type from selected populations of Korea, Yabukita, Russia and East Africa and 27 out of 30 Hakgala tea accessions. Cluster C included 40 genotypes having mainly Assam and Cambod types representing the Assam introductions, TRI and estate populations. Bulk DNA quantity of tea extracted from populations ranged from 131 to 820 ng/µL. A total of 13 alleles amplified at 4 TF-SSR markers provided evidence for the markers to be highly polymorphic and informative. This study is the first report of morphological characterization of old tea germplasm in Hakgala Botanical Garden. The results are valuable in future breeding, conservation and utilization of old tea genetic resources in Sri Lanka.

Keywords: Genetic diversity, Hakgala Botanical Garden, Morphological descriptors, SSR markers, Tea germplasm

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Morphological and Molecular Diversity Analyses of King Coconut Genetic Resources in North Western Province of Sri Lanka

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King Coconut (*Cocos nucifera* var *Aurantiaca)* shows a globally increasing demand as a natural beverage. However, there are no commercial plantations, recommended cultivars or characterized germplasm of King Coconut (KC). This study was conducted with the objective of assessing morphological and molecular diversity of KC genetic resources in the north-western province of Sri Lanka. A total of forty-one samples which included 19 KC and eleven control palms in 19 locations of northwestern province, were characterized. Seventeen morphological traits as described in IPGRI descriptors and genotypic data at four coconut-specific microsatellite markers were used for characterization. Descriptive statistics were derived for morphological data followed by Principal component analysis in Minitab software. Genotypic data were subjected to Euclidian method-based cluster analysis using powermarker software. The first two principal components explained 98.7% of morphological variation while petiole width recorded the highest loading with positive correlation for PC1. Peduncle length with a negative loading accounted for a major portion of PC2. PC scatter plot revealed no clear grouping but tall and dwarf phenotypes were scattered separately from KC while KC scattered separately with Bodiri, Rathran thembili (RRT), Bothal thembili (BT) and Yellow Semi Tall. The exotic varieties Cameroon Red Dwarf (CRD) and Malayan Red Dwarf (MRD) showed near-nut characteristics of KC, emphasizing the beverage potential of them. A total 18 alleles were scored at four SSR loci. Hierarchical clustering of genotypic data resulted in two main clusters. All KC, Rathran thembili, BT, one CRD included in cluster one. Bodiri, Yellow Dwarf, Red Dwarf, MRD, Malayan Yellow Dwarf, Yellow Semi Tall, CRD, Tall and Nawasi grouped in the second cluster. The output of this research would be useful in KC breeding and conservation.

Keywords: Genetic diversity, King Coconut, Microsatellite markers, North western province

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Nanoclay Encapsulated Amplified Coat Protein Fragments as Immune Activators Against Common Bean Yellowing Disease Caused by Horsegram Yellow Mosaic Virus (HgYMV)

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Bean Yellowing Disease (BYD) is a viral disease caused by Horsegram yellow mosaic virus (HgYMV) in beans causing severe yield reduction in Sri Lanka. Topical application of nucleotide fragments as immune activators is an effective method in terms of inducing the immunity of plants, hence developing resistance towards viral diseases. However, the stability of topically applied nucleotide fragments and long-lasting protection given by them is a main problem. Through the present study, the effect of application of montmorillonite (nanoclay) intercalated fragments of PCR-amplified coat protein encoding gene of HgYMV was determined. Accordingly, bean plants (var. Kekulu) were sprayed with 3 different distilled water-based montmorillonite-amplified DNA (Nanoclay: DNA at 1:1, 1:2, 1:3 ratios) suspensions at 7-day intervals. Meanwhile, bean seeds were also treated with 5 different treatments, that include above formulations, amplified DNA, montmorillonite and distilled water (as the control) before planting and kept in the plant house. After 21 days, the natural disease incidence was determined. Moreover, the peroxidase and total phenolic content in leaves and seeds of bean were quantified at 2- and 7-day intervals in a set of treated plants kept in insect proof cages. Meanwhile, DNA release ability from the clay (1:1, 1:2, 1:3) was also estimated using a nanospectrophotometer. Treatment effect for disease incidence was not significantly different ($P= 0.05$), however was significantly different ($P< 0.05$) for peroxidase and total phenol content. The highest peroxidase activity was observed in clay: DNA (1:3) formulation compared to control. Highest DNA release ability was observed in 1:3 formulation within a period of 10 hours. The present study provides valuable insights on the potential of incorporating nanotechnology in terms of controlling BYD caused by HgYMV.

Keywords: Begomovirus, Coat protein gene, DNA, Horsegram yellow mosaic virus, Montmorillonite

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Optimization of Rubber Wood Chip Combustion for Enhanced Energy Efficiency

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Rubber wood chip is one of the sustainable fuel sources and commonly used by industries for heat generation. However, the efficiency of this process is often compromised by high moisture content, which reduces the net calorific value and thermal efficiency of the combustion process. Therefore, this research aimed to improve the energy recovery from rubber wood chips by reducing their moisture content by pre-drying and raw material selection for efficient combustion. The research was conducted at *Midas* Safety Lanka (Pvt) Ltd., which operates a large-scale biomass power plant using wood chips. The study involved a comprehensive analysis of thermal dynamics and optimization of woodchip feedstock properties. Experimental procedure included bio-drying, pre-drying methods, and raw material selection to mitigate the moisture content in wood chips. The calorific values were measured using an oxygen bomb calorimeter and the effectiveness of natural drying techniques was also assessed. Results indicated that bio-drying reduces the chip moisture by about 6%, and natural ventilation after bio-drying could further decrease the moisture by 7% within one day. Further, direct Sun drying of chips lowered the moisture content by 8% in four days. The study also found that branches with a diameter of less than 6 cm had the lowest net calorific value due to higher moisture content than stems and stumps. Pre-drying before combustion at 100°C will have additional benefits if flue gas is used and the Page model was found to be the best fit for the drying curve. The research concluded that the combination of bio-drying, natural ventilation, and sun drying could significantly reduce the moisture content of wood chips, leading to considerable energy saving and increased thermal efficiency of combustion. A standard operating procedure (SoP) was developed for Midas Safety Lanka to enhance the energy efficiency of their existing furnace system.

Keywords: Calorific value, Drying, Moisture content, Rubber woodchip combustion, Standard operating procedure

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Optimize the DNA Fingerprinting Protocol for Traceability of Cattle Using Restriction Enzyme Digestion

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Identification of an individual's unique molecular characteristics of cattle DNA for forensic purposes is a national requirement. This study aimed to optimize the protocol for restriction enzyme digestion-based DNA fingerprinting for traceability of cattle. DNA extracted from blood of known genotypes (Friesian, Jersey, Sahiwal and Girolando) and meat samples (with unknown genotypes) of cattle was used. DNA profiles were generated using six restriction enzymes, namely EcoRI, HaeIII, BamHI, HindIII, ApaI, and DdeI by employing the original protocol which generated smear in gel images. As a remedy, PCR amplicons of 16S mammalian common primer and P3/P6 species-specific primer were subjected to restriction digestion, and the protocol was further improved using HaeIII restriction enzyme. Consequently, PCR amplification followed by a modified digestion protocol with HaeIII restriction enzyme was effective in identifying differences among the cattle genotypes tested. The results of the developed protocol were further verified by improving the gel strength to 2% which helped increase the resolution. Aided by gel analyzer software (23.1.1.), subtle differences among individuals within the breeds or crosses could be detected using the modified protocol and visualization process. Restriction enzyme digestion using a modified protocol on PCR amplified DNA was effective in identifying differences among breeds and individuals. The modifications done to the restriction enzyme digestion procedure was effective in producing optimum results from the EcoRI enzyme. The findings of the present research are helpful in enhancing forensic diagnosis through improved DNA fingerprinting protocol, for identification of individual cattle and specific cattle genotypes. Testing the optimized protocol with a wide range of samples is advised before recommending for future applications.

Keywords: DNA fingerprinting, PCR, Restriction enzyme digestion, Traceability

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Precision Irrigation for *Epipremnum aureum*, *Codiaeum variegatum*, and *Aglaonema maria* as Determined by Chlorophyll Fluorescence Transient Analysis

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The floriculture industry, particularly the cultivation of foliage plants, presents significant economic potential globally. However, the lack of precise guidelines on water management, especially irrigation intervals, poses challenges for growers. This research addresses this knowledge gap by investigating water stress and optimal irrigation intervals for popular foliage plants, including *Epipremnum aureum* (Golden Pothos), *Codiaeum variegatum* (Croton), and *Aglaonema maria*. In this research, water was applied up to field capacity at intervals of 4 days, 8 days, and 12 days as treatments for each species. Based on OJIP parameters, especially Performance Index and other growth parameters, this study identified the ideal irrigation intervals for each species: Aglaonema and Golden Pothos require watering every twelve days, while Croton benefits from irrigation every eight days ($P < 0.05$). Employing a combination of 10"×10" polybags and a coco peat and compost mixture as potting media under specific environmental conditions (average temperature of 28°C and average relative humidity of 72%) optimizes growth. Additionally, the research explores chlorophyll fluorescence transient analysis as a tool to assess photosynthetic performance under water stress, offering insights into plant physiological responses. Results indicated that different plant species exhibit varying responses to water stress, emphasizing the need for tailored irrigation strategies. This research contributes valuable evidence-based guidance for growers, promoting plant health, resource conservation, and sustainable cultivation practices. By enhancing water management practices and leveraging chlorophyll fluorescence analysis, the agricultural community can optimize yields, reduce economic losses, and advance environmentally sustainable foliage plant cultivation.

Keywords: Chlorophyll fluorescence, Foliage plants, Irrigation intervals, Water management

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Revolutionizing Tea Consumption with Innovative Tea Tablets and Dispenser

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A novel approach to tea consumption is proposed by developing a tea tablet using powdered tea and sugar, combined with some natural flavors, i.e. strawberry guava, passion fruit, banana, starfruit, and butterfly pea flowers. The mold to make the tablets was developed using brass. The ingredients for the tablets were mixed under hygienic conditions and pressed in the mold using a dynamometer with a pressure of 3.18×10^7Pa. The final tablet size was standardized to 10mm in height, 14mm in diameter, and 2g in weight. Tablets were produced under three formulations: T1-2g of finely ground fruit, T2- 0.75g of finely ground fruit, 0.75g of loose black tea, and 0.5g of powdered sugar, and T3- 1g of finely ground fruit, 0.5g of instant tea, 0.5g of powdered sugar. A tablet dispenser was designed with two main parts, an upper part containing the tablet holding and emptying unit with a connecting unit, printed using a 3D printer, and a lower part made consisting of the strainer unit made of stainless steel. The upper part was designed to store up to 6 tablets and release one tablet upon pressing a button. Color, flavor, aroma, mouthfeel, and overall acceptability were evaluated using a nonparametric Friedman test using 4 professional tea tasters and 41 semi-trained panelists. Results were similar with the two panels. Overall acceptability of brew ranked butterfly pea (T1), passion fruit (T2), starfruit (T2), banana (T1) & strawberry guava (T2) respectively. Strawberry guava got a significantly lower rating compared to others. The best flavor for tablet preparation was butterfly pea flowers, and the dispenser was deemed more convenient and manually operated. In conclusion, the butterfly pea flower-flavored tea tablet can be considered the best to be used with the device for a good quality cup of tea.

Keywords: Convenience, Flavored tea, Tablet dispenser, Tea tablets, Underutilized natural flavors

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Study on the Potential of Removing Phospholipid from Coconut Oil Using Coal and Coconut Shell-based Activated Carbon

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This study investigated the potential for removing phospholipids from coconut oil using coal and coconut shell-based activated carbon in the bleaching stage of the oil refining process and filtration. The phosphorous content, a critical parameter of the presence of phospholipids, played a pivotal role in assessing the efficacy of various treatments. The untreated coconut oil samples initially exhibited a phosphorous level of 0.0193±0.001 mg/g, highlighting the existence of undesirable phospholipids. These phospholipids tend to make insoluble waxes and gums with storage and time. In the bleaching process, coconut shell activated carbon and coal treatments demonstrated significant reductions in phosphorous content, reaching 0.0075±0.001 mg/g and 0.0080±0.002 mg/g, respectively. Notably, coconut shell-activated carbon outperformed coal, achieving a significantly lower ($P<0.05$) phospholipid content of 0.9899 mg/g compared to 1.0569 mg/g. Despite marginal differences in moisture and free fatty acid contents, coal showcased enhanced oil retention during bleaching, yielding a lower oil loss percentage (4.37%) than coconut shell activated carbon (7.81%). Further investigation of coconut oil filtration under varying temperature and pressure conditions using a coal or coconut shell-based activated carbon column unveiled temperature-dependent efficiency in phospholipid reduction. At 80 °C and 1 bar pressure, comparative analysis revealed that both materials effectively reduced the phospholipid content, with coal exhibiting a significantly greater ($P<0.05$) reduction (0.4112 mg/g) compared to coconut shell activated carbon (0.3919 mg/g). The interaction between temperature and pressure significantly influenced treatment efficacy, providing promising avenues for optimizing coconut oil quality through effective phospholipid reduction.

Keywords: Coconut oil, Phospholipid, Bleaching, Filtering

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Food Quality, Safety and Product Development

A Comparative Study on Total Amino Acid Profile and *In Vitro* Protein Digestibility in Selected Legume Varieties Grown in Sri Lanka

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Legumes belonging to the family Fabaceae are a traditional and vital source of protein in the Sri Lankan diet. However, comprehensive information on the total amino acid profile and *in vitro* protein digestibility of various legume varieties used for culinary purposes in the country is lacking. This research focused on assessing the total amino acid profile and *in vitro* protein digestibility of selected locally grown legume varieties (Mung bean- *Vigna radiate* L, Cowpea-*Vigna unguiculate* L, Soybean -*Glycine max* L, Horse gram - *Macrotyloma uniflorum* and Pigeon pea- *Cajanus cajan* L. Millsp) to screen better varieties for food processing. The investigation included nineteen protein-bound amino acids analyzed using high-performance liquid chromatography with diode array detection (HPLC-DAD) and *in vitro* protein digestibility performed employing pepsin pancreatin enzyme assay. The mean total amino acid (TAA) contents in legume varieties ranged between 18.00 ± 0.99 g/100 g (mung bean variety, MI 05) and 38.16 ± 0.96 g/100 g (cowpea variety, Waruni). The results further revealed that the protein content of legumes ranged from 14.61±0.25%(pigeon variety, Prasada) to 34.46 ±0.23% (soybean variety, PB 01). The *in vitro* protein digestibility of legume varieties ranged from 31.44±2.74% (pigeon pea variety, Prasada) to 59.76±1.38 % (soybean variety, PB 01). The cowpea variety Waruni had a significantly high ($P<0.05$) TAA content and soybean variety PB 01 had the significantly highest ($P<0.05$) protein digestibility. Based on the findings of this study, the above legume varieties can be recommended as promising candidates in food processing to enhance protein availability for consumers.

Keywords: Essential amino acids, *In vitro* protein digestibility, Legumes, Total amino acids

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Anti-Oxidative Potential of Two Varieties of *Kappaphycus alvarezii* in Irradiated Uncured Pork Sausage During Cold Storage

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This study was conducted to evaluate the potential use of seaweed as a natural antioxidant in irradiated, uncured pork sausage during cold storage. Two seaweed powders (SWP) were prepared from green and brown varieties of *Kapphaphycus alverazii*. Preliminary trials were conducted to select the best SWP incorporation levels in pork sausage and 2% (w/w) and 4% (w/w) were selected based on the hardness. Four types of sausages with 2% green (GSW2), 4% green (GSW4), 2% brown (BSW2) and 4% brown (BSW4) SWP and two controls without SWP (with (SA) or without (CS) sodium ascorbate) were prepared and irradiated at 2.5 kGy before storing at 4°C. Lipid oxidation, microbial count, colour, texture, pH, water holding capacity (WHC) and sensory properties of sausages were determined at 1, 7, and 14 days of storage. All SWP-incorporated pork sausages showed higher ($p<0.05$) Thiobarbituric Acid Reactive Substances (TBARS) values compared to controls on day 1, but no differences showed on day 7 compared to CS. Nevertheless, all SWP-incorporated pork sausages showed lower ($p<0.05$) TBARS values compared to CS on day 14. The pH of SWP-incorporated sausages was lower ($p<0.05$) than controls during the storage. Total plate count, *Escherichia coli* count, and L* and b* values showed no differences among sausages during storage. The BSW2 showed higher ($p<0.05$) a* value compared to the controls. There was no difference in WHC and yeast and mould count among sausages on day 1 and 7, but on day 14, GSW4 and BSW4 showed lower ($p<0.05$) WHC compared to CS. Furthermore, BSW4 showed lower ($p<0.05$) yeast and mould count compared to controls on day 14. The sensory panel detected GSW2 as the best sausage for all sensory quality attributes (appearance, colour, odour, taste, texture, and overall acceptability). In conclusion, powders of green and brown varieties of *K. alverazii* can be used as a natural antioxidant in irradiated uncured pork sausage, and incorporation of 2% green *K. alverazii* can even improve the sensory properties of sausage.

Keywords: Cold storage, Irradiation, *Kapphaphycus alverazii*, Natural antioxidant, Pork sausage

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Application of Activated Carbon and Potassium Permanganate ($KMnO_4$) to Maintain Postharvest Fruit Quality of Tomato

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Ethylene triggers the ripening process of tomato fruits affecting their postharvest quality. The study aimed to evaluate the impact of activated carbon (AC) and potassium permanganate ($KMnO_4$) on maintaining of postharvest quality of tomato fruit, *Lycopersicum esculentum* var. 'Abhiman' under room temperature storage (26±2 ºC and 85-90% RH). Fruit quality parameters considered were weight loss, color, firmness, soluble solids content (SSC), titratable acidity (TA), and ripening index. The results showed that the application of AC and $KMnO_4$ treatments was effective in maintaining the postharvest quality of 'Abhiman' tomato fruits. AC and $KMnO_4$ treated fruits remained significantly ($P \leq 0.05$) better in quality attributes than those of untreated fruits during the storage period and showed lower weight loss, SSC, color changes, and ripening index, while firmness, and TA were higher during the storage period. Fruits treated with the combination of 75% AC and 25% $KMnO_4$ showed a significantly ($P \leq 0.05$) lower fruit quality reduction compared to other treatments during storage. Application of activated carbon and potassium permanganate can be recommended to maintain the postharvest quality of tomato fruits during their storage. This study investigated the relationships between various quality parameters in tomatoes during storage. Results showed that weight loss is linked to increased SSC and decreased firmness and TA. Tomato fruits with lower a* value and higher L* and b* values had increased firmness and acidity. A positive correlation between SSC and ripening index and a negative correlation between TA and ripening index were observed.

Keywords: Adsorbers, Ethylene scavengers, Fruit quality, Oxidizers, Ripening index

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Application of Salts Increases Anthocyanin Content in Tea (*Camellia sinensis* (L.) O. Kuntze) Leaves

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Sri Lanka needs to stay competitive in the world tea market. There is a growing market for functional teas with potential health benefits, such as teas with high levels of antioxidants and compounds such as anthocyanin (e.g. as in purple/ pink teas). Although a small quantity of teas with known functional properties such as purple/ pink teas are produced in Sri Lanka, no attempts have been made in enhancing these characters. Therefore, the present study was conducted with the objective of increasing the anthocyanin content in nursery tea plants of different cultivars with application of different salts. Six-months old tea plants of TRI 2043 and TRI 5006 cultivars with reddish coloured foliage and TRI 4071 with green coloured foliage were tested for foliar application of different salts, i.e. $MgCl_2$, KCl and NaCl with 50mM, 100mM and 150mM concentrations. The experiment was conducted using Randomized Complete Block Design with ten blocks, in the plant breeding nursery of the Tea Research Institute, Talawakele. There were significant differences between treatments in the leaf area, leaf count and plant height ($P<0.05$). Different cultivars behaved differently with the application of salts in terms of anthocyanin content: in TRI 5006 cultivar, the total and monomeric anthocyanin contents were increased with the 100mM NaCl application, and in TRI 2043, the total anthocyanin content was increased by 100mM KCl compared to the control ($P<0.05$). There was no change in the anthocyanin content in TRI 4071 with any of the salts, and these contents were far below than the contents of the other two cultivars. No salt or cultivar differences were observed in the chlorophyll florescence measurements. It is recommended to continue the trial for a longer duration and in the field-grown tea.

Keywords: Anthocyanin, Bioactive compounds, Salt treatment, Tea (*Camellia sinensis* (L.) O. Kuntze), TRI 2043, TRI 5006

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Characterization of Physicochemical, Sensory and Microbial Properties of Jerky Processed from Chicken Gizzard and Drumstick Meat

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Jerky is a nutritionally rich dried snack commonly produced from beef. The aim of this study was to valorizing the chicken gizzard to produce Jerky. Ground chicken gizzard or/and drumstick combinations (100% gizzard, 75% gizzard:25% drumstick, and 50% Gizzard:50% drumstick) with marinade/s were used to produce Jerky. Garlic flavoured Jerky was selected as the most desirable flavor and Jerky produced from 50 gizzard meat:50 drumstick meat was selected as the most desirable textured Jerky from two distinct sensory evaluations. Selected Jerky was subjected to physicochemical and microbial quality analysis during the storage period (30-d, 4 ˚C) after packaging in metallic polyester bags. The crude protein, crude fat, crude ash, crude fiber and dry matter of the Jerky was 64.12 ± 2.65%, 9.85 ± 0.52%, 14.17 ± 0.29%, 2.74 ± 0.19%, 82.07 ± 0.09% respectively. There were no significant differences in b*-value (yellowness) of Jerky during the storage time ($P>0.05$). Whereas L*- value (Lightness) and a*-value (redness) showed significant differences from 1-d to 15-d ($P<0.05$) and both values did not show significant differences from 16-d to 30-d ($P>0.05$). Moisture and pH values did not change during the storage ($P>0.05$). However, Jerky showed a significant ($P>0.05$) increase in Thiobarbituric acid reactive substances (TBARS) value and total viable plate counts during 30-d storage period. The yeast or mold counts detected during the storage period were significantly low and did not change during the storage. Jerky produced from 50 gizzard meat:50 drumstick meat with garlic flavored marinade can be used to developed Jerky with high comparable sensory attributes and other high quality attributes.

Keywords: Drumstick, Gizzard, Jerky, Physicochemical, Texture

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Characterization of Composite Flour Derived from *Kiri Ala* (*Xanthosoma Sagittifolium*) and *Hulankeeriya* (*Maranta Arundinacea*) and Determination of the Potential of Substituting Wheat Flour in Pasta Production

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This study intended to investigate the potential of *Kiri ala* and *Hulankeeriya* composite flour to substitute wheat flour in pasta production. The yam samples were cleaned, dried, and ground to obtain the respective flours. Three composite flour blends (CFBs) were prepared by combining *Kiri ala* flour (KF) and *Hulankeeriya* flour (HF) at different ratios (T1=1KF:1HF, T2=1KF:2HF, T3=2KF:1HF). The flour blends were analyzed for functional properties and the selected CFB was used in the pasta development. Four formulations with varying levels of CFBs (F1=20%, F2=30%, F3=40%, F4=50%) were used in the pasta production and their influence on chemical composition, color, cooking properties, and organoleptic characteristics was assessed. Results of the study revealed that there was no significant difference ($P>0.05$) in three CFBs in terms of oil holding capacity and water solubility index. T2 had a significantly ($P<0.05$) higher water holding capacity (1.69±0.17 g/g). Thus, T2 was used in the pasta production. According to the cooking quality characteristics there was a significant difference ($P<0.05$) in optimum cooking time (range 9.41±0.10 -12.03±0.03 min), percentage of water absorption (range 148.67±1.60 - 190.24±0.49%) and percentage of gruel solid loss (range 3.12±0.02 - 4.83±0.05%) among the four pasta formulations. The sensory evaluation (ranking test) revealed that F2 pasta formulation had a significantly ($P<0.05$) higher preference for all the sensory attributes compared to other formulations. The results of the hedonic test revealed that there was no significant difference ($P>0.05$) between F2 formulation and the control sample (100% durum semolina) in terms of overall acceptability. The moisture, crude fiber, and ash content were significantly higher ($P<0.05$) in F2 formulation. The results of this study showed that *Kiri ala* and *Hulankeeriya* composite flours have the potential for substitution of wheat flour and 30% substitution by composite flour is comparatively acceptable in developing pasta with better sensory and cooking characteristics.

Keywords: Composite flour blends, *Kiri ala*, *Hulankeeriya*, Cooking Properties, Sensory characteristics

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Chemical Characterization and Sensory Evaluation of Potential TRI 5000 Series Tea Cultivars for Low Country Region

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Tea Research Institute has released new TRI 5000 series accessions suitable for low country tea growing region of Sri Lanka. This study was focused on determining chemical characteristics and sensory quality of TRI 5000 series tea accessions, 12/11, 278, 174, 23/5, and TRI 4049, TRI 4042 and TRI 2026 are mostly cultivated in the low country region in Sri Lanka. In order to assess the biochemical parameters of black tea such as the total polyphenol content, theaflavin, and thearubigin ratio, black tea samples were processed by using miniature processing method. Organoleptic properties were assessed by trained sensory panelists and evaluated various attributes, including infused leaf characteristics, tea liquor quality, and appearance of dry leaf. The quality of the green leaves was evaluated based on their biochemical properties such as total polyphenol, caffeine, and catechin content. Complying with the ISO standards, all four potential TRI 5000 series accessions met the requirements for chemical parameters, including total polyphenol content, catechin, and caffeine content. Accessions 174, 23/5, and 278 produced high-quality black tea, while 12/11 accessions produced moderate-quality black tea. Based on the evaluation, results of tea made from a selection of potential accessions from series TRI 5000 and several commonly cultivated tea cultivars in the low country region of Sri Lanka, it was found that 23/5, 278, and 174 accessions were of better quality compared to the TRI 4049 and TRI 4042 cultivars, which were considered to be of similar and balanced quality respectively. Potential accessions of the TRI 5000 series exhibited good biochemical and organoleptic characteristics, increased adaptability to different environments, and grower acceptability, resulting in higher productivity and profitability in low-country tea plantations.

Keywords: accessions, adaptability, biochemical, cultivars, low country, miniature processing, organoleptic

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Comparative Study of Seasonal Variations of Milling, Physicochemical and Cooking Properties of Selected Aromatic Rice Varieties

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This study aimed to find the milling, physical, physicochemical, and cooking properties of five aromatic basmati and basmati-type rice varieties grown in two seasons, 2023-*Yala* and 2022/2023-*Maha* seasons. Aromatic rice (Basmati-370, Pusa-Basmati, Pusa-Sugand, Jasmine Rice and SK-Basmati) and improved rice (Bg 94/1, At 405 and At 309) samples were obtained from the Department of Agriculture. Brown rice percentage of aromatic rice varieties in the 2022/2023-*Maha* and 2023-*Yala* seasons ranged from 78-82% and 76-79%, respectively. The total milled rice percentage of aromatic rice varieties in the 2022/2023-*Maha* and 2023-*Yala* seasons varied from 77-81% and 74-78%, respectively. Head rice percentage of aromatic rice varieties cultivated in the 2022/2023-*Maha* and 2023-*Yala* seasons varied from 44-60% and 45-67%, respectively. Improved rice varieties also resulted in significantly higher ($P<0.05$) head rice yield for the 2022/2023-*Maha* and 2023-*Yala* seasons, ranging from 73-76% and 69-74%, respectively. In the 2022/2023-*Maha* and 2023-*Yala* seasons significant differences ($P<0.05$) were observed in the kernel length, thickness, width, sphericity, aspect ratio, geometric mean diameter, bulk density, true density, and 1000-kernel weight of both aromatic and improved rice. All aromatic rice varieties, except Jasmine rice, were categorized as intermediate-high amylose. At 405 and At 309 were classified as low-amylose rice, both harvested during the 2022/2023-*Maha* and 2023-*Yala*. Many aromatic rice varieties (Pusa-Basmati, Pusa-Sugand and SK-Basmati) showed low gelatinization temperatures irrespective of the seasonal variations. All selected rice varieties showed medium to hard gel consistency without any seasonal variations. Cooking characters did not show a significant difference ($P>0.05$) in kernel length after cooking and the length-breadth ratio of cooked rice between the 2022/2023-*Maha* and 2023-*Yala* seasons. Basmati-370, Pusa-Sugand and SK-Basmati rice showed significant seasonal variation ($P<0.05$) in their cooking-time, volume expansion ratio, and water-uptake. The results of this study may help to identify the best rice variety for commercial cultivation, processing, and breeding purposes based on seasonal sensitivity.

Keywords: Aromatic rice, Basmati, Cooking quality, Milling quality, Physical properties, Physicochemical

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Determination of Bioactivity Potential of Selected Medicinal Plants in Sri Lanka

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Medicinal plants have increasingly gained attention for their plethora of pharmacological effects owing to the presence of bioactive compounds and employed in herbal healthcare practices. This study investigated six selected medicinal plants grown in Sri Lanka *in vitro* to assess their bioactive compounds, antioxidative, anti-hyperglycemic, anti-obesity properties and plant extract toxicity. Dried powdered samples of medicinal plants, namely *Heen bovitiya (Osbeckia octandra* L.*), Heeressa (Cissus quadrangularis* L.*), Heen araththa (Alpinia calcarata* Roscoe*), Ankenda (Acronychia pedunculata) , Nika (Vitex negundo* L.*),* and *Lunuwila (Bacopa monnieri),* were extracted with methnol (MeOH) via ultrasonication. The extracts were evaluated for total phenolic content (TPC), total flavonoid content (TFC), antioxidant potential, α-amylase, α-glucosidase, lipase inhibitory activities, and brine shrimp lethality using relevant assays. Among plant extracts, *Heen bovitiya* possessed the highest TPC (291.69±11.41 mg of GAE/g of extract) and TFC (2.48±0.17 mg of CE/ g of extract). Also, *Heen bovitiya* exhibited the highest antioxidant activity in both ferric-reducing antioxidant power (FRAP) (7268.0±95.6 µmol $FeSO_4$/g of crude extract) and DPPH radical scavenging activity (IC_{50}-11.43±0.79 ppm) assays. Furthermore, *Heen bovitiya* (IC_{50}-1129.8±140.2 ppm) and *Ankenda* (IC_{50}-592.1±72.2 ppm) exhibited potential inhibitory activity against α-amylase, while *Heen bovitiya* exhibited significant ($p<0.05$) inhibitory activity against α-glucosidase enzymes. Other plant extracts, except *Lunuwila*, also exhibited potent α-glucosidase enzyme inhibitory activity. Other plant extracts, except for *Heerassa* and *Nika*, exhibited weak lipase inhibition activity (IC_{50}-<1000 ppm). None of the plants exhibited toxicity comparable to atropine (IC_{50}-88.6±8.1 ppm) in the brine shrimp lethality assay. These extracts displayed good antioxidant potential with FRAP (+0.98) and IC_{50} of DPPH assays (-0.69), which correlated well according to the Pearson linear correlation with the TPC content. The study concluded that the extracts of selected medicinal plants have a bioactive potential that claims various pharmacological properties and can be used as ingredients in functional food development for managing non-communicable diseases.

Keywords: Antioxidant activity, Bioactivities, Enzyme inhibitory activity, Heen bovitiya, Medicinal plants
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Determination of Phenolic Content, Antioxidant and Antidiabetic Activities, and Sensory Quality of Selected Flower Tea Infusions

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Herbal infusion teas prepared by soaking herbs with tea in a liquid are popular among health-conscious consumers and a trend in the global tea market. Previous research has reported that these herbal tea infusions possess various health-promoting and disease-preventing properties. This study aimed to evaluate the phenolic content, antioxidant and anti-diabetic activities, and sensory quality of selected flower tea infusions employing flowers used in ayurvedic medicine in Sri Lanka. The total phenolic content and the total flavonoid content were analyzed using spectrophotometric methods. Antioxidant activity was assessed using both the DPPH radical scavenging activity and the ferric-reducing antioxidant power assays. The antidiabetic potential was investigated using *in vitro* alpha-amylase inhibitory assay. A consumer panel assessed the sensory quality using the attributes of taste, aroma, color, and overall acceptability of herbal tea infusions indicating their preference. The results of this study indicate significant variation in phenolic content, and antioxidant and anti-diabetic activities among selected flower tea infusions. *Bowitiya* flower possessed the highest phenolic content (21.184 ± 0.229 mg GAE/g) as well as antioxidant activity (4240.5 ± 310 µg TE/g) compared to that of other flowers. When the tea is mixed with flowers, the phenolic content of both tea and flowers contributes to antioxidant activity and thus increases. Among the most preferred flower tea infusion formulations, the Blue Butterfly pea flower in a ratio of 0.5:1.5 flower to green tea formulation exhibited the highest antidiabetic potential (13.069±0.016 mg/g). Based on the results, it can be proposed that all the selected underutilized flowers have the potential to be used to develop new flower tea infusion products. Further research is warranted to perform toxicity analysis and clinical trials before introducing these flower tea infusions to the market.

Keywords: Antioxidant activity, Bioactive compounds, *Bowitiya,* Flower tea infusion, Underutilized flowers

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Determination of Physicochemical and Functional Properties of the Biling (*Averrhoa bilimbi*) Fruit

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This research aimed to assess the physicochemical characteristics and quality attributes of Biling *(Averrhoa bilimbi)* fruits at various maturity stages. The study involved analyzing raw Biling fruits for parameters such as size, color, firmness, pH, total soluble solids (TSS), titratable acidity, and ascorbic acid content. Based on the collected data, a maturity index was developed. Additionally, a drying curve was established for the drying process at 47 °C using the Biling fruits at 3rd maturity stage (about 40 days after inflorescence). The findings revealed that as maturity advanced, size, pH, TSS, and ascorbic acid content increased, while firmness and titratable acidity decreased. Color assessment using CIE Lab* values demonstrated substantial variations in color attributes, with significant differences ($P<0.05$) between early and late maturity stages in L*, a*, b* values. The drying curve for Biling fruits at the illustrated the moisture reduction during drying, following a pattern comparable to other fruits. This research provides valuable insights into the compositional variation of the Biling fruits with the maturity stage for Biling fruit-based products, offering a foundation for future developments and other innovative applications.

Keywords: Biling fruit, Drying curve, Maturity level, Physicochemical

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Determination of Quality Characteristics and Microbial Safety of Frozen Egg Cubes Fortified with Tomato Powder During the Storage

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Egg is a highly nutritious and versatile food item which can be processed into various products. Egg cubes were formulated with tomato powder at 0%, 2%, 4% and 6%. A sensory evaluation was carried out to determine the best level of tomato powder to be incorporated to egg cubes. Four percent tomato powder fortified egg cubes were selected for further analysis. Another sensory evaluation was conducted to improve the flavor of the 4% tomato powder fortified egg cubes using the same amount (0.5g) of cardamom, cinnamon and clove powder. Egg cubes fortified with 4% tomato powder and flavoured with cinnamon powder were chosen and compared with the control group (0% tomato powder) to assess their keeping quality, during storage in frozen (-18 °C) condition after packaging in metallic polyester bags. The pH values and the water holding capacity of the treated group and control group were significantly different ($P<0.05$) during 28 days of storage condition. The thiobarbituric acid reactive substances (TBARS) values between treated and control groups were significantly different ($P<0.05$) with lass variation in treated group. The lightness between treated egg cubes and control egg cubes were not significantly changed ($P>0.05$), but the redness and yellowness of treated and control groups were significantly different ($P<0.05$). Microbiological analysis during 28 days of frozen storage revealed no significant difference ($P>0.05$) between the treated and control egg cubes. The fortification of 4% tomato powder and addition of cinnamon can produce egg cubes with high sensory and quality attributes and it does not affect the microbial standards of the product.

Keywords: Cinnamon, Frozen storage, Keeping quality, Sensory evaluation, TBARS

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Determination of Roasting, Brewing and Physicochemical Characteristics of '*Lak Parakum'* (*Coffea arabica*) Coffee Variety

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Coffee is one of the most consumed beverages around the world and one of the major exporting crops from Sri Lanka. Consumption of coffee at recommended levels could help to improve the overall health of consumers by providing numerous health benefits. *Lak Parakum* is a newly introduced Arabica coffee variety by the Export Agriculture Research Station (EARS), Matale. The main goal of the current study was to determine the optimum roasting and brewing conditions for this coffee variety and to assess the chemical composition including caffeine content and the proximate composition of the green and roasted coffee beans. Further, the study aimed to assess the variations in the chemical and physical characteristics of roasted coffee beans including pH, colour, density and moisture content with varying degrees of roasting. Proximate composition analysis using standard AOAC methods for sensory analysis (7-point Hedonic test with a 30-member untrained panel), caffeine content (UV-visible spectrometric method), and phosphorus content (colorimetric method) was performed to determine the above-listed characteristics. Based on the sensory testing, the optimum roasting was identified to be 200 °C for 14 minutes, and the optimum brewing condition was at 93.3 °C for 3 minutes. The total caffeine content of the roasted *Lak Parakum* coffee was 1.159±0.004% and the total phosphorus content was 1.83±0.04%. Further, with increasing roasting time, the total colour difference, and pH value of the coffee was significantly increased with a significant decrease in moisture content, particle density, bulk density, and tapped density.

Keywords: *Lak Parakum*, Caffeine, Proximate analysis, Optimum roasting time, Optimum brewing time

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Development and Characterization of Dietary Fiber- and Protein-Rich Instant Porridge Mix for Adults

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In the current Sri Lankan context, over 6.3 million individuals are experiencing food insecurity, and approximately 5.3 million among them are either reducing meals or skipping meals. The introduction of indigenous and convenient foods with better nutritional quality such as healthy porridge will support ensuring food security among the Sri Lankan population. This study aimed to develop and characterize dietary fiber- and protein-rich instant multi-legume porridge mix prepared by incorporating dehydrated fish powder, and targeting adults. Accordingly, two legumes namely mung bean and Bengal gram dahl, skim milk powder, dehydrated wolf herring fish powder, and cinnamon were used as ingredients. The instant porridge mix was prepared as four different formulations (F1, F2, F3, and F4) by using mung beans (45%) as the base. Different proportions of Bengal gram dal and dehydrated fish powder in those formulations were F1–37%, 0%, F2– 34%, 3%, F3–31%, 6%, and F4–28%, 9% respectively. According to the analytical test results, all 4 formulations fulfilled the requirement for being claimed as 'dietary fiber-rich' and 'protein-rich'; with acceptable physicochemical properties. The aroma, taste, and overall preference of the four formulations were significantly different at $p<0.05$ and the F2 was selected as the most preferred formulation. The F2 was analyzed for proximate composition and functional properties namely amylose content, total phenolic content (TPC), antioxidant activity, and microbial content. The F2 contained 12.54% of total dietary fiber, 23.23% of protein, 9.65% of moisture, 4.23% of crude fat, 5.37% of ash, 51.92% of total carbohydrate, 15.47% of amylose, 1.17 mg GAE/g of TPC and 63.09% of antioxidant activity with acceptable microbial quality. This study revealed that the developed healthy and nutritious instant porridge mix has the potential to be used as a convenient food source that can aid food insecurity among Sri Lankan communities.

Keywords: Dehydrated fish powder, Instant porridge mix, Legumes, Protein, Total dietary fiber

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Development and Characterization of Jackfruit (*Artocarpus heterophyllus*) Bulb and Seed Flour Based Crackers

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Jackfruit (*Artocarpus heterophyllus*) is an underutilized crop in Sri Lanka. This study aimed to develop jackfruit bulb and seed flour incorporated crackers while characterizing the physicochemical properties of composite flour blends and determining the proximate composition, physical and sensory properties of the developed crackers. Three different composite flour blends were formulated using different wheat flour (WF), jackfruit bulb flour (JBF) and jackfruit seed flour (JSF) ratios (F2 = 50% WF+ 25% JBF+ 25% JSF, F3 = 50% WF+ 37.5% JBF+ 12.5% JSF and F4 = 50% WF+ 12.5% JBF+ 37.5% JSF). The control (F1) flour sample consists of 100% WF. The developed composite flour blends resulted in significantly higher ($P<0.05$) water absorption capacity and swelling capacity than wheat flour. Among the composite flour blends, sample with higher jackfruit bulb flour had the highest values for bulk density, water absorption capacity, solubility and swelling capacity. The crackers were developed by incorporating 100.0 g of composite flour blends and the control was 100% wheat flour cracker. All developed crackers showed significantly higher ($P<0.05$) crude fiber content than wheat flour-based crackers, which ranged from 2.09 to 2.73%. Further, the crude protein, crude fat, crude fiber, and ash content of crackers significantly increased ($P<0.05$) with increasing the percentage of JSF. The antioxidant activity of composite flour- based crackers increased with an increase in the percentage of JBF. The crackers with more JSF reported greater hardness than crackers with more JBF. The crackers developed with F2 composite flour blend was selected as the sample with the best sensory attributes which were not significantly different ($P>0.05$) from the control sample in terms of aroma, texture and overall acceptability. Utilization of jackfruit bulb and seed in developing composite flours and crackers is feasible, thus increasing the potential of utilizing jackfruit in the food industry.

Keywords: Antioxidant activity, Composite flours, Crackers, Crude fiber, Jackfruit

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Development and Evaluation of TJC Mango Pulp Incorporated Junket: Physicochemical and Sensory Properties Analysis Alongside Storage Assessment

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This study aimed to develop mango pulp-enriched junket, with acceptable sensory and physicochemical properties, and microbial quality. Junkets with varying mango pulp proportions (2.5%, 5%, 7.5%, 10% w/w) were prepared. Sensory evaluation favored the 10% mango pulp level, showing significant ($P<0.05$) differences in texture, color, and flavor. The dry matter content (%), total ash (%), fat (%), crude protein (%), crude fiber (%), total carbohydrate (%), titratable acidity (%), total soluble solids (°Brix), pH, and energy (kJ/g) of the 10% mango pulp incorporated sample were found to be 27.34 ± 0.55, 3.18 ± 0.16, 3.03 ± 0.06, 15.10 ± 1.47, 1.49 ± 0.95, 4.31 ± 0.08, 0.265 ± 0.02, 25.6 ± 0.01, 6.27 ± 0.01 and 19.61 ± 0.18, respectively. Shelf-life assessment under refrigerated conditions over 21 days showed no significant changes in titratable acidity, syneresis, b* value, and pH during storage, whereas the total plate count, L* value, and a* value significantly changed ($P<0.05$). No yeast or mold was detected throughout storage. It was concluded that the addition of 10% mango pulp enhanced sensory attributes of junket, but prolonged storage beyond 14 days led to a significant increase in microbial load by the 21st day of storage, leaving the product unsuitable for consumption.

Keywords: Junket, Mango pulp, Sensory properties, Shelf-life

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Development and Quality Evaluation of Coconut-Based Sweetened Fat Spread

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The objective of the study was to develop a coconut-based sweetened fat spread and to evaluate the quality of the developed product. The first phase of this study was to determine the optimum processing temperature for the fat spread preparation. The three different temperatures (70, 80, and 90 °C) were used to select the optimum temperature using physical and microbial quality evaluation. The second phase was to determine the creamed coconut (CC) and coconut trickle (CT) percentage while keeping the cocoa powder and salt amount fixed through trial-and-error method. The best spread formula was selected using sensory analysis, physico-chemical properties, and proximate analysis. The temperature of 80 °C which maintained an internal product temperature of 72 °C showed a significantly better microbial quality ($P<0.05$) without any visible layer separation. Thus, this temperature was for the spread development. Three treatments were prepared with 7.00 g of cocoa powder, 0.50 g of salt and varying CC and CT amounts (T1=28.00 g CC and 65.00 g CT, T2 = 33.00 CC g and 60.00 g CT, and T3= 38.00 g CC and 55.00 g CT). Based on all analyses, the T1 sample was selected as the best formulation. This product has a moisture content of 14.65 ± 0.24%, and the color values of L^*=15.49 ± 0.62, a*=21.46 ± 0.64, and b*=16.56 ± 1.20. The proximate analysis revealed that the product has a crude fat content of 17%, crude protein content of 4%, ash content of 2%, crude fiber content of 4%, and a total carbohydrate content of 60%. The product yielded an energy content of 404.02 Kcal/100 g.

Keywords: Coconut cream, Coconut treacle, Fat spread, Proximate composition

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Development of a Candy Using African Butter (*Pentadesma butyracea*) Fruit Pulp

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This study investigated the potential of the African butter fruit pulp for developing a candy. The juice was extracted from the matured African butter fruits. Three formulations of toffee with different ratios of fruit juice (10%, 20%, and 30%) were developed and analyzed for preference of color, aroma, texture, taste and overall acceptability using a ranking test. Physico-chemical properties and the proximate composition of the most preferred formulation were analyzed. Also, the antioxidant potential of the candy was determined in terms of the total phenolic content (TPC), total flavonoid content (TFC) and DPPH radical scavenging activity. The toffee made with 20% fruit juice was the most preferred formulation and its pH, titratable acidity, total soluble solids, total sugar content, and ascorbic acid content were 3.9±0.03, 0.51±0.02%, 74.6±0.44%, 74.54±0,84% and 0.08±0.01 (g/100g) respectively. The TPC, TFC and DPPH scavenging activity of candies were 112.34±0.61 (mg GAE/gdw), 31.98±0.18 (mg QE/gdw) and 49.32±0.2% respectively. Results indicated that the pulp has the potential to be developed into a candy having functional properties.

Keywords: African butter fruit, Antioxidant activity, Physicochemical properties, Toffee

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Development of a Fruit Based Healthy Beverage and Evaluation of Its Physicochemical and Antioxidant Properties

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Fruit based beverages play a beneficial role in strengthening health of individuals owing to the presence of higher amounts of vitamins, minerals, phenolic compounds, antioxidants and other bioactive compounds. This study was aimed to develop a fruit based healthy beverage from the combination of green grapes (*Vitis vinifera*), pomegranate (*Punica granatum*), sweet orange (*Citrus sinensis*), ginger (*Zingiber officinale*), turmeric (*Curcuma longa*) and black pepper (*Piper nigrum*). Four formulations (F1, F2, F3, and F4) were selected based on preliminary conducted trials changing percentages of fruit juices and they were subjected to physicochemical, antioxidant properties and keeping quality studies. Three formulations with the highest antioxidant activities were subjected to a sensory evaluation. pH, total soluble solid (TSS), titratable acidity (TA), reducing sugar content, total sugar content, vitamin C content, total phenolic content (TPC), and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging percentage of 4 formulations were at the range of 3.63-3.36, 10.6-9.9 °Brix, 0.63-1.01%, 13.65-12.98%, 21.59-16.57%, 46.7-57.8 mg/100g, 1.16-1.59 mg GAE/g, and 36.48-60.54%, respectively. pH and TSS of formulations were significantly ($P<0.05$) reduced and TA of formulations was significantly ($P<0.05$) increased with 21 days of storage time. F1, F2, and F4 formulations were selected for sensory evaluation due to significantly higher ($P<0.05$) antioxidant activity than F3 formulation. Formulation 1 was selected as the best formulation based on the results of sensory analysis. No colonies of aerobic bacteria and yeast and molds were detected in the final product. Coliforms and E.*coli* were not detected in selected formulation (F1). The results of this study indicated that formulated fruit based beverage was a potential source of antioxidants and microbiologically safe for consumption.

Keywords: Fruit juices, Herbal juices, Fruit based beverages, Antioxidant properties, Physicochemical properties

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Development of a Fruit-based Carbohydrate-Electrolyte Drink and Investigation of Its Physicochemical Properties

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Carbohydrate-electrolyte drinks (CED) are formulated as suitable for rapidly replacing fluid, carbohydrates, electrolytes, and minerals to maintain an individual's hydration, blood glucose levels, and energy production when engaging in physical activities. The present study aimed to develop a commercially viable CED utilizing sweet orange juice and king coconut water and to investigate its physicochemical and sensory properties. Three formulations of CED were developed assuring sugar and sodium contents were within the range of acceptability as per the international standards, by changing the percentage of water and king coconut water mixture while the percentages of other ingredients were kept constant among the formulations. The F_1-F_3 formulations had total sugar contents of 86.84±3.60, 91.47±2.08, and 99.29±1.86 g/L, respectively while the sodium contents of the F_1-F_3 formulations were 446.33±7.51, 446.33±7.51, and 481.00±13.00 mg/L, respectively. The best formulation was selected based on the highest overall acceptability in sensory evaluation and physicochemical properties were determined. The ascorbic acid content, titratable acidity, total soluble solid (TSS) content, pH, reducing sugar content, and non-reducing sugar content of the selected formulation were 161.77±6.37 mg/100 ml, 0.60±0.04%, 6.50±0.00%, 3.64±0.01, 45.29±0.95 mg/L, and 45.85±1.74 mg/L, respectively. Ascorbic acid content, pH, TSS, reducing sugar content, and sodium content among the investigated physicochemical properties were affected by the heat treatment. The proximate composition suggested that the CED mostly contained moisture (93.3%) followed by carbohydrates (6.5%) and had an energy value of 26.4 kcal/100 ml. It was microbiologically safe to consume and the osmolality was detected as 201.0 mOsm/kg indicating the drink was a hypotonic drink. Therefore, the present study showed that the developed CED is a good natural alternative to artificial CEDs available in the market.

Keywords: Carbohydrate-electrolyte drinks, King coconut, Sodium content, Sweet orange, Total sugar content

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Development of a Hybridized Half-fat Cooking Cream through the Integration of Dairy and Coconut Fat

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This study was carried out to develop a half-fat cooking cream by blending dairy and coconut fats, exploring the feasibility and potential benefits of this combination. Targeting a 15% fat content to meet half-fat standards, various sample combinations with different ratios of coconut fat to milk fat (1:0, 2:1, 1:1, 1:2, and 0:1) were formulated. All formulations underwent physicochemical analysis and ranking tests to identify the optimal blend. A sensory evaluation was conducted to determine the suitability of the coconut-integrated dairy cooking cream for two food applications: milk rice and pasta. The absence of coliforms in all formulations deemed them eligible for sensory evaluation. Furthermore, shelf-life stability testing was conducted under two storage conditions: ambient (25°C) and chilled (4 ± 1°C). Based on the results, the 1:1 mixture was identified as the optimal blend, resulting in a final product with 81% moisture, 19% total solids, 15% total fat content, 4% solids non-fat, pH of 4.6, titratable acidity of 1.62×10^{-5} mol/dm^3, viscosity of 302 cP, and density of 1.031 g/cm^3. In terms of sensory evaluation, the pasta application received higher ratings on the 9-point hedonic scale compared to milk rice, indicating the product can serve as a viable alternative to milk cream-based products. Microbiological testing revealed that the aerobic plate count and yeast and mold count remained within acceptable limits for five days when stored under chilled conditions (4±1°C). Moreover, the secondary shelf-life was determined to be five days under chilled conditions (4±1°C), with free fatty acid and peroxide values within acceptable limits. Furthermore, the cost efficiency analysis showed a 31.7% cost reduction when utilizing locally sourced coconuts. Overall, the coconut fat integrated half-fat cooking cream presents a promising alternative for milk cream-based applications.

Keywords: Coconut fat, hybridized cooking cream, half-fat, cost-efficiency

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Development of a Pineapple Flavored Soft Drink Incorporated with Curcumin and Piperine

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Curcumin, a bright yellow crystalline compound, is the major active compound present in the rhizome of all *Curcuma* spp. with a wide array of beneficial properties, including hepato-protective, anti-inflammatory, and antioxidant. Curcumin has been shown to protect against liver damage resulting from both alcoholic and nonalcoholic oxidative stress. However, the bioavailability of curcumin is very low and it is scientifically proven that piperine can enhance the bioavailability of curcumin at the ratio of curcumin: piperine, 100:1. Therefore, the main aim of this study was to develop a pineapple- flavored soft drink incorporated with curcumin and piperine which could potentially have a hepato-protective effect on humans. This study was conducted at the Central Research Station of the Department of Export Agriculture, Matale, Sri Lanka. The curcumin and piperine were extracted by the Soxhlet extraction method and then purified. These were mixed to obtain three different formulations while maintaining the curcumin: piperine ratio as 100:1 (A=500:5, B=300:3 and C=100:1). The most preferable formulation and the preferred sugar level (14, 12 or 10% Brix) was identified using sensory evaluations conducted with 30 untrained panelists. According to the results, Treatment B obtained better ranks in terms of all the sensory attributes, except for taste. There was no significant difference between Treatment A and B. Based on the highest preference, 12% Brix value was selected as the optimum sugar level. The final total soluble solid, pH and titratable acidity values of the developed product were 12%, 4.24 $\pm$ 0.012 and 2.45 $\pm$ 0.011 % respectively. The curcumin content and total phenolic content (TPC) of the final product were 99.7 $\pm$ 0.013 mg/L and 511.13 $\pm$ 0.025 mg/L respectively. However, both the curcumin content and TPC significantly ($P<0.05$) decreased with four weeks of storage time in clear glass bottles.

Keywords: Bioavailability, Curcumin, Photo degradation, Piperine, TPC

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Development of an Energy Drink using Coffee Brew

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Sri Lanka, a major coffee producer, grapples with a significant portion of its coffee beans being classified as low-grade. This study investigated the potential of utilizing low-grade coffee brew in a novel energy drink to address this challenge. The goals were to create an economic value for these beans and to fill the gap in the Sri Lankan market for locally produced, coffee-based energy drinks. Building upon established knowledge linking coffee consumption to improved cognitive function, alertness, and physical performance, which are attributed mainly to caffeine, this study explored the suitability of low-grade coffee brew for conversion into energy drinks. A comparative analysis of suitability was conducted using 100% Robusta coffee brew, blends with varying ratios of Robusta and Arabica coffee, and 100% low-grade coffee brew as an energy drink. Sensory evaluation identified the 100% Robusta and 100% low-grade coffee brews as the most preferred options. The study investigated characteristics such as pH and Total Soluble Solids (TSS) to ensure the final product aligns with international standards set by the World Trade Organization (WTO). The pH value of the most preferred sample was 4 and the brix was 10°. This ensures a commercially viable and shelf-stable beverage. By introducing a novel product utilizing readily available resources, this research has the potential to revitalize the domestic coffee sector. By identifying the 100% Robusta and 100% low-grade coffee brew as a promising base for further development while addressing the need to optimize its physicochemical properties for commercial production, this study presents a novel and potentially transformative approach to utilizing Sri Lanka's coffee resources.

Keywords: Coffee, Energy drink, Low-grade coffee

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Development of Frozen Ginger Puree Cube and Reduction of its Post Quality Deterioration

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This study aimed to optimize the production of frozen ginger puree cubes to meet consumer expectations for sensory appeal. Raw material selection focused on local ginger rhizomes and incorporating them with different ratios of water. Due to the observed stickiness of the cube, xanthan gum was used as a stabilizing agent. Analysis of the results revealed that the incorporation of 0.5% xanthan gum reduced the stickiness among the frozen ginger cubes due to its ability to bind water and create a gel-like structure, which helps trap moisture and prevent it from migrating to the surface of the cubes. The pH of raw ginger ranged from 5.5 to 6.5, exhibiting slight acidity, primarily attributed to organic acids present in ginger. The stability of pH in frozen ginger cubes compared to raw ginger underscores the preservation of ginger's natural acidity during freezing (-40°C). Significant differences ($P<0.05$) in viscosity were observed among samples with varying ginger-to-water ratios. Specifically, the treatment with a ratio of 90% ginger, 10% water, and 0.5% xanthan gum exhibited the highest viscosity, while the treatment with a ratio of 70% ginger, 30% water, and 0.5% xanthan gum showed the lowest viscosity. Based on sensory evaluations, the formulation ratios water 30: ginger 70 with xanthan gum 5%, water 20: ginger 80 with xanthan gum 5%, and water 10: ginger 90 with xanthan gum 5% were identified as promising formulations for further analysis. After careful consideration, water 10%: ginger 90% with xanthan gum 5% emerged as the preferred choice, demonstrating better attributes in appearance, aroma, taste, and texture. Microbial analysis demonstrated that microbial counts remained within acceptable thresholds throughout storage, attributed to the heat treatment of raw ginger. In conclusion, this research provides valuable insights and practical recommendations for producers seeking to enhance the consumer acceptability of frozen ginger puree cubes.

Keywords: Freezing, Ginger puree, Sensory attributes, Stickiness, Xanthan gum

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Development of Nutritious, Protein-Rich Instant Noodle by Incorporating Soy (*Glycine max*) F lour and Drumstick (*Moringa oleifera*) Leaf Powder

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Instant noodles, widely consumed globally as a convenient food, are often rich in starch but deficient in protein and other essential nutrients. In Sri Lanka, where protein-energy malnutrition prevails, addressing dietary deficiencies is crucial in achieving national food and nutritional security. This study aimed to develop protein-rich instant noodle with acceptable physicochemical, sensory, and cooking properties using soybean flour and drumstick leaf powder as affordable sources. The study proposed 4 formulations including control (100% wheat), formulation B (70% wheat, 25% soybean, 5% drumstick leaf powder), formulation C (60% wheat, 35% soybean, 5% drumstick leaf powder), and formulation D (50% wheat, 45% soybean, 5% drumstick leaf powder) to meet the objectives of the study. Physicochemical properties, including hardness, cooking time, gruel content, water absorption capacity, and color, were evaluated. Quantification of protein confirmed that all 3 developed formulations meet the criteria for being claimed as 'protein-rich' based on specified food regulations. There was no significant difference ($P>0.05$) among the three protein-rich formulations in terms of all the evaluated physicochemical properties. Formulation B, was identified as the most preferred formulation according to the results of sensory analysis. The results revealed that the protein, moisture, ash, fiber, and fat contents were higher in the formulation B than that in control, and exhibited enhanced mineral content, total phenolic content, and antioxidant activity. Results of other test methods exhibited that the formulation B contains 9.47% moisture, 17.15% crude protein, 10.75% crude fat, 3.64% crude fiber, 3.44% total ash, 55.55% carbohydrate, 68.4 mg/100 g of calcium, 55.67 mg/100 g of magnesium, 5.36 mg/100 g of iron, 2.57 mg/100 g of zinc, 1.15 mg GAE/g of total phenolic content and 74.16% antioxidant activity, along with acceptable microbial content. The developed protein-rich instant noodle offers an affordable and nutritious alternative to combat protein-energy malnutrition.

Keywords: Instant noodles, Soybean flour, Drumstick leaf powder

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Development of Osmotically Dehydrated Ginger (*Zingiber officinale* Roscoe) and Product Quality Evaluation

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Ginger (*Zingiber officinale* Roscoe) is an aromatic plant that requires preservation to reduce postharvest losses. The osmotic dehydration (OD) method can be used to preserve ginger. OD process is a mass transfer operation that immerses products in hypertonic aqueous solutions (Eg, syrups or brines), partially removing water. This study was conducted to develop osmotically dehydrated ginger and evaluate the quality of the product. Osmotically dehydrated ginger was developed by immersing ginger in 4 different concentrations of sugar solutions (T_1, T_2, T_3, and T_4). T_1 was 50 °Brix sugar solution for 20-22 h. T_2 was 60 °Brix sugar solution for 20-22 h. T_3 was 70 °Brix sugar solution for 20-22 h. T_4 was a series of 50, 60, and 70 °Brix sugar solutions for 20-22 h in each solution. Physicochemical properties, chemical properties, microbiological properties, sensory evaluation, and storage stability were evaluated. According to the test results, there was a significant difference ($p<0.05$) among the 4 treatments in terms of color, hardness, total soluble solids, weight reduction, and bulk density. There was no significant difference ($p>0.05$) in true density among the 4 treatments. T_4 was the most preferred sample by the sensory panelists. T_4 was analyzed for chemical and microbiological properties. The chemical analysis of T_4 was found to be 9.6% of moisture, 0.4% of crude fat, 0.8% of crude protein, 2.0% of crude fiber, 1.1% of ash, 88.2% of total carbohydrate, 359.6 kcal/100 g of energy, 70.2% of total sugar, 6.32±0.01 pH, 17.08±7.39% of titratable acidity, 11.30±2.38% of antioxidant activity, and 1.300±0.002 mg GAE/g of total phenolic content along with acceptable microbial content. The developed products were stable for up to 35 days with preferable sensory attributes. This study revealed that the developed osmotically dehydrated ginger is a potential value-added product for commercial production and is safe for consumption.

Keywords: Ginger, Osmotic dehydration, Physicochemical properties

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Development of Seaweed (*Eucheuma cottonii*) Pulp Incorporated Mango (*Mangifera indica*) (Tom EJC) Jam

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Eucheuma cottonii is a red alga rich in nutrients and possesses medicinal properties. By incorporating this seaweed into people's dietary items, it can enhance seaweed consumption. This study aimed to introduce seaweed pulp to augment the nutritional value of mango jam and substitute pectin as a thickening agent. Seaweed and mango (Tom EJC) pulp were added in varying proportions, while other ingredient levels remained constant. Seaweed was included in amounts of 6%, 9%, 12%, and 15%. The treatment samples, a control with 0% seaweed, and commercial mango jam underwent a series of analyses, including proximate analysis, pH determination, titratable acidity measurement, and microbial testing. Additionally, sensory evaluation was conducted to assess consumer acceptability. The results indicated that the 12% seaweed incorporated sample exhibited higher ($P<0.05$) nutritional properties compared to both the control and commercial mango jam. It further showed higher protein and ash content than the other treatments. The moisture, protein, fat, total ash, total dietary fiber, and fat content of the 12% seaweed pulp-containing jam were 26.41, 9.57, 0.33, 0.35, and 2.67% (w/w), respectively. It displayed a pH of 3.84, titratable acidity of 0.94% (W/W), and a total soluble solid of 65%, all within acceptable ranges. The jam containing 6% seaweed was chosen based on consumer preference. The integration of seaweed such as Eucheuma cottonii into jam presents an effective strategy for augmenting seaweed consumption among consumers while simultaneously enhancing the nutritional profile of the jam.

Keywords: *Eucheuma cottonii*, Mango pulp, Nutrient analysis, Sensory analysis

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Development of Vinegar from Industrial Waste of Pineapple (*Ananas comosus*) Peel and Core

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Pineapple peel and core are the major solid waste in the pineapple processing industry. Economical uses of the waste are beneficial for both industry and the environment. The study was focused on the feasibility of utilizing pineapple peel and core in the production of vinegar. Extracted juice from pineapple peels and core was subjected to natural fermentation with different treatments and monitored the progress. The treatments were T_1 (juice 500 ml with 0.25 g yeast (*Saccharomyces cerevisiae*), T_2 (juice 500 ml with 0.5 g yeast), and T_3 (juice 500 ml with 1 g yeast). The alcohol content in three treatments was measured in two-day intervals for five days. The starter culture for acetic acid fermentation was Colman's brand organic sap vinegar. The treatments were T_1 (600 ml alcoholic juice and 10 ml starter culture), T_2 (600 ml alcoholic juice and 20 ml starter culture), and T_3 (600 ml alcoholic juice and 30 ml starter culture). The alcohol content, total acidity, and total solid content of the product were determined. Permanganate oxidation value, alkaline oxidation value, and Iodine value were measured using Iodometric titrations. A sensory evaluation was conducted to determine the acceptability of the final product. The findings indicated that the best treatment was T_2 and 5 days fermentation for alcoholic fermentation and T_3 and 18 days fermentation for acetic acid fermentation. The final product quality complies with the standard of the Sri Lankan Food Act, No 26 of 1980 for natural vinegar. It contained total solids of 1.75 ±0.06 g per 100 mL, total acidity of 5.14 ± 0.02 per 100 mL, permanganate oxidation value of 1227.67±14.90, alkaline oxidation value of 207.00 ± 3.50 and iodine value of 4.42 ±2.60 indicating that there was no addition of artificial vinegar. According to sensory results, consumers showed a higher preference for vinegar made out of pineapple core and peel over commercial products.

Keywords: Natural vinegar, Physiochemical parameters, Pineapple waste, *Saccharomyces cerevisiae*

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Do Different Carrageenan Extraction Methods Influence on the Carrageenan Yield, Carrageenan Fraction and Gel Strength of a Marine Red Seaweed, *Kappaphycus alvarezii* (Elkhorn Sea Moss or Doty)?

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Carrageenan is a cell wall polysaccharide which has been commonly used in different industries. Considering high economic value of carrageenan, various carrageenan extraction methods have been developed all over the world. However, up to now, there were few studies on how the different extraction methods would influence on yield and physicochemical parameters of carrageenan. The present study aimed to compare four common extraction methods such as, conventional $Ca(OH)_2$ autoclaving, 6% (w/v) $Ca(OH)_2$, 6% (w/v) KOH and 6% (w/v) NaOH on yield %, gel strength, functional groups of κ-, λ- and ι-carrageenan fractions, water holding capacity and colour. As the source of carrageenan, brown color morphotype of *Kappaphycus alvarezii* which was grown in Jaffna were harvested at 45 days. Yield percentage of carrageenan, transmittance under Fourier Transform Infrared (FTIR), gel strength, water holding capacity and *L*a*b** values were measured as variables among extraction methods. The highest ($P<0.05$) carrageenan yield % (37.20%) was recorded in the 6% KOH (w/v) extraction method followed by conventional method (14.96%). All the extractions have given similar FTIR spectrum patterns with slight deviations at 845 cm^{-1}, 925-930 cm^{-1} and 1220-1260 cm^{-1} wave ranges. The highest ($P<0.05$) gel strength (1745.86 g/cm^2) was recorded in 6% (w/v) KOH method, whereas conventional method recorded the lowest ($P<0.05$) gel strength (706.26 g/cm^2). Moreover, conventional and 6% (w/v) KOH treated samples showed the highest ($P<0.05$) water holding capacity (98.59% and 97.42%) along with the highest ($P<0.05$) *a** and *b** values. By contrast, lightness (*L**) did not show any significant difference ($P>0.05$) among carrageenan extracted from four methods. Therefore, it can be concluded that, 6% (w/v) KOH extraction method provides the highest carrageenan yield (37.20%) along with desirable physicochemical properties compared to rest of the carrageenan extraction methods when use *Kppaphycus alvarezii* as a seaweed source.

Keywords: Carrageenan, Carrageenan fraction, Carrageenan yield %, Gel strength

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Effect of Agar and Cinnamon (*Cinnamomum zeylanicum*) E ssential Oil Based Edible Coating on the Quality and Shelf-Life of Tea Buns

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The bakery industry faces challenges related to maintaining the freshness of bakery products during market storage. A promising method to overcome the problem could be considered as an urgent need. This study investigated the effect of agar and cinnamon (*Cinnamomum zeylanicum*) essential oil based edible coating on the quality and shelf-life of tea buns. The tea buns were coated with an agar-based coating containing cinnamon essential oils at three different levels 0.5%, 1.0%, and 1.5%. Coated tea buns were evaluated in three-day intervals up to 12 days storage period in terms of their change of moisture content, color, pH value, hardness, sensory evaluation, total aerobic plate count, and the water vapor permeability of the edible coating layer. There were no significant differences ($P>0.05$) in the moisture content, hardness, and color of the coated tea buns throughout the 12-day of storage period. pH values of all coated and control samples were significantly reduced ($P<0.05$) after 6 days of storage period. Total aerobic plate counts of samples that have been coated with 1.0% and 1.5% essential oil-incorporated edible coatings, showed 1.5×10^4 CFU/g and 1.4×10^4 CFU/g respectively at 7 days of storage periods. The constant reference Duo-Trio test results showed that there were no significant differences ($P>0.05$) in the perceptible sensory quality between the coated and control samples. The water vapor permeability of the edible coating layer ranging from 2.75×10^{-13} to 2.80×10^{-13} g mm^{-1} Pa^{-1} s^{-1}. Overall, agar-based 1.5% essential oil incorporated edible coating showed the most favorable characteristics among the treatments.

Keywords: Edible coating, Agar, Cinnamon essential oil, Tea bun

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Effect of Aloe Vera Gel Coating on Postharvest Quality, Shelf-Life and Disease Development of Capsicum (*Capsicum annum* L. var. Muria 385 F1)

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Capsicum (*Capsicum annum* L.) is a popular commercial vegetable grown in Sri Lanka and experiences high postharvest losses. This research was carried out to enhance the postharvest shelf-life and quality of Capsicum. Capsicums fruits (var. Muria 385 F1) were coated with three different concentrations of Aloe Vera (AV) gel solutions; 30% AV solution (AV-30), 50% AV solution (AV-50), 70% AV solution (AV-70), and 100% distilled water (AV-0), which served as the control. The coated fruits with AV gel stored in low temperature (8-10 ^{o}C) and high relative humidity (85-90%) in cardboard corrugated boxes. Data on physiological weight loss, fruit firmness, total soluble solid content (TSS), ascorbic acid content, colour change, marketability, disease incidences (DI), and disease severity (DS) were measured at five-day intervals until the end of the 20-days storage period. Among the coating concentrations, AV-30 showed the lowest physiological weight loss (12.18%), highest fruit firmness (66.0 N), lowest TSS ^{64}percentage (5%), minor colour variation, and highest marketability (80%), along with the lowest DI (13%) and DS (7) values. AV-50 showed the highest ascorbic acid value (37 mg/100 g) at the end of the 20 days storage period. Results of this study concluded that AV-30 was the optimal AV coating solution concentration for extending the shelf-life and reducing the postharvest quality loss of capsicum fruits.

Keywords: Aloe Vera, Capsicum, Coating, Postharvest, Shelf-life

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Effect of Heat Moisture Treatment on Morphology and Physicochemical Properties of Starches Extracted from *Kiri Ala* (*Xanthosoma sagittifolium*), *Hulankeeriya* (*Maranta arundinacea*) and *Buthsarana* (*Canna indica*)

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Starch is an abundant constituent of plants and mainly stored in the fruits, roots/tubers, and seeds/grains. Starch from three selected underutilized root and tuber crops namely *Xanthosoma sagittifolium, Maranta arundinacea* and *Canna indica* were extracted, modified and evaluated the morphology and physicochemical properties of native and modified starches. Heat moisture treatment (HMT) was done using 18% and 24% moisture levels, at 100 ºC and 120 ºC for 4 h and 6 h. Granular morphology was not affected by the HMT, which means size and shape of starch showed no difference in both native and modified starches. However, HMT resulted some rough surfaces of the granules. Modified *Buthsarana* starch showed lower L* values compared to the other two starches which ranges from 86.15 to 88.48, while modified *kiri ala* and *hulankeeriya* showed L* values between 90.18 and 94.63 and 91.98 to 92.92, respectively. Delta E values were calculated comparing with pure white color. The ΔE values of modified *kiri ala, hulankeeriya* and *buthsarana* were ranged in between 6.38-10.51, 7.90-8.16 and 12.61-16.05, respectively. Bulk density of starch was decreased after the modification. Water holding capacity increased after the modification compared to the native starches, except 24%, 4h, 100 ºC and 24%, 6h, 100 ºC treatments in *kiri ala.* No significant difference (p>0.05) was observed in oil holding capacity in modified starches, compared to their native counterparts. Swelling power increased with increasing temperature in both native and modified starches. At higher temperatures, swelling power capacity of native starch was higher than that of modified starch. Modified *kiri ala* and *hulankeeriya* starches exhibited maximum water solubility at 70 ºC and 80 ºC. Transparency increased in both *kiri ala* and *hulankeeriya* after the modification, which indicates lower retrogradation. These findings indicate the potential of HMT to improve starch characteristics in underutilized crops.

Keywords: Heat moisture treatment, *Kiri ala, Hulankeeriya, Buthsarana,* Morphology, Physicochemical properties

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Effect of Nitrogen Fertilization on Potato (*Solanum tubersoum* L.) Tuber Quality: Composition, Physico-Chemical Properties and Functional Properties

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Excessive nitrogen (N) fertilizer application has become a significant threat to sustainable agriculture. Information on the effect of fertilization on food quality is lacking, hence, in this research, four potato varieties (Granola, Topaz, Briana, Triplo) grown under two different N fertilizer treatments and the variety Granola grown under six different fertilizer treatments were employed to study their effects on potato tuber quality in terms of compositional, physicochemical and functional properties. Dry matter, ash, starch, amylose, ascorbic acid, nitrogen, calcium, potassium and total phenolic content were tested using standard methods. Solubility, swelling power, water adsorption, and antioxidant activity were also evaluated. The significance of the results was determined at P=0.05 level. Application of 194 kg N /ha of farmyard manure (FYM) + 151 kg N/ha of urea resulted significantly high content of dry matter (18.83%), amylose (25.71%), ascorbic acid (2.59 mg/g DW), total N (1.62%), and protein N (0.81%). Low N fertilizer (FYM) resulted in significantly high phenolic content (0.89 mg/g DW) and antioxidant activity (5.63 µmol AsA/g DM). Two different N fertilizer treatments had no significant effect on starch content, solubility, and swelling power. Among six N fertilizer treatments applied to Granola, amylose content (36.87%) was significantly high in potatoes grown without urea or farmyard manure. Significantly high total N content resulted from FYM + 151 kg N/ha urea and farmer practice (FYM + 210 kg N /ha), 1.7% and 1.76 % respectively, while significantly high protein N content (0.72%) resulted from farmer practice. Water adsorption was significantly high in control (302.4% DM) and potatoes grown under 151 kg N/ha FYM + urea (314.9 % DM). Antioxidant activity (48.76 µmol AsA/ 100 g FW) was significantly high in the control. The results of this study provide insights into multidisciplinary research to evaluate the effects of N fertilization on human nutrition.

Keywords: Nitrogen fertilizer, Potato (*Solanum tuberosum* L.), Physico-chemical properties, Tuber composition, Tuber quality

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Effect of Potassium Sorbate on the Survivability and Functionality of Yoghurt Culture

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The addition of potassium sorbate to yoghurts is prohibited except for flavoured or thermized variants, as outlined by Sri Lanka Standards (SLS). This has sparked controversy in the food industry due to the limited effectiveness of pH reduction in controlling all microbial groups. Potassium sorbate can adversely affect yoghurt culture, potentially lowering the standard level over time. This study explores the impact of potassium sorbate on the culture of plain yoghurts, ensuring compliance with SLS while determining a safe level for its inclusion. Initially, 30 test reports from small and medium-scale yoghurt producers were assessed for their compliance with SLSI standards. Surprisingly, 70% of enterprises failed to meet the minimum requirement of 10^7 CFU/g viable starter culture. Further investigation revealed that 60% of these non-compliant enterprises had incorporated potassium sorbate, indicating potential violations of SLS product standards. Additionally, a study on eight established market yoghurt samples at their shelf-life end revealed a significant negative correlation ($p<0.05$) between added sorbate and starter culture count, underscoring the potential harm of potassium sorbate on yoghurt cultures. Interestingly, no statistically significant relationship ($p>0.05$) was found between pH, titratable acidity, and the presence of added sorbate in these market samples. To establish a safe threshold for potassium sorbate, a controlled experiment added four concentrations (0 ppm, 100 ppm, 200 ppm, 300 ppm) to freshly prepared yoghurt. Over a 6-day refrigerated storage period, a strong correlation between added sorbate and yoghurt culture viability was observed. Notably, the results suggested 100 ppm as a safe level for potassium sorbate addition to yoghurt. This research offers valuable insights into yoghurt compliance with SLS product standards and establishes a quantitative relationship between potassium sorbate addition and yoghurt culture viability. These findings aim to improve yoghurt production practices, bolster consumer confidence, and foster a healthier yoghurt market in Sri Lanka.

Keywords: pH, Potassium sorbate, SLS product standard, Titratable acidity, Yoghurt culture

This research was supported by Industrial Technology Institute of Sri Lanka

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Effects of Somatic Cell Count on Milk Composition and Milk Quality in Baduragoda GN Division

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This research investigated the effects of somatic cell counts (SCC) on cow milk composition and quality in the Baduragoda GN division. Data were collected from 24 dairy farmers within 2 months. Milk samples were analyzed for SCC, fat content, solid non-fat content and quality parameters including colour variation of resazurin test, alcohol test result and milk pH. The normality test of milk fat content, solid non-fat content and milk pH value within each SCC category was analyzed. It indicated that these variables followed a normal distribution ($p > 0.05$). The study found a strong negative correlation between milk fat and SCC ($p < 0.05$) indicating that as SCC increases, fat content decreases significantly. A positive correlation was observed between SCC and milk pH ($p < 0.01$) suggesting that elevated SCC was associated with high pH in milk.

Keywords: Correlation, Milk composition, Quality parameters, Somatic cell count

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Establishment of a Trained Sensory Panel and Evaluation of the Performance

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A trained in-house sensory panel was established for comprehensive subjective evaluation of food products at the HJS Condiments Ltd., Biyagama. The sensory attributes of flavor, aroma, texture, and overall appearance were considered for training the prospective panelists selected through structured approach, emphasizing the importance of consistency and reliability. A rigorous screening process was implemented to select individuals with diverse sensory backgrounds and a keen interest in sensory perception. Screening tests were conducted as basic taste test, basic odour test, color ranking test, texture descriptive test and taste intensity ranking test. Fifteen panelists were selected from the performed tests. All the members correctly responded for the duo-trio tests and paired comparison test. Training sessions were conducted to familiarize the panelists with descriptive analysis techniques, standardized vocabulary, and evaluation protocols. The effectiveness of the sensory panel was evaluated through proficiency tests including ratio, interval and category scale tests. The probability values of scale tests were significantly higher than the other tests ($p>0.05$). Results demonstrated that the the panelists are able to provide precise and consistent sensory assessments, thereby enhancing the quality and reliability of sensory analysis data in food product development and quality control. The research output has contributed to the advancement of sensory science by establishment of well-trained sensory panel for industry product quality determination.

Keywords: Duo-trio, Evaluation, Paired comparison, Screening tests, Sensory panel

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Evaluating the Feasibility of Long Grain Rice Flour for Developing Food Products Having Low Glycemic Index

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Low-glycemic index (GI) foods play a crucial role in the dietary management of chronic diseases such as type 2 diabetes. This study aimed to assess the feasibility of producing low-GI food products utilizing long-grain rice varieties known for their inherently low GI. Three long-grain varieties, namely CIC Red Fragrance (CIC-RF), CIC White Basmati (CIC-WB), and CIC Sticky Basmati (CIC-SB), alongside one medium-grain variety, BG 352, were subjected to comprehensive analyses of physio-chemical properties of flour and sensory properties and GI of its food applications. According to the results, CIC-SB classified as low amylose content variety while all the other varieties classified as high amylose content varieties. Significant differences ($P<0.5$) were observed among rice flours in various physicochemical properties including water absorption index, swelling power, solubility index, and color. Sensory evaluation of string hoppers derived from these rice varieties exhibited no significant differences ($P>0.5$) in appearance, flavor, texture, and overall acceptability, although significant differences ($P<0.5$) were observed in color for CIC-RF and aroma for BG 352. *In vivo* starch digestion analysis classified CIC-RF and CIC-WB as low GI, with respective GI values of 50 ± 6.0 and 54 ± 7.1, and CIC-SB and BG 352 were categorized as medium GI, with GI values of 64 ± 5.3 and 66 ± 9.0, respectively. Conclusively, string hoppers that is produced using CIC-RF and CIC-WB rice flour can be recommended for diabetes patients according to guidelines of WHO.

Keywords: Glycemic index, Long grain rice, Physicochemical properties

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Evaluation of Different Physical Forms of a Spice Seasoning Mixture on Quality Parameters of the Seasoned Chicken Meat

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The process of seasoning chicken with dry ingredients plays a crucial role in enhancing its flavor, texture, and shelf life. Seasoning involves the application of a mixture of dry ingredients such as salt, pepper, herbs, and spices to the chicken's meat surface before cooking. This process not only adds flavor but also affects the meat's tenderness, texture, pH, and other physicochemical properties. This study was conducted to evaluate different physical forms (normal, particle size reduced to 100 µm and 200 µm and extracted oleoresin mixture) of a spice seasoning mixture on the quality parameters of the seasoned chicken meat. The experiment involved four seasoning mixtures based on physical nature and three holding times. Results showed that finer spice particles (100 µm and 200 µm) were absorbed more efficiently into the meat compared to normal particles. The study revealed that allowing more time for seasoning penetration increased seasoning uptake but also influenced seasoning loss. The cooked yield was significantly affected by the particle size of the spice mixture, with smaller particles resulting in higher yields due to better penetration and protein extraction onto the meat surface. Additionally, cooked loss was minimized when using finer spice particles and longer holding times. Sensory evaluation indicated that different physical forms of spice mixtures influenced properties like toughness, color, aroma, flavor, and overall acceptability of seasoned chicken meat. For each hour of seasoning, chicken samples seasoned with a spice mixture of 100 µm were found to be significantly preferred over other treatments. In conclusion, the physical nature of spice seasoning mixtures significantly impacts the quality parameters of seasoned meat.

Keywords: Breast meat, Holding time, Meat seasoning, Micro particles

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Evaluation of Functional and Sensory Properties of Selected Curry Leaf (*Bergera koenigii*) Ecotypes Grown in Sri Lanka

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Curry leaf (*Bergera koenigii*) plant is a native plant to Sri Lanka, thrives naturally across all the agroecological zones of Sri Lanka. Several morphologically distinct ecotypes of curry leaf plants are found. Hence, this study aims to explore the potential variations among ecotypes in terms of functional and sensory properties. The moisture content, bulk density, water holding capacity, water solubility, swelling power, total phenolic content, DPPH scavenging activity and sensory attributes of curry leaf powder were assessed with respect to selected seven different locations in Sri Lanka along with a variety and a species of curry leaf. Among the observed physical properties, Kurunegala ecotype stands out exhibiting the highest water holding capacity, water solubility and swelling power which were recorded as 3.72±0.02%, 19.56±0.21% and 8.21±0.13%, respectively, followed by Rikillagsakada ecotype which had the second greatest values for water holding capacity and swelling power which were recorded as 3.63±0.09% and 7.76±0.24%, respectively. The highest total phenolic content was recorded from Rikillagaskada (44.12±4.06 mg GAE/g) followed by Kurunegala (39.06±0.53 mg GAE/g) and the third highest value was recorded from Ritigala (37.89±1.13 mg GAE/g) ecotype. The highest antioxidant capacity in terms of DPPH radical scavenging activity was recorded from Ritigala (64.83±0.09 mg AAE/g) followed by Rikillagaskada (64.26±0.89 mg AAE/g) ecotype. It was evident that Rikillagaskada and Kurunegala ecotypes exhibit promising qualities in terms of total phenolic content, sensory attributes and physical characteristics which can be used in food applications.

Keywords: Antioxidant activity, Curry leaves, Ecotype, Functional properties, Phenolic content

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Evaluation of the Frying Properties of Coconut Oil through the Incorporation of Testa Extract and Vitamin E

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Coconut testa is the thin brown-outer cover surrounding the coconut kernel, which generates as waste in the coconut industry and used as an animal feed. This study was carried out to evaluate the frying properties of coconut oil through the incorporation of testa extract and vitamin E under deep-fried conditions. The radical scavenging activity (RSA), peroxide value (PV), free fatty acid content (FFA), and moisture content (MC) of initial oil, heated oil, and deep-fried oil samples were determined using the AOAC method. Initially, FFA content, PV, and MC of oil samples were determined. These values were 0.23%, 1.26 meq/kg, and 1.89% respectively. Comparison of the oil with SLS values ensured that the oil sample was of good quality. After deep-frying the oils' FFA content, PV and moisture content were changed to 0.51%, 1.26 meq/kg and 0.28% respectively. The FFA content, PV and MC after addition of paring extract was 0.48%, 21.64 meq/kg and 0.25% respectively. The FFA content, PV and MC after addition of vitamin E was 0.38%, 27.33 meq/kg and 0.15% respectively. RSA of before and after frying of oil samples was 16.15 ± 0.23 and 1.76 ± 0.12 respectively. The RSA of paring extract added oil before and after frying was 22.83 ± 1.02 and 19.45 ± 0.70 respectively. The RSA of vitamin E added oil before and after frying was 31.01 ± 1.09 and 14.80 ± 0.34 respectively. The paring extract and vitamin E added oil had high RSA under before and after frying conditions. FAA and PV were lower in paring extract and vitamin E incorporated oil. The statistical analysis showed that there is a significant difference ($P<0.05$) in three oil samples for FFA content, RSA and PV under deep-fried condition.

Keywords: Coconut oil, Coconut paring extract, Coconut testa, Deep-frying, Vitamin E

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Evaluation of the Prebiotic Effect of Selected Underutilized Yams Grown in Sri Lanka with *Lactobacillus curvatus*

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Probiotics are beneficial live microorganisms, while prebiotics, such as yams, are undigested food components that nourish probiotics in the large intestine. This study assessed the prebiotic effect of four underutilized local yam types namely, Canna (Buthsarana: *Canna indica*), Water Yam (Raja Ala: *Dioscorea alata*), Arrowroot (Hulankiriya: *Maranta arundinacea*), and Taro (Kiri Ala: *Xanthosoma sagittifolium*), using *Lactobacillus curvatus*. Samples of these yams were dried, powdered, and incorporated at 3% (w/v) into sterile skimmed milk media containing 12% (w/v) solids and activated culture [10% (v/v)]. The mixture underwent anaerobic incubation at 37°C for 12 hours, followed by refrigeration at 4°C. Plate counts and pH were monitored on days 0, 7, 14, 21, and 28. A sample without prebiotics served as the negative control. The prebiotic effect of arrowroot and water yam was higher ($P<0.05$) than that of Taro or Canna. All four treatments exhibited a significant increase in colony-forming units compared to the negative control. Both Arrowroot and Water Yam showed the highest colony-forming units (CFU $\log_{10}$ values) by day 14 (6.32 ± 0.08 and 6.28 ± 0.08, respectively). From day 14 to the end of day 28, the number of colonies declined with the reduction of pH in all yam samples, possibly due to the high acid content suppressing *Lactobacilli* growth. Both Arrowroot (6.08 ± 0.10) and Water Yams (6.12 ± 0.05) showed CFU numbers slightly higher than the lowest recommended therapeutic level of 6 $\log_{10}$/ml at the end of 28 days of storage. The negative control exhibited the highest pH (6.6) at the end of storage, indicating poor *Lactobacilli* growth. Arrowroot showed the lowest pH (5.2) with *Lactobacillus curvatus*. In conclusion, Arrowroot and Water Yam exhibit high prebiotic effects with *Lactobacillus curvatus*, while other yam flours also possess considerable prebiotic effects. Therefore, underutilized local yams evaluated in this study can be used as potential prebiotics.

Keywords: CFU, *Lactobacilli curvatus,* pH, Prebiotics, Probiotic

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Exploring the Relationship among Nutritional Composition, Glycemic Index, and Functional Properties of Newly Introduced Basmati-Type Rice Varieties in Sri Lanka

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The study examined three novel basmati-type rice varieties named CIC Super-Kernel, CIC-Red-Fragrant, and CIC-Ceylon-Purple-Rice, focusing on their nutritional profiles, glycemic index (GI), and other vital health-related attributes. Standardized analytical methods such as AOAC for proximate, fat, mineral, and dietary fiber compositions, the Iodine colorimetric method for amylose content, the Folin-Ciocalteu method for total phenolic content, and the DPPH scavenging method for antioxidant activity were employed, offering a comprehensive overview of these rice variants. A group comprising twenty-five healthy volunteer subjects was selected to participate in the GI testing study. The GI values were within a close range for all three varieties—CIC-Super-Kernel (49±9.4%), CIC-Red-Fragrant (50±3.9%), and CIC-Ceylon-Purple (51±7.3%)- classifying them as low-GI foods. Such rice types are beneficial for individuals managing diabetes, as they help control blood sugar levels. The amylose content across the varieties was observed to be consistent, ranging from 22.4% to 23.4%. Similarly, dietary fiber content showed slight variations between 5.2% and 6.4%, with no statistically significant differences ($P<0.05$) among the varieties. These attributes contribute to the overall satiety and digestive health benefits of rice. Notably, the CIC-Red-Fragrant variety stood out for its significantly higher ($P<0.05$) total phenolic content (39.33±3.89 mg GAE/g) and antioxidant activity (91.95±0.37%), indicating a potentially greater health benefit in terms of combating oxidative stress compared to the other two varieties. The study also unveiled a significant positive correlation between GI and optimum cooking time ($r=0.95$; $P<0.05$) and water uptake ratio ($r=0.96$; $P<0.05$), and a significant negative correlation between GI and the length-to-breadth ratio ($r=0.96$; $P<0.05$). This research underscores the potential of these basmati-type varieties in contributing to diverse and health-oriented diets, reinforcing the importance of choosing rice types based on comprehensive nutritional profiles and specific health goals.

Keywords: Glycemic index, Basmati, Amylose, Dietary fibre, Antioxidant
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Exploring Underutilized Yams in Sri Lanka: An Integrative Assessment of Nutritional, Bioactive, and Processing Attributes of *Dioscorea* Species and Prospective Food Applications

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The current food insecurity status quo in Sri Lanka compels to seek more nutritious and healthy alternative staples. This study was conducted to characterize 41 *Dioscorea* yam species obtained from the germplasm preserved at the Field Crops Research and Development Institute, Mahailluppallama aiming to confirm their potential to provide a viable solution to mitigate national food insecurity. Nutritional, bioactive, and processing attributes of these yams were determined using standard testing methods. Carbohydrate-related nutritional parameters, namely total carbohydrate and sugar contents were higher in *D. alata*, whereas inulin was more abundant in *D. bulbifera*. Several yams surpassed 4% ash content and phosphorous, potassium, and calcium contents of the yams were within the ranges 16 – 532, 227 – 617, and 2.2 – 6.2 mg/ 100 g (dw) respectively. Among the yams, 'Raja ala dam' was recorded to have high mineral content. Crude fat values varied within 0.01 – 1.72% and a significantly positive correlation ($P<0.01$) was identified between the crude fat and anthocyanin contents. The vitamin C content of the yams was within the range of 5.33 – 34.65 mg/ 100 g (dw). Tannin content was below 15 mg/ 100 g (dw) for all yams. Appreciable levels of bioactivity were exhibited by several yams which were correlated with high levels of phenolic, flavonoid, and anthocyanin compounds. An *in vitro* study determining the glycemic index of 'Raja ala dam' indicated it as a low glycemic index food. The loss of phytochemicals in yams upon preparation by boiling was limited to approximately 50% loss. Fufu, instant soup powder, yam fries, yam pudding, and natural food colourant were developed revealing their processing potential to develop food products. The present study serves as an exploration of understanding the value of yams and the means of reinstating them into the diets of the Sri Lankan people.

Keywords: *Dioscorea*, Alternative staple, Nutritious, Functional, Food applications

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Fulfillment of Daily Protein Requirement of Adult Humans: Development of a Functional High-Protein Beverage

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The functional beverage market has experienced rapid growth, targeting elderly individuals to assure a healthy aging process. The aim of the present study was to develop a functional high-protein drink to gain the daily protein requirement of adults using whey protein isolate (WPI), collagen hydrolysate (CH), Ashwagandha (*Withania somnifera*) root powder (ARP) and to evaluate physicochemical, microbiological and sensory properties of the developed product. The beverage was developed in the forms of a ready-to-drink (RTD) product and a premix (PM). two sets of 4 different ARP blends consist of 0.57% (T1), 0.86% (T2), 1.14% (T3),1.43% (T4 and 0.1% (T5), 0.15% (T6), 0.2%(T7), 0.25%(T8) were used in PM and RTD formulations, respectively. Whey protein isolate, CH, and full-fat milk powder were used as protein sources in PM and WPI, CH and fresh milk were used in RTD at a protein concentration of 77.12% (w/w) with 3.5% (w/w) fat. Tricalcium phosphate, coffee flavor, guar gum, sucralose, and caramel color were included as other ingredients. Treatment 2 from PM and T4 from RTD scored the highest in sensory acceptability. Protein (81.29±2.10%) and fat (4.22±1.42%) contents were within the accepted level of specifications for malted food drinks under Sri Lankan Standards Institution. The RTD product was stored at 4 ℃ for two weeks and analyzed for color, microbial counts, titratable acidity, pH, total solids, and viscosity on 0, 3, 7, 11, and 14 days of storage. The PM was stored at room temperature (29.4℃±1.45) for two weeks and microbial counts were analyzed at same time intervals as in RTD. During the storage, color and pH reduced while titratable acidity and viscosity increased in RTD. Microbial counts were not significantly different (P>0.05) in total plate counts, yeast and mold counts of PM during the 2 weeks. The current study revealed that RTD beverages and PMs could be formulated with a high-protein content with desired flavor and functional properties.

Keywords: Functional beverages, Healthy aging, High-protein beverages, Whey protein, *Withania somnifera*

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Gelatine Extraction from Sea Chicken (*Canthidermis maculata)* Fish By-Products for Waste Reduction and Added Value in the Seafood Industry

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Gelatine, a vital biopolymer derived from collagen hydrolysis, finds extensive use across various industries due to its exceptional technological and functional attributes. While predominantly sourced from mammals, the need for alternative gelatine sources is burgeoning, driven by societal and religious considerations. By-products from the fish processing industry emerge as a promising alternative source owing to their abundant collagen content. Sea chicken fish (*Canthidermis maculata*) generates a considerable amount of skin waste that can be used as a collagen source for gelatine extraction. Thus, this research evaluated the HCl and CH_3COOH effect, at 0.15 M, and 0.2 M, on extraction yield, gel strength, viscosity, colour, pH, protein, ash, minerals and melting point of Sea chicken fish skin gelatines. Results revealed significant differences ($P < 0.05$) in extraction yield based on acid type. At a concentration of 0.15 M, HCl produced the highest extraction yield at 8.99%. The skin treated with 0.15 M CH_3COOH achieved a maximum protein content of 82.75%. Additionally, the pH and viscosity levels were 4.94 and 3.95 cP, respectively, meeting standard requirements. Furthermore, the gel strength of sea chicken skin gelatine extracted from all treatments is higher than commercial gelatine, suggesting its potential suitability for various food-related applications. Specifically, HCl at 0.20M exhibits the highest gel strength of 0.5583 N.

Keywords: Acid treatment, *Canthidermis maculata*, Cost-effectiveness, Extraction yield, Fish gelatine

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Improvement of Set-Yoghurt Quality by Incorporating Chitooligosaccharides Derived from Crustacean Shell Waste

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Chitin is an abundant natural polysaccharide and chitosan is its most important derivative. The water insolubilities of chitin and chitosan limit their applications in many industries. The physical, chemical or enzymatic depolymerization of chitin and chitosan deliver chitooligosaccharides (COS) which are water-soluble and exhibit superior properties compared to the parent polymers. This study mainly focused to improve quality of set-yoghurt by incorporating COS derived from crustacean shell waste. Chitin was isolated from shell waste of *Portunus pelagicus* (Blue swimming crab), *Litopenaeus vannamei* (White leg shrimp) and *Penaeus monodon* (Black tiger prawn) by sequential chemical treatments. Chitosan and COS were prepared by deacetylation and chemical hydrolysis, respectively. The synthesized compounds were characterized by Fourier transform infrared spectroscopy (FTIR). Thermal properties of the synthesized compounds were studied by thermogravimetric analysis (TGA) and their surface morphologies were examined by scanning electron microscopy (SEM). Properties of set-yoghurt incorporated with COS derived from *Penaeus monodon*, which had the highest yield were studied by adding it in set-yoghurt with two concentrations (0.05w/v and 0.1w/v). Total bacteria, yeast and mold counts were determined. The chitin yields of crab, shrimp and prawn were 15.70±0.26%, 21.46±0.23% and 19.79±0.10%, respectively. The chitosan yields of crab, shrimp and prawn were 13.17±0.12%; 18.99±0.25% and 15.31±0.12%, respectively. The COS yields of crab, shrimp and prawn were 1.34±0.16%, 3.18±0.22% and 4.027±0.14%, respectively according to the initial dry weights of shells. The microbial analysis of set yogurt over a 5-day period revealed a significant difference ($P<0.05$) in levels of yeast and mold, while there was no significant difference ($P>0.05$) in total plate count. The yogurt containing 0.1% (v/w) COS demonstrated the lowest count of yeast and mold compared to the other samples. This indicates that incorporating COS may have a positive impact on the inhibition of yeast and mold growth in yogurt, thus showcasing its potential as a natural preservative in dairy products. Further examination into the antimicrobial properties of COS while yogurt production has the potential to provide valuable insights for enhancing the quality and shelf life of the product.

Keywords: Chitooligosaccharide, Chitosan, Crustacean, Yeast and mold count

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Investigation of Functional Properties of Jackfruit Seed Flour and Development of a Jackfruit Seed Flour-Based Snack

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Deep-fried snacks are high-demand foods among consumers. But it contains a high amount of calories and fat. Jackfruit seeds are rich in nutrients and contains substantial amount of carbohydrates, proteins, and low-fat. Therefore, it is important to process seeds into flour and use it to produce convenient food products. This study was conducted to investigate the functional properties of jackfruit seed flour and to develop a jackfruit seed flour-based snack. Jackfruit flour was prepared using three different methods, roasting, oven drying, and boiling. Boiled jackfruit seed flour contained the highest moisture content (7.04%), water-holding capacity (2.08 g/g), bulk density (0.81 g/cm^3), oil-holding capacity (2.04 cm^3/g), swelling power (6.91%), and the lowest solubility (7.69%). Roasted jackfruit seed flour showed the lowest oil-holding capacity (1.84 cm^3/g). Flour mixture was prepared using jackfruit seed flour: rice flour: wheat flour with a 4:1:1 ratio and snack was produced using extrusion technology. The frying time for the snacks prepared using roasted, boiled, and oven-dried jackfruit seed flour was 15, 17 and 10 seconds, respectively. Boiled jackfruit seed flour-based snacks obtained the highest consumer acceptability. Proximate analysis showed that the boiled jackfruit seed flour-based snack contained, 83.61% carbohydrate, 4.74% moisture, 6.46% fat, 2.90% ash, 1.70% fiber, and 0.59% protein. In conclusion, it was evident that jackfruit seed flour has the potential to produce a low-fat, nutritious snack as a value-added product.

Keywords: Deep-frying, Flour based-snacks, Jackfruit seed

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Isolation, Identification, and Characterization of Probiotic Lactic Acid Bacteria from a Traditionally Fermented Rice-Based Culture Suitable to be Used in Fermented Dairy Products and Livestock Production

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Probiotic lactic acid bacteria (LAB) are commonly used in fermented dairy products and also as feed additives for livestock. The potential of fermented rice as a probiotic carrier should be assessed in order to determine its potential use as an alternative to conventional probiotic carriers. Hence, the objective of the current study was to isolate, identify, and characterise potential probiotic LAB strains from traditionally fermented rice-based cultures. Primary isolation of LAB was performed using four culture preparations on De Man-Rogosa-Sharpe agar and *Bifidobacterium* agar. Presumptive isolates were first characterised at the genus level by Gram staining, catalase assay, endospore staining, and motility tests. Purified DNA samples of presumptive LAB were submitted for 16S rRNA gene sequencing. Biochemical characterisation was performed by evaluating hydrogen sulfide (H_2S) production, glucose fermentation, temperature tolerance, and NaCl tolerance. Probiotic properties were investigated using antibiotic sensitivity, antimicrobial properties, bile tolerance, and milk coagulation ability. Preliminary phenotypic tests identified 48 isolates, all of which did not produce H_2S and demonstrated a homofermentative sugar utilisation pattern with glucose. A majority of the isolates (71%) showed a detectable growth at 15 °C and 45 °C, and the tolerance to NaCl concentrations of up to 6.5%. With respect to probiotic potential, it was found that the isolates were sensitive to widely used therapeutic antibiotics and showed good antimicrobial activity against *Staphylococcus aureus*, *Escherichia coli*, *Salmonella enteritidis*, and *Candida glabrata*. The isolates also displayed bile tolerance up to 0.3% (w/v) and milk coagulation ability. In conclusion, the majority of LAB isolated from fermented rice-based cultures demonstrated promising results for major probiotic properties which will enable their use in fermented milk products and other livestock production activities. Further studies are recommended to confirm their probiotic properties through *in vivo* trials.

Keywords: 16S rRNA sequencing, Biochemical characterization, Fermented rice, Lactic acid bacteria, Probiotics

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Microbial Dynamics along the Milk Value Chain in Banduragoda Veterinary Region: Identifying Critical Stage for Spoilage Prevention and Quality Enhancement

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Milk spoilage and low-quality milk are significant concerns in developing countries like Sri Lanka. This study aimed to assess bacterial loads in milk, measured via total bacterial count (TBC), across four key segments of the dairy value chain (primary producers, milk collection point (MCP), milk chilling center (MCC) and processing factory) in the Banduragoda veterinary region of Gampaha district. A total of 88 raw milk samples representing 22 from each segment were collected. Laboratory analyses included assessment of microbiological quality and keeping quality (KQ), along with pH and temperature measurements. Statistical analysis was done using Minitab19 software. Results revealed varying TBC values across the four segments of value chain: primary producers ($4.38\pm1.42\times10^5$ cfu/ml), milk collection point ($11.24\pm4.65\times10^5$ cfu/ml), milk chilling center ($94.60\pm21.40\times10^5$ cfu/ml), and processing plant ($113.70\pm14.40\times10^5$ cfu/ml). Significant negative linear relationships were observed between on-farm TBC and pH, while relationships between TBC and pH of MCC were weak and insignificant. MCP and processing plant segments of the value chain showed weak and insignificant positive linear relationships between TBC and pH. Relationships between TBC and temperature were weak and insignificant at on-farm and MCC segments, moderate and insignificant at the MCP segments, and very weak and insignificant at the processing plant segment.

Keywords: Dairy value chain, Milk quality, Milk spoilage, Raw milk, Total bacterial count

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Micro-Screw Press Extraction of *Terminalia catappa* L. Fruit's Kernel: Analysis of Oil and the Defatted Residue

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Terminalia catappa L. (TC) is an underutilized species in Sri Lanka. This study aims to extract oils from TC kernels using a micro-screw press extractor and analyze oil and the defatted residue, to compare compositional differences between purple and yellow cultivars. The extracted oils were analyzed for oil yield, color, saponification and iodine value, fatty acid profiles, melting and cloud point, followed by Fourier transform infrared spectroscopic (FTIR) analysis. The defatted residue remaining after oil extraction underwent proximate composition analysis and sequential extraction with hexane, dichloromethane, and methanol. The crude extracts were then assessed for total phenolic content, total flavonoid content, ferric-reducing antioxidant power (FRAP), and DPPH radical scavenging activities using *in vitro* assays. Both cultivars exhibited palmitic acid as the predominant fatty acid, followed by oleic acid and linoleic acid, displaying notable compositional variations between them, with higher overall unsaturated fatty acid content. Melting points of TC purple and yellow were 15.62 °C and 15.11 °C, respectively, with cloud points at 2.39 °C and 2.10 °C, suggesting solidification in refrigerated conditions. FTIR spectral results showed that the spectral bands for both TC cultivars were indicative of the same organic functional groups: hydroxyl, alkenes, alkanes, esters, aromatic ethers, and hydrocarbons. Defatted TC purple exhibited 62.1% protein, while TC yellow displayed a significantly (p<0.05) higher content of 70.0%. TC Yellow methanol extract showed the highest phenolic content (10.81±0.26 mg GAE/g) and DPPH radical scavenging activity (IC_{50}: 177.23±10.14 ppm). Hexane extract of TC Yellow displayed the highest flavonoid content (49.23±2.65 mg CE/g). TC Purple methanol extract exhibited the highest FRAP value (0.40±0.02 mmol $FeSO_4$/g). Inter-varietal differences were evident in both oil and residue. The protein-rich residue holds promise for diverse dietary applications, and although its antioxidant activity is lower than ascorbic acid, it suggests potential for functional foods.

Keywords: *Terminalia catappa*, micro-screw press extraction, compositional differences, antioxidant activity, protein-rich residue
This research was supported by the National Institute of Fundamental Studies, Hanthana Road, Kandy.

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Nutritional, Antioxidant, Antidiabetic and Anti-obesity Properties of Four Edible Seaweed Species in Sri Lanka

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Recent studies have revealed that seaweed exhibit strong antioxidant properties against the free radicals produced during metabolism in human. Consequently, health related problems such as diabetes, obesity and malfunctioning of metabolism can be lowered by seaweeds. This study was conducted to evaluate nutritional, antioxidant, antidiabetic and anti-obesity properties of four seaweed species in Sri Lanka: *Sargassum wightti*, *Sargassum fluitans*, *Glacilaria corticata* and *Turbinaria ornata*. These properties were tested in undigested seaweed extracts and in the bio-available fraction of *in vitro* digested seaweed samples. Undigested seaweed extracts were prepared using three different solvents: 100% distilled water; 100% ethanol: distilled water in 3:2 ratio and 100% ethanol: distilled water in 7:3 ratio. In addition, seaweeds were digested *in vitro* to obtain the bioavailable fraction. Antioxidant activity of extracts and bioavailable fraction of seaweed were analyzed using DPPH (1, 1-diphenyl-2-picrylhydrazyl assay), ABTS [2, 2'-azinobis (3-ethylbenzothiazoline-6-sulphonic acid assay), FRAP (Ferric ion reducing antioxidant power assay), ORAC (Oxygen radical absorption capacity assay), total phenolic content (TPC) and total flavonoid content (TFC). Antidiabetic and anti-obesity potentials were measured using alpha amylase inhibition and lipase inhibition assays, respectively. The heavy metal and trace element contents were measured by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). The TPC, ABTS, DPPH values in bioavailable fractions were not significantly different among the four species. *T. ornata* had the highest ($P<0.05$) FRAP value (1.01±0.02 µmol Fe^{2+} equivalent/g), whereas *S. wightti* showed the highest ($P<0.05$) ORAC values (7.99±0.11µmol TE/g). In both extractions and bioavailable fractions, antidiabetic potential was higher ($P<0.05$) than anti-obesity potential. The extractions of *G. corticata* (26.85 ±0.62 mg/mL) and *T. ornata* (25.49±1.10 mg/mL) had higher ($P<0.05$) anti-obesity activity than other species. All four-seaweed had high amounts of trace elements, and Pb and Cd values exceeded the Codex Alimentarius safe levels, hence cultivation of seaweed under controlled seawater conditions is recommended. In conclusion, four selected seaweed species contain higher antioxidant, antidiabetic and anti-obesity activities.

Keywords: Antidiabetic, Anti-obesity, Antioxidants, *In vitro* digestion, Seaweed, Trace elements

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Optimizing Processing Parameters for Young Jackfruit: A Scientific Exploration of Blanching, Dehydration and Rehydration Conditions

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Across much of Asia, Jackfruit (*Artocarpus heterophyllus* Lam.) is a widely cultivated staple food. When the fruit reaches a size of 15-20 cm, it is classified as a young jackfruit. As a seasonal crop, it produces a bountiful harvest during its season, but due to its short shelf life, a significant amount of the crop goes to waste. To mitigate this, the study aimed to optimize the blanching, dehydration, and rehydration parameters of young jackfruit for preservation purposes. Based on the results of the peroxidase test, the optimal hot water (95 °C) blanching time was 15 min. After blanching, the samples were subjected to hot air drying at three different temperatures: 50, 60 and 70 °C. Three time-temperature combinations were selected based on the reference moisture content of 8% (w.b.), and the best combination was chosen after conducting colour analysis and considering the least amount of time required for drying. The selected optimal time-temperature combination was 60 °C for 4 h. Results showed no significant differences ($P>0.05$) in volume and shrinkage for three drying different time-temperature combinations. Rehydration experiments were conducted at three different temperatures; 30, 40 and 50 ℃. The best result was obtained at 50 ℃ for 90 min, as it required the least amount of time and had the highest constant rehydration ratio. The final product had 83.8% volume recovery when compared to fresh young jackfruit. Based on the results of the sensory test, the process optimized sample of young jackfruit had a higher level of consumer acceptability. This study revealed that the optimized processing conditions for young jackfruit have the potential to be used as a convenient market product that could help to improve food security in Sri Lankan communities.

Keywords: Blanching, Dehydration, Rehydration, Young jackfruit

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Physicochemical and Nutritional Analysis of Selected Local Yam Species for Evaluating the Potential as Thickening Agent for Soup Mixtures

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This study assessed the physicochemical and nutritional characteristics of local yam species, namely *Dioscorea alata* (*Yapane dam ala*, *Raja ala* and *Ini ala*), *Xanthosoma sagittifolium* (*Kiri ala*) and *Ipomoea batatas* (sweet potato) with a focus on their starches as potential soup thickeners. The tubers, their respective flours and starches (extracted using water) were subjected to analysis. Starch samples were incorporated separately into a mushroom soup as a thickener, and preference for different soup mixtures was evaluated. Yam tubers showed varying moisture, ash content and antioxidant activity. Proximate compositions of flours differed significantly ($P<0.05$) with *Yapane dam ala* and *Ini ala* having significantly higher ($P<0.05$) protein contents. The tap, loose and true densities of flour were highest in *Raja ala* and lowest in *Ini ala*. Water activity was highest in *Kiri ala* flour and lowest in *Ini ala* flour which was found with the highest oil holding capacity. The swelling power was highest in *Yapane dam ala* flour and the lowest in *Ini ala* flour. In starches, water holding capacity was highest in *Ini ala* and lowest in sweet potato and *Kiri ala*. No significant difference ($P>0.05$) for swelling power was observed among the tested starch types. The solubility index of *Ini ala* starch was the highest. Sweet potato starch had the lowest amylose content. Among the soup mixtures, there was no significant difference ($P>0.05$) for the preference of color and aroma while preference for texture and taste were significantly different ($P<0.05$) in which the soup containing sweet potato starch had the highest preference followed by *Kiri ala* and the control (corn starch). The control had the highest overall preference which was followed by soup containing *Kiri ala* and sweet potato respectively. Conclusively, *Kiri ala* and sweet potato starches have a high potential to be used as thickeners in soup mixtures.

Keywords: Flour, Local yam, Physicochemical properties, Starch, Thickening agent

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Prebiotic Potential of Milk Residues from Coconut (*Cocos nucifera* L.) and Soybean (*Glycine max*) on the Growth and Survivability of a Microbial Starter Culture with Probiotic Properties

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Coconut residue (CR) and soybean residue (SB) are major by-products resulting from processing of coconut milk and soy milk respectively. This research aimed to evaluate the prebiotic potential of the above residues and to develop a fermented synbiotics base matrix using the residues. The CR and SB were obtained by extracting milk under laboratory conditions. The CR and SB residues were mixed separately with cow milk according to three different ratios (1%, 3%, and 5%) to develop fermented synbiotics base matrixes. Fermented synbiotics base matrixes were analysed for pH, Titratable acidity (TA), and microbial counts. Finally, a fermented synbiotics base matrix was selected from each residue and the time taken to reach 4.5 pH and microbial counts were determined. Microbial starter culture comprised of *Streptococcus thermophilus* and *Lactobacillus bulgaricus* was used as prebiotic starter culture. Both residues and fermented synbiotics base matrixes developed from residues were compared with cow milk as a control. Colony counts of cow milk, CR, and SB were 1.7E+10 ± 0.00 CFU/g, 7.95E+ 07 ± 2.00E +07 CFU/g, and 1.2E+10 ± 0.28E +10 CFU/g respectively. The highest colony counts of fermented synbiotics base matrixes of CR were obtained in 5% CR treatment (4.35E+10 ±0.21E+10 CFU/g). The highest colony counts (5.2E+09 ± 1.98E +09 CFU/g) of fermented synbiotics base SB matrixes were obtained by adding 5% SB. Selected fermented synbiotics base matrixes were 3% SB and 5% CR. Both took 4 hours to reach 4.5 pH. Final colony counts of 3% SB and 5% CR showed higher values 1.65E+11 ± 0.35E+11 CFU/g, 5.4E+10 ± 0.14E+09 CFU/g respectively, than initial colony counts. The above results confirm that by-product residues from CR and SB, considered industrial waste, exhibit prebiotic potential and can be utilised to develop a fermented synbiotics base matrix.

Keywords: Coconut Residues, Fermented synbiotics base matrix, Prebiotic potential, Prebiotic starter culture, Soybean Residues

This research was supported by Industrial Technology Institute of Sri Lanka

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Present Status of Postharvest Practices of Vegetables in Anuradhapura District

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Vegetables play a crucial role in Sri Lankan food system, significantly contributing to the country's economy, food security, and overall well-being. Vegetables are perishable agricultural commodities. Improper postharvest practices cause qualitative, quantitative, and economic losses. In Sri Lanka, postharvest losses of vegetables are estimated to be 20-40%. Therefore, it is essential to study the present status of postharvest practices for vegetables to identify the underlying problems and improve the vegetable supply chain more efficiently. The study was conducted by collecting information from the farmers, collectors, transporters, wholesalers, and retailers using a semi-structured questionnaire as an indirect measure of postharvest loss. The total sample size was 115. Farmers were randomly selected from 4 divisional secretariats in Anuradhapura district. Similarly, other stakeholders were selected randomly. According to the study, 60% of the vegetable farmers in Anuradhapura district are small-scale producers. The most cultivated vegetables during 2022/23 were pumpkin, chili, and brinjal. Almost all farmers (98%) followed the recommended harvesting times. Most farmers sold their produce to wholesalers and most transporters transported vegetables during the early morning hours. Most of the stakeholders graded their commodities before selling mainly based on the size. The types of vehicles used by stakeholders are significantly ($P<0.05$) different. Open trucks and closed trucks were used by most of the stakeholders. There was a significant ($P<0.05$) difference among stakeholders for the usage of packaging materials. Farmers largely used poly-sacks. Most of the stakeholders used wooden boxes for packing tomatoes while cardboard boxes for bitter gourd. Most of the stakeholders were aversive of using plastic crates because of their high initial cost, high transportation cost, and inconvenience in handling. Most vegetables are sold through the normal supply chain, while only a small percentage goes to supermarkets. The study suggests conducting training programs for safe postharvest handling, transportation, and packaging is essential. Further, promoting plastic crate usage and making it mandatory by law is yet to be achieved.

Keywords: Postharvest losses, Postharvest technologies, Stakeholders, Supply chain, Vegetables

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Process Optimization to Extract Essential Oil and Oleoresin from the Different Grades of [*Cinnamomum zeylanicum* Blume] Cinnamon Bark and Screening of Antioxidant Activity, Essential Oil Composition and Potential to New Product Development

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Sri Lankan cinnamon, also known as true cinnamon (*Cinnamomum zeylanicum* Blume), is known to be the best cinnamon in the world. This study was conducted to optimize the extraction process of essential oil and oleoresin from the nine grades of true cinnamon bark. The effects of extraction time, temperature, particle size, and the chemical composition of the resulting essential oil were analyzed. The BP-Boosy grade yielded the highest content (95.39±0.29%), making it the most viable grade for large-scale processing. The highest essential oil yield of the BP-Boosy grade (1.38±0.01 ml/g) was achieved at 100°C and 4 h of extraction. While, grades H2 (2.36±0.18%), H3 (2.30±0.07%), and Special (2.36±0.12%) exhibited the highest oil contents. Moreover, the BP-Boosy (1.36±0.03%) grade was the most strategic choice due to its lower raw material cost among all the grades. The highest cinnamaldehyde content was observed in H3 (72.31±0.30%), C5 (65.38±0.42%), and H1(67.57±0.36%) grades respectively. The highest eugenol content (5.272±0.021%) was in the H3 grade and the highest linalool content (2.63±0.002%) was in the BP-Boosy grade. The Special grade had the highest cinnamyl acetate content (3.37±0.02%), and M4 (0.61±0.0023%), C4 (0.62±0.002%), and C5 (0.62±0.01%) grades possessed the highest safrole content. In addition, the BP-Boosy grade had the highest antioxidant activity. This study recognized BP-Boosy grade as the most profitable and strategically sound option for the large-scale production of essential oil, due to its high oleoresin yield, lower production cost, and favorable chemical profile.

Keywords: Cinnamaldehyde, *Cinnamomum zeylanicum* Blume, Essential oil, Eugenol, Oleoresin

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Production of Peanut Butter and Determination of Emulsion Stability Using Xanthan Gum, Guar Gum, Soy Lecithin and a Commercial Stabilizer Blend

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Oil separation of the peanut butter is a major problem in the market shelf. The stabilizers and emulsifiers are incorporated to prevent oil separation. The objective of this study was to evaluate the effects of different stabilizers/emulsifiers on oil separation of the peanut butter. Four types of stabilizers/ emulsifiers are incorporated into the peanut butter sample to evaluate oil separation and effect of other physicochemical parameters. Oil separation percentage, moisture content, proximate analysis, acid value, peroxide value, viscosity, colour, total soluble solid (TSS), and pH were the physicochemical parameters which were used to evaluate different types of peanut butter formulations. The samples were stored at room temperature for further analysis. Organoleptic acceptance of five peanut butter formulations were tested using nine-point hedonic test. Roasting time-temperature combination for peanut butter preparation was selected by conducting hedonic test. Proximate analysis was conducted for each five formulations and four treatment groups were compared with control sample. Percentage of crude protein was significant ($P<0.05$) in each sample. Accelerated oil separation and real-time oil separation of stabilizer/emulsifier treated formulations were significantly different from the control level mean ($P<0.05$). Real-time oil separation percentage of Palsgaard® oil binder 01 treated peanut butter sample was zero. Viscosity of only the guar gum treated peanut butter formulation was significant compared to the control. pH, TSS, Colour, acid value and peroxide value was significantly affected by stabilizer/emulsifier type ($P<0.05$) but changed with the time. Preference of colour, odor, taste and overall acceptability of five formulations were not significantly different ($P>0.05$) but texture was significantly affected ($P<0.05$). In conclusion, the peanut butter formulation treated with guar gum obtained highest consumer preference for its sensory attributes, while the product treated with Palsgaard® oil binder 01 exhibited the lowest oil separation and received positive consumer acceptance.

Keywords: Emulsifiers, Oil Separation, Peanut Butter, Physicochemical Parameters, Stabilizers

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Selected Bioactivities and Sensory Characteristics in Tea Infusions of Peels from Bael Fruit, Wood Apple, June Plum and Sour Orange

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Fruit peels are reported to be rich in many bioactive compounds. This research aimed to assess phenolic contents, potential antioxidant activities, and antihyperglycemic properties of tea infusions formulated using peels of selected underutilized fruits including bael fruit (*Aegle marmelos*), wood apple (*Limonia acidissima*), june plum (*Spondias dulcis*), and sour orange (*Citrus aurantium*). The dried fruit peel powders were mixed with either black or green tea to prepare tea bags (2 g). Next, tea bags were brewed for 3 minutes in 200 ml hot water to prepare infusion. Sensory studies were employed to identify the consumer-preferred tea formulations. The highest total phenolic content (TPC) (10.85 ± 0.09 mg, GAE/g in DW) and the highest total flavonoid content (TFC) (9.39± 0.10 mg CE/g in DW) were found in bael fruit peels, among all the tested fruit peels. Among all the infused tea formulations, 0.5:1.5, bael fruit peel:green tea formulation exhibited the highest TPC and TFC. The highest antioxidant activity in DPPH radical scavenging property (1.93 ± 0.01 mg TE/g in DW) was also found in bael fruit peels, among all the tested fruit peels. The highest antioxidant activity (4.36 ± 0.01 mg TE/g in DW) in terms of DPPH radical scavenging property was found in the formulation 0.5:1.5, bael fruit peel:green tea. However, the highest antioxidant activity based on the ferric reducing power was found in 1:1, fruit:green tea formulations of both bael and wood apple peels. Moreover, 1:1 bael fruit peel:black tea formulation exhibited the highest α-amylase inhibitory activity (14.59 ± 0.06 mg/g). This study confirms that, mixing fruit peel powders with black or green tea improves the functional and sensory properties of tea. More importantly, bael fruit peel powder is the best candidate to formulate tea infusions with improved functional properties and with accepted consumer preferences among the tested fruit peels.

Keywords: Antihyperglycemic property, Antioxidant activity, Bioactivity, Fruit peel tea infusion, Phenolic content

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Strategic Acidity Regulation Techniques to Mitigate Post-Acidification in Wood-Apple Fruit (*Limonia acidissima*) Drinking Yoghurt

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Post-acidification poses a significant challenge in fruit-incorporated yogurt and yoghurt-based products, affecting their shelf-life and flavor profile. Current mitigation methods often are less effective and costly on an industrial scale. To address this issue, a study was carried out to investigate the effectiveness of using sodium bicarbonate as a cost-effective acidity regulator. Preliminary trials were conducted to determine the optimal incorporation level of sodium bicarbonate in wood-apple fruit yoghurt where 0.7% w/w (0.6995g/100g) wood-apple fruit pulp being identified as the most effective concentration. Sensory evaluation revealed a significantly high ($p<0.05$) preference for taste and overall acceptability in the sodium bicarbonate-treated drinking yoghurt compared to the control group. Over a 14-day refrigerated storage period, the treated sample exhibited significant differences in pH, titratable acidity, and moisture content compared to the control. This study highlights the efficacy of sodium bicarbonate, in combination with altered incubation time and rapid cooling methods, as an effective strategy for mitigating post-acidification in fruit-infused fermented milk products.

Keywords: Acidity regulator, Post-acidification, Rapid cooling, Sodium bicarbonate, Wood-apple Drinking yoghurt

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Study on the Development of Off-flavors and Off-odors in PET Bottled Drinking Water During Storage Using a Trained Sensory Panel

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This study aimed to investigate the impact of various storage conditions on the development of off-tastes and off-odors in Polyethylene Terephthalate plastic (PET) Bottled Drinking Water (PBDW) using a trained sensory panel. A multi-faceted approach was employed, beginning with a general consumer survey to identify off-tastes and odours in bottled water. Based on the results of the survey, bottles were stored near to different items such as soap, incense sticks, dry fish, chlorine and mud and exposed to sunlight, over different time durations (3 days, 1 weeks, 2 weeks, 4 weeks, 8 weeks) in controlled conditions. A trained sensory panel was developed and used to identify off-tastes and odours in the stored PBDW. Panel performance and absence of significant differences among the panel members were proven statistically using one sample binomial test and chi square test, respectively. After 3 days of storage period, odours of incense stick, dry fish and soap were recognized in PBDW and only the soap taste was identified. The result after the first week of storage was similar to that of 3 days of storage. After 2 weeks, in addition to the 1st week of storage, off-tastes of incense sticks and dry fish were identified. Results were similar after 4 weeks of storage. Exposing the bottles for 8 weeks led to development of off tastes and odours of earthy musty and plastic as identified by the panelists. Neither chlorine taste nor odour was detected in PBDW during the study period. The study reveals that the storage conditions have a significant influence on the sensory quality of PBDW and guidelines for storing the PBDW were established based on the results.

Keywords: PET Bottled Drinking Water (PBDW), Off-taste, Off-odors, Trained sensory panel, Storage conditions.

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The Potential of Oyster Mushroom (*Pleurotus ostreatus*) and Chi ckpea (*Cicer arietinum L.*) as a Protein Source in Vegan Instant Soup Mix

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Instant soups are a popular choice for their convenience, but they are often criticized for their low nutritional value and potential adverse impact on human health. This study was conducted to develop a vegan instant soup mix using oyster mushrooms (*Pleurotus ostreatus*) and chickpeas (*Cicer arietinum L.*) as an alternative protein source that is more flavorful, nutritious, and convenient. Three instant soup mixes were formulated using different ratios of Oyster mushroom flour and chickpea flour (60% mushroom+12% chickpea; 48% mushroom+24% chickpea; 36% mushroom+36% chickpea). The formulations were subjected to physicochemical, microbiological, sensory, and proximate analysis with a commercially available mushroom soup mix as the control. There were no significant differences ($P>0.05$) in the pH values, total soluble solids, water absorption capacity, and oil absorption capacity among the mushroom-chickpea formulated soup mixture samples compared to the control. The solubility and viscosity of the instant soup formulations significantly increased ($P<0.05$) when the amount of chickpea flour was increased. The total aerobic plate count of all formulations was shown less than 10^4 CFU/g at 20 days of storage period. Preference ranking test indicated that instant soup formulation containing 48% Oyster mushroom flour and 24% chickpea flour provided a better overall preference and consumer acceptability than the other two formulations. Proximate analysis and hedonic test have shown that the formulation containing Oyster mushroom flour 48% and 24% chickpea flour contains higher crude protein content (26.89%), high ash content (2%), high fat content (18.41%), higher antioxidant activity (51.56%), and better consumer acceptability than the commercial soup mixture.

Keywords: Chickpea flour, Instant soup, Oyster mushroom flour

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Utilization of Cassava Starch as an Economically Viable Adjunct in Beer Production

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This research investigates the viability of utilizing cassava (*Manihot esculenta*) as an adjunct in beer manufacturing. Cassava, a starchy root crop widely cultivated in tropical regions, presents an attractive alternative to traditional adjuncts such as barley and wheat due to its abundance, low cost, and potential to withstand adverse environmental conditions. The study encompasses various aspects of the brewing process, including cassava processing methods, wort production, fermentation kinetics, and sensory evaluation of the resulting beers. Through a series of experiments, the impact of cassava adjuncts on key parameters such as fermentability, flavour profile (aroma, colour, taste, and mouthfeel) and the overall quality of the beer was examined. Results indicated that cassava can effectively contribute fermentable sugars to the wort, leading to successful fermentation and desirable sensory attributes in the finished product. Cassava-added beer samples had a significantly different ($p<0.05$) lighter colour and significantly different ($p<0.05$) higher ABV (Alcohol by volume) values compared to the control sample. Furthermore, economic and environmental considerations associated with cassava utilization are discussed, highlighting its potential as a sustainable adjunct for beer manufacturing. This research provides valuable insights into diversifying raw materials in brewing and offers opportunities for enhancing the economic viability and sustainability of the beer industry.

Keywords: Cassava, Fermentation, Beer

This research was supported by HJS Condiment Limited.

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Utilization of Eggshell Waste as the Calcium Source in Calcium-Fortified Rusks

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The food industry produces a significant amount of eggshell waste during processing, creating an opportunity for value addition. Converting eggshells to powder may provide a food-grade source of calcium carbonate. This study aimed to reduce waste and lower production costs of calcium-fortified rusks by producing food-grade eggshell powder. Eight formulations of eggshell powder were prepared, with membrane (WM) or without membrane (NM), to match the properties of commercially available calcium carbonate (CACC). Four rusk formulations were created by changing the eggshell calcium source. All the eggshell powder samples were tested for microbiological safety. A powder sample of 40 µm without an eggshell membrane was prepared through sieving (NM-40). It was selected as the best sample based on purity, particle size, and yield. The NM-40 sample purity, moisture content, bulk density, whiteness index, and mean particle size were 98.67±0.58%, 1.56±0.04%, 0.80±0.02 g/ml, 95.48±0.76, and 16.8 µm respectively. Rusk samples were prepared by incorporating different proportions of eggshell powder samples. The selected rusk sample contained 1.5 g of NM-40 eggshell powder and other ingredients (ESP-2). It was not significantly different ($P>0.05$) from the control rusk prepared by incorporating 1.5 g of CACC powder (CCR). The calcium content and moisture content of the ESP-2 sample were 67.37±1.01 mg/100 g and 2.83±0.13% respectively. The hardness, length, breadth, thickness, weight, chroma value, and hue angle of the ESP-2 sample were 12.24±2.31 N, 4.12±0.15 cm, 3.25±0.20 cm, 1.16±0.12 cm, 7.69±0.13 g, 28.96±0.68, and 75.64±0.67 respectively. The results of the triangle test suggested that there was no significant difference ($P>0.05$) between the ESP-2 and the CCR samples. Based on physicochemical, microbial, and sensory properties, it can be concluded that NM-40 eggshell powder can be used as a cost-effective alternative to CACC powder.

Key words: Egg shell, Particle size, Powder, Sieving

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Value Addition to Industrial By-products: Development of a Bovine Collagen Fortified Functional Fermented Whey Dairy Beverage

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Value addition to whey can be considered as one of the sustainable utilization of industrial by-products. Fortification of collagen into dairy beverages could provide recommended daily intake of proteins and other potential health benefits. Main purpose of this study was to develop a fermented whey-based collagen incorporated dairy beverage for effective value addition for industrial by-products. In the current study, the preparation of five treatment combinations with different concentrations of whey (0%, 80%, 70%, 60% and 50% w/w) and collagen (0%, 1.25%, 1.5%, 1.75% and 2% w/w) were carried out. The best ratio of whey and collagen preparation were selected by conducting sensory evaluations and further evaluated for physicochemical properties including pH, colour, titratable acidity, total soluble solid content and viscosity. The product was subjected to different physicochemical analyses at 0 day, 3 days, 7 days, 11 days and 14 days of storage at 5±1°C. The compositional analyses revealed that 70% whey and 1.5% collagen incorporated beverage had 18.67±0.21% dry matter, 0.01±0.00% crude fat, 2.59±0.08% crude protein, and 15.42±0.32% nitrogen free extract. Dairy beverage also had 301.96 ± 6.74 KJ per 100g of gross energy. The total lactic acid bacterial counts (7.06±0.39 log CFU/mL) were not less than the minimum acceptable limits (7 log CFU/mL) up to the date of expiry stated by the Sri Lankan Standards Institute at 9 days storage at 5±1°C. The viscosity and titratable acidity were the highest and pH and colour were the lowest at 14th day of storage period ($P<0.05$). Therefore, shelf life of the final dairy beverage was estimated as 9-11 days under 5±1°C without added preservatives. The results of this study revealed that 70% (w/w) whey and 1.5% (w/w) collagen incorporated fermented value-added dairy beverage can serve as an innovative and newly emerged functional drink.

Keywords: Collagen, Physiochemical properties, Proximate composition, Sensory evaluation, Whey

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Verification of a HPLC Method for Quantification of Total Catechins in Green Tea and Assessing Geographical Variations in Total Catechin Content

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The methodological accuracy of quantifying catechins in green tea, is pivotal. The Sri Lanka Tea Board lacks catechin testing services, underlining the necessity for verification of the method of High-Performance Liquid Chromatography (HPLC) method for quantifying total catechins (ISO 14502-2) before adoption. This study focused on the verification of an HPLC method of quantifying total catechins in green tea and assessing geographical variations in total catechin content. The HPLC instrument parameters, encompassing flow rate, mobile phase gradient program, and detection wavelength, were precisely configured. Performance parameters such as linearity, accuracy, limit of detection (LOD), limit of quantification (LOQ), specificity, repeatability, and reproducibility were evaluated. The calibration curves were linear in the ranges between 50 ppm to 175 ppm, showing correlation coefficients (R^2) of more than 0.997. The accuracy based on relative spike recovery was 112.3%. LOD and LOQ were 0.025 and 0.080 respectively. The retention time of caffeine, gallic acid and seven catechins were identified under selectivity. The repeatability limit (r) and reproducibility limit (R) were 0.90 and 1.74 respectively, which were not 5% greater than the respective values of 1.21 and 3.71 identified in the ISO 14502-2 method. Total catechin content of green tea were 8.95±1.28% and 7.44±1.57% respectively for high and mid-elevation, on a dry matter basis, with a significant ($P<0.05$) difference. The percentage distribution of catechins followed a consistent trend across the two elevations as catechin < epicatechin gallate < epicatechin < epigallocatechin gallate < epigallocatechin. In conclusion, the HPLC method of quantifying the total catechin content of green tea at the Sri Lanka Tea Board was successfully verified and the catechin content of green tea was found to be higher in tea from high elevations.

Keywords: Caffeine, Catechins, Geographical variation, Green tea, Verification

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Community, Environment and Management

Achieving Carbon Neutral of a Selected Textile Industry: Using Homegarden Agroforestry Systems

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Global warming has been recognized as one of the world's most significant environmental issues in the twenty-first century and it is mostly due to anthropogenic activities. Accessing carbon footprints (CFP) of all contributing sectors are important to identify the emission sources, levels and their impacts and to implement strategies for mitigation. Therefore, this study was conducted to assess the CFP of MAS Intimates – Casualline, garment factory located at Mawathagama in the Kurunegala District and to study the potential of carbon sequestration (CS) of employees' homegardens to study the possibility of achieving carbon neutrality. After defining organizational and operational boundaries, all emission sources and activities were identified under three scopes. The CFP of each emission source and activity was calculated by multiplying activity data with relevant emission factors (EF). Results showed that the total CFP of the factory is 3209.93 tCO_2-e/year. The average CFP per employee in the factory is 1.07 tCO_2-e/year. Indirect emissions account for the highest portion of total CFP, (52%), followed by other indirect emissions, (47%), and direct emissions account (1%) of the total CFP. Fifty homegardens were selected randomly and CS per each homegarden was assessed separately. Homegardens were categorized based on the land extent and existing carbon stocks of each homegarden was calculated. Homegardens with the optimum carbon stocks for a given land extent category is considered as the CS enrichment potential and the total CS was calculated. Results revealed that the CS enrichment potentials in tCO_2e/year in the land extent categories of < 20 perch, 20 – 40 perch, 40 – 80 perch, 80 – 160 perch, and > 160 perch were 69.9, 839.7, 41.3, 163.8, 41.8, respectively. Assuming that 50% of total employees of 3000 represent the same land extent distribution pattern, the total CS enrichment potential is 34,695 tCO_2e/year. Thus, the MAS intimates - Casualline can utilize the proposed CS enrichment strategy to achieve the goal of becoming a carbon-neutral organization.

Keywords: Carbon footprint, Carbon neutrality, Carbon sequestration, Global warming, Homegarden

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Adaptation to Climate Change by Coastal Fishermen in Galle District, Sri Lanka

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Weather and climate changes are recognized as major threats to human society. The effects of climate change are felt most strongly by ecological systems, human settlements, agriculture, fisheries, and water resources. The Global Climate Risk Index has place Sri Lanka among the top ten countries in the world at risk of extreme weather events, emphasizing its significant vulnerability to climate change. This study focused on identifying the adaptation to climate change by coastal fisheries sector. Twelve climate change adaptation strategies identified for the fisheries sector were evaluated on tick options from a list of strategies to identify the level of adaptation by the respondents. A sample of one hundred thirty three fulltime coastal fishermen from three categories of boats were selected through stratified random sampling. A pre-tested questionnaire survey was conducted to collect data. Quantitative data was analysed using IBM SPSS 19 software. According to the results of the study, all (100%) of the respondents have experienced changes in their fishing practices during last five years and the majority identified weather change as the reason for this change. On contrary to the scientific evidence, the majority (60%) of respondents believed that climate change is due to natural causes. Almost all (98%) strongly believed that climate change issues are relevant to Sri Lanka and significantly impact the livelihood of the people. All (100%) respondents have experienced poor harvest of fish and low fish diversity due to climate change. Perception about climate change showed positive correlation with income ($r=0.002$, $p>0.005$), education level ($r=0.032$, $p<0.05$) and boat type ($r=0.000$, $p>0.001$). Perception was positively correlated with adaptation level ($r=0.000$, $p<0.01$). It is recommended to develop and rebuild landing sites properly, disseminate information on adaptation strategies, conduct a climate change awareness program, modify the boats, and prepare an institutional framework to mitigate effects of climate change.

Keywords: Adaptation, Awareness, Climate change, Perception

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An Investigation into The SME Holders' Intention to Adopt Sustainable Business Practices: A Study of the Manufacturing SME Sector in Gampaha District of Sri Lanka

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The rapid industrial development of the past century has led to widespread environmental and social consequences. There is a vital need for businesses to adopt sustainable business models, replacing conventional approaches with sustainable practices. The core philosophy of sustainable development centers around the triple bottom line (TBL), emphasizing equal consideration for environmental, social, and economic aspects in the development process. The aim of this study was to thoroughly examine the dynamics of sustainability in this context by analyzing the various aspects that influence decision making procedures based on theory of planned behaviour. However, this new practice has not been fully accepted and practiced by many SMEs. Further, studies related to integrating sustainability are also very rare in the literature. Therefore, this study was conducted to investigate the factors that directly and indirectly influence the SMEs holders' intention towards adopting sustainable business practices. The research design was a mixed method with a deductive approach. A sample randomly selected SMEs holders (n=85) were surveyed by a researcher administrated questionnaire. Structural Equation Model (SEM) was employed as the analytical method to test the hypotheses and the relationship between variables. It was found that SME holders' intention to adopt sustainable business practices has significant relationships with the subjective norms, target customer group, education level and age of responders. Younger managers are more conscious of these factors than older managers. Export-oriented SMEs have a higher intention than local SMEs. In conclusion, this study highlighted a few crucial elements that need to be prioritized when developing and growing sustainable business practices in Sri Lanka. Some recommendations for future research studies have also been given at the end of this paper.

Keywords: SMEs, environmental sustainability, Theory of planned behaviour, Structural equation modelling (SEM)

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Analysing Stock Market Efficiency: Sri Lanka in Comparison to Asian Frontier Markets

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This report investigates the presence of weak-form and strong-form efficiencies in the Colombo Stock Exchange (CSE), Karachi Stock Exchange (KSE), Dhaka Stock Exchange (DSE), and Hanoi Stock Exchange (HNX). The objective of the study is to compare the CSE with the rest of the Asian Frontier Market countries. Normality, stationarity, and volatility of each market have been analyzed. Descriptive Statistics were done using STATA version 15.0 software package and Augmented Dickey-Fuller test (ADF test), and the Generalized Autoregressive Conditional Heteroscedastic (GARCH) model were tested. Market efficiency has been compared in terms of returns, risk, and volatility. The analysis was done covering a period of January 2000 up to December 2023. Using the comparative tests, the results were not able to produce any extremists in one variable throughout the study period. In terms of the outcome returns, the order was inconsistent in showing weak and strong form hypotheses. The efficiency of markets in terms of return predictability does not follow a clear pattern. In terms of risk, the order is somewhat consistent, with HNX having the highest risk and DSE having the lowest risk. Risk results show that CSE is slightly efficient and developing risk management strategies might attract more investors and retain existing ones.

Keywords: ADF test, Colombo Stock Exchange, Efficiency Market Hypothesis, GARCH model, Risk management

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Assessing Nitrogen Dynamics at Bellankadawala Cascade during *Maha* Season: A Case Study at a Globally Important Agricultural Heritage System

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Nitrogen fertilizers applied to agricultural lands are lost through different ways causing surface and groundwater pollution. Nitrogen dynamics with fertilizer application during the major paddy growing season (*Maha*) in the Bellankadawala tank-based irrigation systems of the Palugaswewa cascade system in the dry zone which was declared as a Globally Important Agricultural Heritage System by the UNFAO were assessed. Spatial and temporal variations of surface and groundwater for pH, EC, nitrate (NO_3^-), ammonium (NH_4^+), total nitrogen (TN) status of major inlets connected to the Bellankadawala tank, within the tank and tank outlet, and agro-wells located within paddy fields and surrounding uplands were analyzed during the *Maha* season of 2023/24. Water samples were collected weekly from selected locations. Information on fertilizer usage in each land use of respective inlets and farmer's knowledge on nutrient management and its impacts, and willingness to rehabilitate tank cascade systems were also collected. Results showed a considerable temporal variation of NO_3^- from 0.228 mg/L to 12.114 mg/L, NH_4^+ from 0.584 mg/L to 8.24 mg/L and TN from 4.26 mg/L to 22.06 mg/L in inlet canals connected to the tank. Results further revealed a temporal variation showing peaks of NO_3^-, NH_4^+ and TN levels that coincide with the pattern of fertilizer application in inlet canals. There was no considerable variation in NO_3^-, NH_4^+ and TN in the tank water during the study period. The groundwater samples collected within the paddy fields showed higher NO_3^- concentration compared to the samples collected from upland fields closer to the paddy fields. Investigation of the fertilizer usage of farmers revealed that the majority of the farmers use lower rates than recommended. Awareness of the farming community about the impacts of overuse of fertilizers and role of components of traditional tank cascade were poor, however majority identified the need of tank rehabilitation.

Keywords: Bellankadawala cascade, Fertilizer usage, *Maha* season, Nitrogen dynamics, Water quality

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Assessment of the Distribution of Water Footprint Components in University Students for Water Saving in Hostels of the University of Peradeniya

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The global population experiences various undesirable health issues and mortalities due to the limitations in accessing healthy and safe drinking water. In addition to that, existing limited water resources are facing server challenges due to climate change and anthropogenic activities. Sri Lanka is rich in water resources, however due to natural i.e., climate change, and anthropogenic activities, such as water pollution and high-water demand due to population growth, the available water resources in Sri Lanka would be scarce in the future. In this context, calculation of water footprint is a commendable approach for sustainable water resources development and management. A study on the water consumption habits of the students at the University of Peradeniya was carried out by surveying the students staying in four hostels. Using the survey data, both direct and indirect water footprints were computed. The study indicated that female students exhibited a higher direct water footprint value of 3406 liters/ per person/month compared to male students. The average direct water footprint of the population was 3330 liters/per person/month by female students. In addition to that the water usage distribution among the students within their respective hostels with their monthly expenses was also studied and reported. Indirect water footprint components are also computed and documented. Finally, recommendations were given to reduce the direct water usage in the University.

Keywords: University students, Water consumption habits, Water footprint

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Behavioral Strategies to Minimize Losses: Impact of Information Provision and Nudging on Tomato Loss Reduction at Retail Environment

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Tomato, a widely consumed vegetable in Sri Lanka, faces losses that accounts for around 40% of its production along the supply chain. Despite efforts to reduce these losses, they persist, especially at the retailer level. This study aimed to quantify the extent of tomato losses in the Sri Lankan retail market, and to assess the impact of information provision and nudging on tomato loss reduction. This was accomplished through a social experiment conducted with 27 retailers in the Kandy district of Sri Lanka over a period of 14 days. The data were analyzed using descriptive statistics, t- tests, and regression analysis. During the quantification phase, it was identified that at the retailer stage, approximately 5% of total purchased tomatoes are lost daily per seller, resulting in an average daily monetary loss of LKR 472.75 per retailer when the average price of a kilogram of tomatoes is LKR 677.40. However, only 2% of the total purchased tomatoes were lost due to retailer mishandling. The rest were the unavoidable losses that are consequences of the actions of upstream supply chain actors. The results further revealed that providing retailers with information on effective practices and nudging through comparing their monetary loss to a benchmark, resulted in an overall reduction in tomato losses. Nevertheless, the response to this information varied among different retailers, implying that there are other factors that affect tomato losses at the retailer level and their adoption of good practices. When formulating food loss reduction strategies for supply chain actors, it is important to understand that their business objectives are not centered on minimizing food losses, but rather on mitigating monetary losses and improving customer retention. Therefore, it is crucial to emphasize the economic impact of these losses during interventions to motivate them to adopt the introduced strategies.

Keywords: Good practices, Monetary loss, Social experiment, Supply chain actors, Unavoidable losses

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Benefit-Cost Analysis and Sustainability of Rainforest Alliance Certification in Sri Lankan Upcountry Tea: A Comparative Study Between Certified and Non-Certified Estates

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Rainforest Alliance (RA) certification was introduced with the aim of ensuring sustainable agricultural practices that benefit both people and nature with respect to economic, environmental, and social sustainability. This comparative study is an attempt to determine the benefits and costs and sustainability of RA certification in upcountry tea estates of Sri Lanka. Primary data were collected from 60 divisions of tea estates including 36 divisions for RA certified and 24 divisions for non- RA certified. Purposive sampling technique was used to take respondent samples from RA certified and non-RA certified divisions from the sampling frame. Benefit-Cost ratio (BCR) was calculated using total benefit as total volume of production multiplied by average price and the total cost including farming, management, social and environmental costs of each division. The results showed as 1.672 for RA certified and 1.249 for non-RA certified divisions as an average. Multiple linear regression was estimated to identify the cost of factors which determine the Benefit-Cost ratio differences of each division. RA certified status, organic compost and pruning-plucking costs were the factors that had a positive significant ($P<0.05$) relationship with the BCR. Soil-water management costs, worker communication and inorganic fertilizer costs had a negative significant ($P<0.05$) relationship with the BCR. Another regression model was estimated to analyse the long-term sustainability of economic, social and environmental indexes which determine the BCR. Environment and social sustainability had a positive significant ($P<0.05$) relationship to the BCR of RA certified divisions and economic sustainability had no significant ($P<0.05$) relationship with the BCR. The findings suggest that RA certification in Sri Lankan tea estates positively influences social and environmental sustainability, although its direct impact on economic sustainability is less pronounced based on collected data.

Keywords: Benefit-Cost ratio, Multiple linear regression, Rainforest Alliance, Sustainability, Upcountry tea

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Comparative Screening of *In Vitro* Antidiabetic and Antioxidant Activities of Young Leaves and Flowers of Selected Sri Lankan Medicinal Plants

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Sri Lanka is renowned for its rich tradition of herbal medicine, and some plants have been used for centuries to manage diabetes and oxidative stress. This study investigated the antidiabetic and antioxidant properties of five Sri Lankan plants: young leaves of Jack (*Artocarpus heterophyllus* Lam.), Heen Bin-Kohomba (*Andrographis paniculata* (Burm.f.) Nees), Ivy gourd (*Coccinia grandis* (L.) Voigt), Cluster fig (*Ficus racemose* L.) and flowers of Aloe vera (*Aloe barbadensis* Mill.). total phenolic content (TPC) and total flavonoid content (TFC) were determined using standard TPC and TFC assays. Antioxidant activity was assessed by DPPH and FRAP assays, while alpha-amylase and alpha-glucosidase inhibition assays evaluated the antidiabetic potential. young Jack leaves exhibited the highest TPC (54.225±0.754 mg GAE/g) and TFC (18.3402±0.1384mg QE/g), suggesting strong antioxidant potential. Cluster fig displayed the highest FRAP value (23.836±1.133 mg TE/g). Jack and Ivy gourd young leaves extracts underwent further analysis. young leaves of Jack showed a lower IC_{50} value (236.636±0.44 ppm) in the DPPH assay compared to Ivy gourd (337.649±1.456 ppm), indicating superior free radical scavenging activity. Conversely, Ivy gourd leaves displayed the strongest alpha-amylase inhibition (IC_{50} = 9.145±0.0485 ppm), while Jackfruit leaves exhibited the strongest alpha-glucosidase inhibition (IC_{50} = 1.494±0.004 ppm). These findings suggest all five plants possess varying antidiabetic and antioxidant properties. Jackfruit leaves emerged as particularly promising, demonstrating the most potent free radical scavenging activity and glucosidase inhibition. Further research is needed to explore the mechanisms underlying these effects and validate their potential use for diabetes management.

Keywords: Antioxidant, Anti-diabetic, Herbal, Inhibition, Oxidative stress

This research was supported by Industrial Technology Institute of Sri Lanka.

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Consumer Attitude and Purchase Intention towards Organic Personal Care Products: An Application of the S-O-R Model

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There is a growing demand globally and domestically for organic personal care products driven by health and environmental consciousness. Hence, understanding these intricacies may be important for better targeting by the manufacturers to an already burgeoning market. Therefore, this study aims to identify the factors influencing consumer attitudes towards these products and investigate the impact of utilitarian and hedonic attitudes on the purchase intention of organic personal care products in the Kandy District of Sri Lanka. Adopting the Stimuli-Organism-Response (S-O-R) model, a comprehensive framework was developed to understand consumers' purchase decisions regarding organic personal care products. A cross-sectional survey methodology was employed, gathering data from 107 female consumers who use organic personal care products aged between 20 and 50. Structural Equation Modeling (SEM), specifically employing Partial Least Squares (PLS), was utilized for the data analysis using SmartPLS-4 statistical software. Results indicate that product knowledge and ecological welfare significantly positively influence both utilitarian and hedonic attitudes ($P<0.05$). Furthermore, product quality exhibits a significant positive impact on utilitarian attitude ($P<0.05$), while no significant influence is observed on hedonic attitude ($P>0.05$). Conversely, sensory appeal and product price did not significantly influence either utilitarian or hedonic attitudes ($P<0.05$). Importantly, both hedonic and utilitarian attitudes significantly predict purchase intention ($P<0.05$), highlighting their pivotal role in the consumer decision-making process. These findings contribute to a deeper understanding of consumer behavior in the organic personal care products market. Marketers and policymakers can leverage these insights to tailor marketing strategies and product offerings to better meet consumer needs and preferences.

Keywords: Consumer attitudes, Organic personal care products, Stimuli-Organism-Response (S-O-R) Model, Structural Equation Modeling

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Demand, Attitudes, and Awareness among International Tourists Towards Responsible Tourism in Udawalawe Wildlife Destination

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Responsible tourism respects the environment, community, and culture of the tourist destination while protecting the interests of local communities and their heritage sites. It aims to promote sustainable development, mitigating the negative effects of irresponsible mass tourism. This study investigated the demand, attitudes, and awareness for responsible tourism among international tourists who visited Udawalawa Wildlife Destination, Sri Lanka during January and February 2024. A pre-validated self-administered questionnaire was used to collect data. A simple random sampling method was applied to select participants. Descriptive analysis and the Kruskal-Wallis test were adopted for data analysis. Results revealed that a significant proportion of tourists were over 60 years old (43.7%), with a majority being female (58.9%) and originating from European countries (87.1%). Education levels were predominantly secondary (30.8%) and tertiary (34.4%). A majority of tourists (92.7%) were aware of responsible tourism. Respondents consistently expressed positive attitudes, regardless of their age and gender towards responsible tourism, with a mean score of 37.10 on a Likert scale ranging from 1–5. The perceived conditions in the Udawalawa wildlife destination related to responsible tourism were rated high, with a mean score of 38.65 on a Likert scale ranging from 1–7. The findings of the study revealed that tourists who had tertiary education demand responsible tourism in comparison to mass tourism. The combination of high awareness and positive attitudes, along with favorable conditions in Udawalawe Wildlife destination, indicates a good setting for promoting and sustaining responsible tourism practices.

Keywords: Community development, Environmental protection, Sustainability, Tourism in Sri Lanka

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Determination of Nutritional status, Nutritional Literacy and Nutrient Intake of Undergraduates Engaging in Selected Sports at University of Peradeniya

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Nutritional status plays a major role in optimizing athletic performance. It is a critical component of success for individuals participating in sports and physical activities. Adequate nutrient intake and nutritional literacy enables athletes to make informed decisions about their dietary choices to meet energy and nutrient requirements. This study investigates the nutritional status, nutritional literacy, and nutrient intake of undergraduate athletes at the University of Peradeniya, involved in selected sports. The study included 435 athletes from 19 sports. Methods employed include a three-day food record to determine the nutrient intake, nutrition for sport knowledge questionnaire (NSKQ) to determine nutritional literacy, and measurements of body mass index (BMI) and body fat percentage to determine the nutritional status. Results indicate that, while a majority of participants (76.8%) fall within the normal range of nutritional status according to the Asia-Pacific BMI classification, a significant ($P<0.05$) proportion (63.4%) was classified as overweight based on body fat percentage. Nutritional literacy was found to be low among participants because, 97.5% of participants did not have an adequate nutritional literacy. Inadequate intake of various nutrients was observed among undergraduate athletes, except for zinc and vitamin K. There was ($P<0.05$) a significant relationship between protein and iron intake and nutritional status determined by the body fat percentage, highlighting the importance of comprehensive nutrient assessment. However, no significant ($P>0.05$) relationship was observed between nutritional literacy or nutrient intake and BMI-based nutritional status, indicating a complex interplay of factors influencing nutritional outcomes. Findings of this study indicated that most of the undergraduate sportsmen and sportswomen do not have adequate nutrient intake, nutritional literacy and better nutritional status. Therefore, this study recommends the necessity for targeted interventions to improve nutritional status, literacy, and intake among undergraduate athletes, with future research to assess their impact on athletic performance and overall well-being.

Keywords: Nutritional status, Nutritional literacy, Nutrient intake, Body mass index, Body fat percentage

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Development of a Risk-based Environmental Monitoring Program for Food Processing Area Based on the BRCGS, IFS and FSSC 22000 Requirements

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Environmental monitoring in the food industry is a systematic approach crucial for maintaining and ensuring the safety and quality of food products. This proactive strategy involves regular assessment of environmental factors to detect and mitigate potential contaminants, contributing to the industry's commitment to delivering safe and wholesome food to consumers. This initiative aims to create a comprehensive risk assessment, identifying critical points and potential hazards specific to the food processing area. Surface sampling involves systematically collecting samples from food contact surfaces and non-food contact surfaces, ensuring compliance with BRCGS, IFS, and FSSC 22000 standards. Also, it serves as a vital tool to evaluate cleaning efficiency in the food processing area, providing valuable insights into the effectiveness of sanitation protocols, and aiding in the maintenance of optimal hygiene standards. Air quality monitoring focuses on evaluating microorganisms in the food processing environment to maintain hygienic conditions and prevent potential contamination. Through the inspection of swab samples, 4 out of 69 sampling points were identified as Extreme High-Risk points, 28 out of 69 sampling points as High-Risk points, 28 out of 69 as Moderate High-Risk points and 9 out of 69 as Low-Risk points in the food processing area. Acceptable limits of Total Plate Count, Yeast and Mold Count, *Enterobacteriaceae*, Coliform bacteria, and *Escherichia coli* for food contact surfaces were determined by depending on the historical data and current environmental analysis. By establishing immediate corrective actions, the environmental monitoring program seeks to mitigate risks efficiently and strives to foster a culture of continuous improvement, ensuring the ongoing safety and quality of food processing operations.

Keywords: Acceptable limits, Air quality monitoring, Assessment, Environmental monitoring, Risk Surface sampling

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Elucidation of Phylogenetic Relationships of Selected *Capparis* Species in Sri Lanka

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Capparis, the largest genus within the family Capparaceae, holds significant importance due to its medicinal properties, yet systematic treatment remains a subject of inquiry. Phylogenetic relationships among most *Capparis* species have not been unresolved. In the present study, phylogenetic relationships among five *Capparis* samples in Sri Lanka, namely *C. zeylanica*, *C. brevispina*, C. *moonii*, and two unidentified samples, *Kaluwellangiriya* 1 and Kaluwellangiriya 2, were investigated using the chloroplast gene, *matK*. Nucleotide sequences were subjected to BLAST similarity searches, and the most closely related subject sequences were used for phylogenetic analyses. Maximum-likelihood in IQTree and Bayesian inference in MrBayes were used in phylogenetic reconstruction utilizing the Jukes Canter nucleotide substitution model as the best-fitting model for the data. Also, 19 vegetative characteristics were examined. Morphological data were clustered using PAST4.03. A scatter plot was also obtained from the Principal Component Analysis (PCA). The dendrogram had three distinct clades, *C. brevispina* and *C. zeylanica,* forming one cluster, and *C. moonii* and *Kaluwellangiriya* 2 in another, while *Kaluwellangiriya* 1 stood apart from the rest. This clustering pattern was consistent with the PCA results. Phylogenetic analysis identified three distinct clades with *C. zeylanica* ,*C. brevispina* and *Kaluwellangiriya* 2 grouped together, and *C. moonii* and *Kaluwellangiriya* 1 formed a separate clade. Notably, relationships were different in morphological and molecular analyses through *C. zeylanica* and *C. brevispina*, which clustered together in both analyses. The separation of *Kaluwellangiriya* 2 and *Kaluwellangiriya* 1 in both analyses suggests the possibility of these unknown samples representing new species or previously undocumented records in Sri Lanka.

Keywords: *Capparis* spp., DNA barcoding, *matK*, Phylogenetics

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Evaluating the Effectiveness of Extension Programs Conducted by the Department of Agriculture in the Pulasthigama Agriculture Instructor Range: A Case Study

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Evaluation of government-funded extension programs helps to prove public accountability and decide on the future directions for the improvement of the program. The Department of Agriculture (DoA), Sri Lanka has conducted a series of extension programs (EPs) in the Pulasthigama Agricultural Instructor range aiming at empowering the farm women in the area. The study adopted the program evaluation logic model to determine the effectiveness of the extension programs in terms of; farmer participation in EPs, and training programs, outputs, outcomes. A descriptive study design was adopted. Data were collected from focus group discussions, key informant discussions, and a cross-sectional survey (n=74). Participants for the survey were selected using cluster sampling method. The reliability of the questionnaire was checked by Cronbach's alpha test. Quantitative Data analysis was done using IBM SPSS 19 software and qualitative data analysis was done manually. Nonparametric tests of the Mann-Whitney U test and Spearman's rank correlation test were used to test the hypothesis. According to the findings, one respondent has attended an average of 3 extension programs. A majority (89.5%) of respondents has received material support while some (28.4%) have received financial support. Perception on extension services was measured in terms of perception of income progression, extension relevance, participatory nature of extension, financial support, and multiple communication channels used. The overall satisfaction regarding EPs was strongly and positively correlated with the use of multiple communication channels by extension practitioners (r=0.526 p=0.000). Further, overall satisfaction showed a positive correlation with participant's perception on; income progression (r=0.343 p=0.003), participatory nature of extension (r=0.329 p=0.009), and number of trainings participated (r=0.329, p= 0.004). The study concludes that EPs implemented in the Pulasthigama area are highly effective and participants are satisfied with the outcomes.

Keywords: Extension programs, Evaluation, Logic Model, Satisfaction

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Examining the Effect of Decision-Making factors by Farmers on Collective Action and Efficacy of their Farming: A Study on Farmer Communities Engaged with a Large-Scale Private Sector Organization in Sri Lanka

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Decision Making Factors play a pivotal role to the efficacy of farming in multiple contexts. At different demographic levels collective action of farmers have made an impact to the outcome of farming. Physical, socio personal and economic factors of decision making collectively impact the community's effectiveness and collective action of the community. This study has intended to examine the effect of decision making factors on farming efficacy, understand the effect of collective actions on farming and to analyze the relationship between collective action and farming efficacy. Sixty-five Vegetable farmer clusters consisting of both upcountry and low country were selected. Grama Niladari divisions of 07 vegetable collection centres (VCC) namely, Thambuththegama, Norochcholei, Hanguranketha, Nuwara Eliya, Bandarawela, Boralanda and Sigiriya, attached to a large-scale agriculture organization were selected. Farmer clusters were interviewed through a pre tested questionnaire. Stratified sampling technique was used to select vegetable collecting centres while using simple sampling technique to draw farmer clusters within vegetable collecting centres. The results revealed that decision making factors significantly influenced the collective action of farmer clusters ($p<0.05$) as a whole. Farming efficacy was not significantly affected as such ($p<0.05$). Some clusters have a positive growth in efficacy, clusters with competitive farmers resulted an inverse relationship in efficacy due to physical and socio personal factors of decision making. Overall, collective action of farmers significantly influences on farming efficacy of clusters. Economic factors relating to the decision making had a high impact on farming efficacy. Overall, collective action of farmers significantly influences of farming efficacy of farmer clusters. Economic factors related to farmers efficacy negatively impact on collective action of farmers. And social factors related to efficacy had a positive effect. Study reveals that impact establishment of centralized collective action by farmer-based organizations increases the farming efficacy.

Keywords: Collective action, Decision making factors, Farming efficacy, Vegetable farmers

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Exploring Entrepreneurial Decision-Making Approaches and Influential Factors among Undergraduate Business Operators at the University of Peradeniya

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Among undergraduates in a university some undergraduates are doing business while conducting their studies. They are operating their businesses under a limited resource context. The study aims to investigate the entrepreneurial decision-making (EDM) approaches adopted by undergraduate business operators, and whether the EDM approaches change with the owner and business characteristics. In doing so, the study drew on three different concepts of EDM approaches in resource-constrained environments—causation, bricolage, and effectuation. The research was conducted at the University of Peradeniya. The research employed mixed methods including a questionnaire survey with undergraduate business operators (n=81) and in-depth interviews with the subset of the sample (n=15). Data were analyzed using statistical tests (MANOVA and ANOVA) and were supplemented with insights that emerged through qualitative data. The findings revealed that undergraduate business operators adopted all three EDM approaches to different degrees. The results further revealed that these approaches significantly vary with the gender and family background of undergraduate business operators ($P < 0.05$). In particular, female undergraduates are highly adopted to effectuation while male undergraduates adopt causation. Undergraduate business operators who have family businesses are highly adopt to effectuation and those who do not have family businesses mainly adopt in causation approach. The findings of the study could be important when flourishing undergraduates to be successful entrepreneurs.

Keywords: Bricolage, Causation, Effectuation, Entrepreneurial decision-making approaches, Undergraduate business operators

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Exploring the Food Insecurity Experiences and the Association between Food Insecurity and Nutritional Deficiencies among Undergraduates of the Faculty of Agriculture, University of Peradeniya

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This study examines the association between food insecurity and nutritional deficiencies among undergraduates at the Faculty of Agriculture, University of Peradeniya. Also, the study explores the student experiences related to food insecurity on campus using photo-elicitation interviews. The study included 100 students covering all academic years of the faculty. The data on demographics and dietary habits were collected using an interviewer-guided questionnaire. Food insecurity was assessed using the Food Insecurity Experience Scale with possible score ranges from 0-8 with higher scores indicating greater food insecurity. The serum ferritin and albumin levels were assessed using Sandwich Chemiluminescence Immunoassay (CLIA) and bromocresol green method, respectively. Participant-driven photo-elicitation interviews were conducted among a subsample of 30 high/moderate food-insecure students. For the photo elicitation interview, each student provided five of their photographs and reported on their experiences with accessing food. One-on-one interviews were recorded, transcribed, and analyzed using the constant comparative approach of grounded theory. The mean total food security score was 2.98 (± 2.43) with 9%, 32%, and 59% reporting low, moderate, and high food security, respectively. The mean serum ferritin level was 46.74 (±58.24) and 31% had low serum ferritin levels. The mean serum albumin level was 4.59 (± 0.25), however, none had low serum albumin levels. There was a significant relationship between food insecurity level and the serum ferritin level ($r=-0.546$; $P<0.05$). There was no significant relationship between food insecurity and the serum albumin level ($r=-0.132$, $P>0.05$). Students shared experiences of accessing food at the university through photos and interviews, revealing five key themes: 1. Irregular meal consumption, 2. Food purchasing locations, 3. Limited food diversity, 4. Impact of food insecurity on health and academics, and 5. Coping mechanisms. These insights went beyond mere food scarcity, offering a comprehensive understanding of food access challenges in university life.

Keywords: Food insecurity, Nutritional deficiency, Photo elicitation interviews, Serum albumin level, Serum ferritin level
The work was funded by University of Peradeniya Research Grant (URG/2023/02/Ag).

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Exploring the Influential Factors on Awareness and Attitudes towards Functional Beverages and Related Products Consumption: A Study on Potential Consumers in Matara District

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"Functional beverages" are considered as having health benefits beyond basic nutrition, and as potentially improving well-being, have a growing demand in global and local markets. This study aims to explore the factors affecting health, brand awareness, and attitudes toward the consumption of functional beverages among prospective consumers in Matara district. The study focused on socio-demographic characteristics, product characteristics, and psychological traits. Data were collected from 68 respondents using a structured questionnaire. Respondents were intercepted in public places in the study area following a systematic sampling procedure, during January 2024. Five different types of potential products; Calcium-enriched and/or Omega-3 added milk powder; Probiotics enriched yoghurt drink; green tea; Sports/Energy drinks, and Soy milk were included. The findings revealed that consumers have a major preference for Calcium-enriched and/or omega-3 added or milk powder, as well as Probiotics enriched yoghurt drinks. When pooling the data and conducting a general analysis for the five products, health awareness and attitudes were found to have a significant impact on medical advice for diet-related issues ($p < 0.05$). Additionally, brand awareness and attitudes showed a significant impact on product features ($p < 0.05$). For health awareness and attitudes towards the Calcium-enriched and/or Omega-3 added milk powder, a significant impact was observed with medical advice for diet-related issues ($p < 0.05$). Additionally, brand awareness and attitudes were found to have a significant impact on both medical advice for diet-related issues and the purpose of consumption ($p < 0.05$). Furthermore, health awareness and attitudes towards Probiotics enriched yoghurt drinks, a significant impact was observed with product features ($p < 0.05$) and medical advice for diet-related issues ($p < 0.05$). Incorporating collaboration with health professionals and utilizing natural, non-hazardous ingredients as part of a marketing strategy will bring benefits to both consumers and marketers.

Keywords: Brand awareness, Consumer attitudes, Functional beverages, Health awareness, Probiotics enriched food

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Factors Affecting the Performance of Women Entrepreneurs in Central Province, Sri Lanka

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Women entrepreneurship is an act of owning a business allowing women to be economically independent. Majority of the population (50.7%) in Sri Lanka are women, still, the active labour force participation of women (ages 15+) is only 33%. The rest are just passive recipients. The survey done by the Ministry of Industries of Central Province in 2023 has reported a huge variation in performance of women entrepreneurs. This study was conducted to identify the factors affecting women entrepreneurship in Central province, Sri Lanka. A sample size of 100 women entrepreneurs, selected from all three districts of the Central province, were interviewed face to face for the collection of data. The impact of financial, cultural, networking, training, motivational and business environmental factors on the perceived business performance were measured on a five point Likert scale. Women entrepreneurs included in this study represent different product categories like food & agricultural sector, home decorative items, textile related items, jewellery and handmade kitchen appliances. Approximately 95% of the respondents sell their products only to the local market and only 5% reach foreign market for higher profit earnings. Findings show that motivational factor significantly positively affect on performance while, cultural and financial factors significantly negatively affect on performance of women entrepreneurs. Not having a permanent market place to sell their products, difficulties in purchasing raw materials at affordable prices, competition with imported products, issues when obtaining Business Registration and getting loans were the main barriers faced by the women entrepreneurs.

Keywords: Business Environmental factor, Networking factor, Women Entrepreneurship, Women Entrepreneurs' Performance

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Food Security, Dietary Diversity, and Nutritional Status of Undergraduate Students Residing on Campus at the University of Peradeniya, Sri Lanka

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The current study aimed to assess the prevalence and predictors of food insecurity and to determine the association between dietary and nutritional factors with food security among undergraduate students residing on campus at the University of Peradeniya. A total of 600 undergraduate students representing the nine faculties of the University participated in the study. In addition to collecting socio-demographic data, the food security status and dietary diversity of participants were assessed using the 8-item Food Insecurity Experience Scale Survey Module (FIES-SM) and the dietary diversity questionnaire developed by the FAO/Nutrition and Consumer Protection Division (May 2007 version) respectively. Height and weight measurements were obtained through calibrated scales to calculate BMI, and body fat percentage was assessed using a bioelectrical impedance analyzer. Covariate-adjusted multivariate linear regression was employed to identify significant predictors of food security, while bivariate correlation analyses explored the associations between food security status and dietary diversity, as well as food security status and nutritional status. The overall prevalence of food insecurity was 44.1%, with 29.8% experiencing moderate food insecurity and 14.3% facing severe food insecurity. Factors such as faculty, ethnicity, frequency of home visits, and alcohol consumption were identified as significant ($P<0.05$) predictors of food insecurity. The analysis showed a significant negative correlation (coefficient = -0.212, $P<0.05$) between the total food insecurity score and participants' dietary diversity. Further, there was a significant negative correlation (coefficient = -0.089, $P<0.05$) between food insecurity total score and participants' BMI. However, there was no significant association ($P>0.05$) between the total food insecurity score and the fat percentages of the undergraduates. This study underscores the vulnerability of university undergraduates as a group for food insecurity, emphasizing the need for corrective actions to enhance food security in this population.

Keywords: Dietary diversity, Food insecurity, Nutritional status, University of Peradeniya

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Green Manure Trees and Shrubs Used by the Vegetable Farmers in Nuwara Eliya

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The utilization of green manure trees and shrubs by vegetable farmers in Nuwara Eliya was investigated in this study with a focus on species selection, biomass production, nutrient content and pest control efficacy. Reconnaissance visits and farm surveys were conducted to identify commonly used hedgerow species and, five farms having each species were randomly selected for the study. The results indicate a higher prevalence of large spreading hedgerow species including *Polygonum mole, Artemisia vulgaris,* and *Plectranthus barbatus* among farmers. Analysis of nutrient content in the three green manure trees/shrubs reveals an average Nitrogen content of 2.5% and Phosphorus content of 1% with significant variations observed in Potassium content between trees/shrubs. Furthermore, significant differences ($P<0.05$) in dry matter production between the tested trees/shrubs where *Polygonum* and *Artemisia* being the higher dry matter producers compared to *Plectranthus*, highlights the importance of species selection. Notably, *Polygonum* demonstrates superior performance as a green manure species, while *Artemisia* exhibits better efficacy as a plant protector compared to *Plectranthus*. These findings contribute valuable insights into the selection and management of green manure species for further improving vegetable farming practices in Nuwara Eliya. By identifying the most effective species for biomass production, nutrient enrichment and pest control, this research aimed to support farmers in enhancing soil fertility, reducing reliance on synthetic fertilizers, and improving crop yields in the region. The conducted evaluation of green manure trees and shrubs revealed the potential for integrating agroforestry practices into vegetable farming systems to promote environmental sustainability and food security in Nuwara Eliya area and other similar agricultural landscapes.

Keywords: *Artemisia vulgaris*, Hedgerows, *Plectranthus barbatus*, *Polygonum mole*

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Growth Performance of Different Aged Khaya in the Dry Zone of Sri Lanka: Case Study from the Inamaluwa Forest Plantation

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At present, Khaya is a prosperous and potential forest plantation tree species in the Dry zone of Sri Lanka. Forest Department is promoting this species for its high-quality timber, in addition to no elephant damage. This study involved a comprehensive data collection on variables; tree height, diameter at breast height (DBH), crown width, crown depth, basal area, biomass and carbon stock, and establishment of regression models to understand the relationships between these variables. Overall, the results indicated that the growth performance of Khaya plantations varied with age, but in general, mean values of DBH (26.1cm), tree height (21.1m), crown depth (7.3m), crown width (11.6m) and carbon stock (124905kg/ha) observed in old plantations. However, certain variations were observed, particularly in the 15year-old Khaya plantation where, the mean value of DBH was 21.9cm, and it was lower than the DBH of 14-year-old plantations where it was 22.1 cm. However, the mean values of tree height (17.6m) and crown width (5.3m) of 14-year-old and 15-year-old stands were larger than tree height (17.0m) and crown width (4.9m) of 16-year-old Khaya stands, which was influenced by the presence of teak trees due to intercropping practices and wildlife interactions. Despite these variations, biomass and carbon stocks showed an increasing trend with plantation age, highlighting the potential for carbon sequestration in these forest ecosystems. The establishment of regression models provided valuable insights into the relationships between tree height, crown depth, crown width, tree volume, and carbon stock with DBH. These models are characterized by high R-squared values, offer reliable predictions for estimating tree parameters based on DBH and carbon stock based on tree age indicating the strong influence of tree diameter on overall tree growth and tree age influence the carbon sequestration potential. The variations observed across different years and locations emphasize the need for tailored approaches to forest management and carbon accounting practices. Further research and monitoring efforts are warranted to better understand the long-term dynamics of tree growth and carbon sequestration in Khaya plantations and other forest ecosystems in the dry zone.

Keywords: Carbon stock, Dry zone, *Khaya senegalensis*, Tree growth

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Human-Monkey Conflict: A Case Study of the University of Peradeniya, Sri Lanka

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Human encroachment into wild habitats through deforestation and habitat fragmentation has intensified competition for natural resources resulting in conflicts between humans and wild animals. Human-monkey conflict (HMC) is one of those conflicts that prevails currently in many regions of Sri Lanka. This issue has created adverse effects on the quality of life for residents and monkeys. This study aimed to assess the perceptions, impacts, awareness, and attitudes of undergraduate students toward HMC based on their gender and respective registered faculty at the University of Peradeniya. The current study utilized a pre-validated self-administered opinion survey to collect data. A stratified random sampling method was adopted for the selection of participants. A total of 474 participants were surveyed and the response rate was 87%. Mann-Whitney U test and descriptive analysis were employed to analyze data. The sample population comprised 48% males and 52% females which allowed us to assess the effect of the gender of students towards the aforementioned attributes. Female participants were found to be less aware of the HMC in comparison to male participants. Female participants expressed a higher positive perception towards HMC, leading to a stronger desire for effective resolution compared to males ($P = 0.034$). According to the study, the majority of the participants (34%) have identified loss of natural habitat for monkeys as the primary reason out of many other possible reasons for HMC. The perceived impact of HMC on daily living activities and general attitudes toward the severity of HMC were found to be gender-neutral ($P>0.05$) among students from all the faculties. The majority of the students (89%) suggested collaborating with wildlife experts to develop long-term, sustainable solutions to mitigate HMC in the university area. It is recommended to apply mitigating strategies for HMC at the University of Peradeniya to improve the quality of life for residents and monkeys.

Keywords: Gender perspectives, Human-Wildlife conflict, Quality of life, Sustainable solution, Wildlife

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Identification of Wild Edible Mushrooms in Sinharaja Rain Forest and its Adjacent Environment

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In the pristine ecosystems of the Sinharaja natural forest and its adjacent areas in Sri Lanka, this research aims to identify and document wild edible mushrooms through a systematic classification process. Employing a combination of morphological analysis and field surveys, the study conducted an ethnomycological survey involving eight villages, interviewing 95 participants to gauge indigenous knowledge and utilization of edible mushrooms. This study identified 14 edible mushroom species belonging to 08 families and 09 genera within the Sinharaja rainforest and adjacent villages. Utilizing random sampling, statistical analyses, such as Spearman correlation and Mann-Whitney U test, were applied to assess the relationship between participant demographics (age and gender) and their mushroom identification and edibility knowledge. One sample chi-square test was employed to analyze questionnaire responses, revealing a significant difference ($P<0.05$) in Mushroom identification knowledge and edibility knowledge between males and females, with identification knowledge higher in males. Males exhibited a statistically significant higher average ability to identify (7.79 ± 0.33) and knowledge of the edibility (8.50 ± 0.31) of wild mushrooms compared to females (6.77 ± 0.35 and 7.49 ± 0.32, respectively). Age also demonstrated a positive correlation ($P<0.05$) with both identification ($R=0.458$) and edibility knowledge ($R=0.364$). Direct field observations facilitated the identification of morphological characters and habitats of various wild mushrooms, including cap, stipe, gills, ring, and volva. Key findings indicate a potential for mushroom cultivation and domestication, emphasizing the need for sustainable harvesting practices and commercial cultivation. Local communities possess valuable knowledge, especially among men and older generations, suggesting opportunities for education and awareness campaigns targeting younger individuals. The study underscores the higher taste and nutritional value of wild mushrooms compared to commercially cultivated ones, highlighting the importance of establishing a national fungi herbarium, culture collection, and a robust local research network in Sri Lanka. This research contributes to the broader exploration of economic development through responsible fungal domestication, emphasizing the significance of promoting education, awareness, and new technologies related to wild mushroom identification and consumption.

Keywords: Edible fungi, Ethnobotanical knowledge, Morphological, Sinharaja

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Impact of Adaptation of Climate Smart Agricultural Practices on Household Food Security Among Vegetable Farmers in Bandarawela, Sri Lanka

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Vegetable farming is one of the most prominent farming systems as well as a major livelihood of the local population in Bandarawela, Sri Lanka. Bandarawela has a unique climate, which is most suitable for cultivating a wide range of vegetable varieties. But in recent years, farmers in Bandarawela have faced so many challenges due to climate change. Climate Smart Agriculture (CSA) is one of the most suitable and innovative approaches designed to mitigate the impact of climate change. This research was conducted to investigate the impacts of adaptation of climate-smart agriculture practices on household food security among vegetable farmers in Bandarawela. A survey was conducted to gather data from 150 vegetable farmers who were selected randomly. For assessing the adaptation level of CSA practices, a Likert scale was used, and for assessing household food security status, Food Consumption Score (FCS) and Household Food Insecurity Access Scale (HFIAS) were used. Descriptive analysis and regression analysis were undertaken to analyze collected data. According to the results of the regression analysis, income, educational level, and land size were identified as the socio-economic factors affecting the adaptation of CSA practices ($P<0.05$). The adaptation level of CSA practices positively affects the Food Consumption Score. ($P<0.05$). Additionally, household income and land size also positively affect the FCS ($P<0.05$). Adaptation of CSA practices negatively affects the Household Food Insecurity Access Scale. Moreover, the age of the farmer and household income were negatively affected by the HFIAS ($P<0.05$). These results have shown that adaptation of CSA practices has a positive impact on household food security among the vegetable farmers in Bandarawela ($P<0.05$). Farmers who are highly adapted to CSA practices have a higher level of food security. This research concluded that promoting CSA practices among vegetable farmers can enhance the food security of the households.

Keywords: Climate Smart Agriculture, Food Security, Vegetable Faming

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Impact of Social Protection Schemes as a Determinant of Food Insecurity in Sri Lanka

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Food insecurity is considered a critical global challenge, which has garnered much attention worldwide due to its adverse impact on human well-being and the achievement of SDG goal two. Sri Lanka is emblematic of persistent issues with food insecurity making it a significant concern for policymakers in terms of targeted policies such as social protection schemes. However, research on the impact of social protection schemes on food insecurity in the Sri Lankan context remains relatively scarce. Therefore, the overall objective of the study aims to investigate the impact of social protection schemes as a determinant of food insecurity. To measure food insecurity, the study used the Food Insecurity Experience Scale (FIES), which creates a standardized approach to assess the severity and prevalence of food insecurity. Household-level data was obtained from the Household Income and Expenditure Survey in 2019 published by the Department of Census and Statistics of Sri Lanka, which includes 19,911 households. As explanatory variables, social protection schemes like receiving pension, *Samurdhi*, school lunch, and the *Threeposha* program were considered. In addition, socio-economic and demographic variables were used as controls. A Generalized Linear Model (GLM) was used to investigate the relationship between social protection schemes and food insecurity. Pension and foreign income significantly impact reducing food insecurity ($P<0.05$). However, the *Threeposha* program did not significantly influence food insecurity ($P>0.05$). *Samurdhi* and the school lunch programs only significantly influence the moderate level of food insecurity ($P<0.05$). Further, household size, food and non-food expenditure, and monthly income significantly influenced food insecurity while having young children in the household did not significantly influence any form of food insecurity. The findings of the research shed light on the influence of social protection schemes on food insecurity in the country and highlight the importance of targeted policy implementation.

Keywords: Food Insecurity Experience Scale (FIES), Food poverty, Generalized Linear Model, Household Income and Expenditure Survey, Social Protection Schemes

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Influence of Visitors on the Behaviour and Welfare of Zoo Housed Tigers and Leopards: A Case Study at the National Zoological Gardens in Sri Lanka

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A National Zoological Garden is a large-scale facility that houses a diverse collection of animals for public display, education, conservation, and research. Visitors are crucial contributors to the functioning of zoological parks. The "visitor effect" refers to the observable changes in the behaviour and physiological responses of animals when they are exposed to zoo visitors. Big cats like tigers (*Panthera tigris*) and leopards (*Panthera pardus*) are among the most visited species in zoos globally. This study was conducted to examine the visitor effect on behaviour of captive tigers and leopards housed at the National Zoological Gardens in Sri Lanka. The main objective of this study was to investigate the behavioural response of zoo-housed tigers and leopards to visitor densities and noise. Further, the study aimed to understand the relationship between stereotypy, animal history, and enclosure design of tigers and leopards. The behaviour of nine big cats housed at the National Zoological Gardens in Sri Lanka, was monitored using focal animal sampling technique during January and February 2024. The visitor density and ambient noise were recorded for the same duration. Both species were found to dedicate a significant amount (>50%) of time exhibiting inactive behaviours. Tigers and leopards engaged in stereotypic behaviours for 26±7% and 12±5% of their time, respectively. Multiple linear regression analysis revealed stereotypic behaviours were significantly ($P<0.05$) influenced by high visitor density. However, ambient noise did not influence ($P>0.05$) the stereotypy of both felid species. Pearson chi-square analysis revealed a significant variation of stereotypy in association with biological (age, sex, and origin) and captive (enclosure design) variables. Zoo visitors play an integral role in zoos, yet their presence can have a negative impact on the well-being of captive animals. Environmental enrichment may be a valuable technique that zoo management can employ to enhance the living conditions of animals in captivity.

Keywords: Behaviour, Big cats, National Zoological Gardens, Stereotypy, Visitor effect

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Intentions of the Next Generation for Family Business Succession: A Study of Undergraduates of the University of Peradeniya, Sri Lanka

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The study of family businesses has emerged as a crucial area of research, given their substantial contributions to the economy. Succession, the transfer of business leadership from generation to generation, is a critical aspect of family business continuity. Previous studies have indicated a mere 7% desire among individuals with family business backgrounds to directly succeed their parents after completing studies, emphasizing the need to explore the determinants of succession intentions in the next generation. Thus, this research focuses on investigating the factors influencing the intentions of the next generation in Sri Lankan family businesses, specifically among undergraduates of the University of Peradeniya. Employing a deductive approach and a quantitative method with a cross-sectional time horizon, the study targets undergraduates with the potential to succeed in family businesses. Data collection involved distributing a questionnaire to respondents via official university emails, encompassing closed-ended and open-ended questions in Sinhala, Tamil, and English. The sample included 97 potential business successors as respondents. The analysis method employed in this study includes a Structural Equation Model (SEM) to test hypotheses and explore relationships between variables. Findings indicate that attitude towards behaviour, gender, and firm size significantly influence succession intentions, with males showing higher intentions for family business succession than females. Conversely, subjective norms, perceived behavioural control, and level of involvement exhibit limited influence on succession intentions. Notably, future career paths of undergraduates influence their intentions to succeed in family businesses. In conclusion, this study sheds light on the factors influencing succession intentions in family businesses among Sri Lankan undergraduates. The results contribute valuable insights to the existing body of knowledge, aiding future research and informing stakeholders in the realm of family business management and succession planning.

Keywords: Business leadership, Family business, Structural equation modeling (SEM)
Succession, Theory of planned behaviour

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Navigating Agricultural Contracts: Types, Drivers, and Outcomes in Mango Grower-Collector Agreements

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Mango stands as a cherished fruit globally, renowned for its exquisite flavor and widespread consumption. Mango harvesting encounters obstacles due to labour scarcity and the labour-intensive nature. In response to these challenges, contract agreements have emerged as a pragmatic solution. This study aimed to investigate the types of mango grower-collector contracts, particularly focusing on their outcomes related to price, fruit loss and tree damage. By examining these outcomes, the research sought to identify key factors influencing occurrence of these outcomes. Additionally, the study aims to explore the mitigation strategies employed by growers to minimize losses. The data collection extended across the total 68 mango growers in Anuradhapura and Kurunegala districts in Sri Lanka. The research employed a questionnaire survey. The study drew four different types of contracts including Tree-based, Volume-based, Weight-based, and Fruit-based. Descriptive statistics were employed to illustrate the diverse outcomes associated with various contract types and statistical analyses, including multiple linear regression and binary logistic regression, were conducted to identify the factors influencing price fluctuations, fruit loss, and tree damage. The findings indicated that a predominant proportion of mango growers (41.2%) engaged in weight-based contracts, and they are the ones who received the highest average price as well (201.79 LKR/kg). The tree-based contract types demonstrated the highest average fruit loss (23%). Variety and season were identified as factors affecting price, while land size, variety, and harvesting methods were identified as factors influencing fruit loss. Measures taken to reduce loss and the relationship with collectors were found to affect tree damage. Facilitation of knowledge sharing initiatives and exploration of value adding opportunities for less popular varieties and encourage mango growers to obtain quality assurance credentials have been suggested to improve the link between the mango growers and collectors.

Keywords: Binary logistic regression, Contract agreements, Fruit loss, Mango collector, Tree damage

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Optimizing Nitrogen Fertilizer Allocation across Diverse Agro-climatic Zones for Enhanced Rice Production: An Analysis Using an Integrated Crop and Economic Model

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Distribution of nitrogen (N) fertilizer among rice farmers has been highly regulated by the Government of Sri Lanka. When the fertilizer supply is limited, the optimal distribution pattern should be based on yield response to fertilizer considering region-specific factors such as climate, soil, and management regime. The objective of the study was to find the optimum quantity of N fertilizer for rice for different agro-climatic zones (ACZ) that would maximize total production of rice within the country. This study adopts Agricultural Production| Simulator Model (APSIM), an integrated crop and economic model combining a linear programming (LP) model and simulation of agricultural production. Nine diverse areas were included in the study. Six agro-climatic zones; Intermediate Low Country (IL); Intermediate Mid Country (IM); Intermediate UP Country (IU); Wet Low Country (WL); Wet Mid Country (WM); and Wet Up Country (WU) were included as it is. The Dry Low Country was included as three separate zones based on historical rice yield levels (high, medium, and low). The results clearly indicated that different areas have different rice yield response functions for N and a blanket approach to fertilizer allocation overlooks the factors determining yield levels and fails to maximize yields. The results of the simulation experiments of the LP model indicate that when allocating fertilizers, Dry Zone should be prioritized. In an event of shortage of N availability, the prioritization must be done according to the following order, i.e., DL3> DL1> IM> DL2> IL> IU> WL> WM> WU. During a drought in DZ, like what prevailed in 2001, the priority order changes as, DL3> IM> DL1> IL> DL2> IU> WL> WM> WU, showing a lesser response in medium and low yield regions in the DZ. The results also indicate that an intervention to reduce N losses in the wet zone would lead to higher rice yields.

Keywords: Agro-climatic zones, APSIM, Fertilizer response, Rice, Simulation modelling

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Quality Evaluation of Leather Manufactured from Goat Hides Using Vegetable Tannins Extracted from Selected Plant Materials

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Vegetable tanning is an important leather processing method due to its reduced environmental impact. Given the challenges and expenses associated with commercially available tannins, exploring alternative tannins derived from plants and understanding their properties are crucial. This study was conducted to determine the physical properties of tanned leather from goat hides using locally available plant materials: *Artocarpus heterophyllus* (Jackfruit-leaves), *Terminalia catappa* (Kottamba-leaves), *Cocus nucifera* (Coconut-coir), *Nigella sataiva* (Black cumin seed-residue) and commercial tannin materials (mimosa powder and black wattle solid). Extraction of tannins from plant materials was accomplished via high-pressure water extraction, tannin quantities assessed through spectrophotometry. Leather tanning was processed manually. The leather's physical parameters were assessed utilizing IULTCS (International Union of Leather Technologists and Chemists Scarcities) official methods. The tannin yields from coconut coir, jackfruit, kottamba and black cumin seed-residue were 1.45±0.22%, 4.49±0.06%, 4.46±0.05% and 1.68 ±0.11% respectively. Kottamba-tanned leather exhibited significantly high tannin absorption. The highest density (0.85±0.04mg/cm^3) and tensile strength parallel to backbone (50.67±3.48N/mm^2) were resulted by coconut coir-tanning, and the highest tensile strength perpendicular to backbone (63.34 ±4.67N/mm^2) was resulted by black cumin- residue-tanning. Kottamba-tanned leather had the highest value for elongation break parallel to the backbone (26.97 ±0.8%) and wattle-tanned leather had the highest value for elongation perpendicular to the backbone (31.52±0.8%). Water absorption (146.09 ±11.48%/day) was highest in wattle-tanned leather. For 10,000 flexes, kottamba, mimosa and wattle tanned leathers tolerated highly. In conclusion, all the evaluated plant materials have the potential as the vegetable tanning agents for leather tanning to make suitable end products.

Keywords: Black cumin seed residue, Coconut-coir, IULTCS, Jackfruit-leaves, Physical properties

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Short-Run Supply Responses to Higher Food Prices: A Cross-Country Panel Data Analysis of Cereal Production Over 2000-2022

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Efficient agricultural production is paramount for global food security and economic stability, yet it is influenced by complex supply responses. This study addresses the pressing issue of insufficient supply response, leading to persistent price increases that detrimentally affect net poor consumers and hinder farmers' ability to capitalize on higher prices due to limited output. Mitigating these challenges is crucial for alleviating food insecurity and poverty across agricultural and non-agricultural communities. The research focuses on analyzing the short-term effects of price changes on cereal supply response, specifically examining yield adjustments at the intensive margin and variations in the harvested area at the extensive margin. Additionally, the study explores how country land availability moderates these supply responses. This is a cross-country time series analysis using secondary data from FAOSTAT, UNSTAT, IMF, IFPRI database, and World Bank indicators. Analyzing time series from 2000 -2022 period where the global economy showed significant price increase and price volatility. Key findings reveal that "Intensive Supply Response" characterizes the average supply response observed across cereal-producing countries. Land-scarce countries demonstrate an intensive supply response, with cereal prices on the rise. Conversely, land-abundant countries show minimal adjustments in cultivated areas in response to cereal price variation. Furthermore, in land-abundant countries with low tractor ownership (low mechanization), there are no statistically significant increases in production, yield, or cultivated area. However, in the short run, land-abundant countries with high tractor ownership exhibit an "Intensive Supply Response" to price increases by boosting yields in existing cultivation areas. Increased public agricultural expenditure as a percentage of total agricultural GDP encourages farmers to practice intensive supply response to price increases. Additionally, the presence of conflicts leads to reductions in production, yield, and cereal cultivation areas, highlighting the detrimental impact of geopolitical factors on agricultural supply response.

Keywords: Agriculture supply response, Extensive supply response, Intensive supply response, Land abundant countries, Land scarce countries

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Stress among Tea Pluckers in Sri Lanka: A Focus on Life Events and Perceptions of Technology among Workers at an Upcountry Plantation

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Using a focus on Hatton, Sri Lanka, this study explores pluckers' daily events stress and overall stress, and attitudes regarding work related technological adaptation. It aims to map out the daily life events of tea pluckers, identify the most stressful events, and measure overall stress levels and perception of tea pluckers regarding technical advancements in their field of work as a source of stress. A mixed method was used for total 67 female pluckers in a particular estate in Hatton, basically included in to 3 separate regions. Data collection was done using a structured questionnaire through in depth interviews with each female plucker. Observations were also recorded in a field diary and discussions were conducted with key informants. Descriptive analysis was done for map the daily events profile, and stress levels. Cluster analysis was done for identify the patterns with related to socio demographic details. By a thematic analysis, pluckers' perception on "technological adaptation" was identified. Mainly 19 common daily life events were identified including "walking", which takes up a lot of their time and effort. Daily life stress and overall stress vary across pluckers. The total tea plucker women community was classified into 3 groups as low stressed, high daily event stressed and high overall stressed. The groups differed on socio-demographic factors. The highly stressed group has their special and somewhat severe grievances that seem to have contributed to their stress levels. Pluckers have a positive perception on technological adaptation. Through examining these aspects, the study sought to understand difficulties that women tea pluckers' experience. The results should help stakeholders in the tea business and policymakers improve the working conditions and well-being of tea pluckers while using technological adaptation in a sustainable manner.

Keywords: Daily events stress, Digitalization, Mechanization, Overall stress, Worker perceptions on technology

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The Impact of Grassroots Level Promotional Tools on Farmers' Purchasing Decision of Crop Protection Chemicals (CPCs) in the Absence of Mass Media Promotions

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The current regulatory framework of Crop Protection Chemicals (CPCs) industry in Sri Lanka has left the CPC companies with limited promotional tools due to the restrictions imposed by the "control of pesticide Act no. 33 of 1980" on mass media advertising and promotions. Hence, the study was designed to examine the differential impact of grassroots level promotion tools on the purchasing decision of CPCs among farmers, with a specific focus on investigating variations based on socio-economic factors, including educational background and income level. Notably, there is a lack of studies focusing on non-price-based promotional tools, with most existing research predominantly centered on price-based promotions. The population of the research consisted of 1,100 registered farmers for fertilizer in Ipalogama DS division in Anuradhapura district. Data was collected through face-to-face interviews, guided by a pre-tested structured questionnaire. Descriptive statistics and regression analysis were used to analyze data and achieve research objectives. Findings underscore the significant positive impact of leaflets/ brochures, particularly in weedicides and insecticides purchases. Moreover, the analysis reveals the influence of annual income levels on weedicides purchases and identifies word-of-mouth communication and retailer's recommendations as pivotal external communication channels shaping farmers' awareness of CPCs. Notably, brand experiences, quality perceptions, and peer recommendations emerge as key determinants guiding farmers' brand choices. The study sheds light on the intricate dynamics of grassroots level promotions, offering valuable insights for agrochemical companies navigating the competitive landscape in Sri Lanka.

Keywords: External communication channels, Farm household income, Grassroots level promotional tools, Purchasing decision of CPCs,

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The Influence of Flower Symbolism on Consumer Purchasing Behavior and Local Business Strategies

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Beyond their aesthetic appeal, flowers have deep symbolic meanings deeply rooted in social and cultural contexts. This study examines the significant impact that flower symbolism has on consumer behavior, concentrating on small- and medium-sized floral businesses in Sri Lanka. This study aims to study the complex relationships between symbolism, and consumer behavior in the floral industry by examining consumer perceptions and preferences regarding flower symbolism and the methods used by floral businesses to incorporate these symbolic meanings into their operations. In order to collect thorough data, the study used a mixed-method approach that combines surveys, interviews, and observation. Survey questionnaires were utilized to gather information about how customers understand and interpret flower symbolism on different occasions. The data was collected through physical and online questionnaires which were available in Sinhala, and English. Owners and managers of floral businesses who were interviewed for this research offered useful insights into how symbolic values affect their production, marketing, and sales strategies. Findings revealed that consumer preferences and purchase decisions are significantly influenced by the symbolic meanings associated with various flower bouquets, highlighting the cultural significance of floral arrangements in Sri Lankan society. Consumers' perceptions of flower symbolism varied, according to descriptive analysis, which had a big impact on what they decided to purchase. Additionally, the study clarifies how floral businesses use the symbolism of flowers to customize their products to customer needs and increase market competitiveness. The study also looked at how floral businesses used official and informal support networks, and it found that different retailers had different preferences. For floral retailers, marketers, and policymakers looking to create more meaningful and culturally appropriate market strategies, the study's conclusions provide insightful meaning.

Keywords: Consumer behavior, Floral industry, Flower symbolism, Purchase decision, Retailer behavior

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The Nature of the Contractual Relationship and the Quality of Life of Women Tea Pluckers: The Case of a Plantation Company Based in Hatton

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Sri Lankan estate population is 4.3% and 77% of them live in estates owned by Regional Plantation Companies (RPC). Plucking tea is the largest single operation in tea plantations with main contribution from women. This study aimed at measuring the Quality of Life (QoL) among women tea-pluckers and compare their QoL concerning contractual relationship as permanent, contract, or Revenue Sharing Model (RSM). A cross-section design using a quantitative and qualitative mixed method approach was used at a tea estate in Hatton, Sri Lanka. The study population was 67 women tea-pluckers working in a particular tea estate. The information about socio-demographic status, nature of the job, QoL related to WHOQOL-BREF questionnaire, and tangible aspects of QoL were measured. The study population consisted of 61.2% permanent and the rest contract and RSM workers. More than 80% of workers with overall QoL of women tea-pluckers were at a satisfactory level as perceived by them. The environmental QoL domain indicated a lower value compared to the other domain. Regression analysis indicated a relationship between contractual relationship and marital status with the overall quality of life indicating a significant difference between the marital status and contractual relationships with the overall QoL. Tangible aspects of the environmental and psychological quality of life had a positive relationship with the overall QoL. Women tea-pluckers reported high requirements for conducting social relationships, ownership of the items, and less ability to cut down the expenses due to their low income. To fulfill this gap they target different credit sources. There were issues with social well-being of the tangible aspects of QoL. The carrying of plucked tea baskets and reaching the uneven geographical locations cause physical pains especially musculoskeletal symptoms. Overall QoL of women tea-pluckers in the considered tea estate showed satisfactory levels of overall QoL. However, there is a gap between the previous literature and this research findings.

Keywords: Contractual relationship, Mixed methods research, Quality of life, Revenue Sharing Model, WHOQOL-BREF questionnaire

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Trade Policy Effects of Global Value Chain Participation of Sri Lanka: Implications for Selected South Asian Nations

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Recent literature on international trade highlights the key role of global value chains (GVCs) in structural transformation, development, and growth, particularly for developing countries. In Sri Lanka in the current context, GVC has been highlighted as a potentially suitable solution. Thus, in this study, the following specific objectives were set i.e. 1) an extensive investigation of sectoral and bilateral GVC participation, and 2) an empirical analysis of the relationship between trade policy factors namely; tariffs and Foreign Direct Investment (FDI) with GVC participation of Sri Lanka with selected South Asian nations (India, Pakistan and Bangladesh). First, the Wang-Wei-Zhu bilateral gross exports decomposition method was applied to panel data from Multi-Regional Input-Output (MRIO) tables of the Asian Development Bank to decompose bilateral-sector gross exports. A three-way Fixed Effects gravity model with Pseudo Poisson Maximum Likelihood (PPML) estimation was employed to investigate the impacts of trade policy factors on the decomposed GVC components. In contrast to expected outcomes, the coefficient results related to tariffs obtained for forward GVC participation of all sectors are not statistically significant ($P<0.05$). The coefficient results related to FDI obtained for all manufacturing sectors are negative and statistically significant ($P<0.05$). Based on the results, for value-added products, Sri Lanka needs to negotiate with partner countries for tariff reductions but for intermediate products, Sri Lanka needs to focus on other policy factors rather than tariffs. In addition, negotiations should focus on attracting more FDI into the manufacturing sector of Sri Lanka.

Keywords: Foreign Direct Investment, Global Value Chains, Gravity Model, Pseudo Poisson Maximum Likelihood Estimation, Tariffs

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Utilization of Private Agricultural Extension and Advisory Services by Farmers in Tambuttegama, Sri Lanka

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This study investigates the utilization of Agricultural Extension and Advisory Services provided by private organizations (PAEAS) among farmers in the Tambuttegama Divisional Secretariat, highlighting the significant yet underexplored benefits these services offer to the agricultural community. Despite the benefits, many farmers are hesitant to use private advisory services. This study explores why farmers do or do not use private advisory services, aiming to better understand private organizations' impact on farming development. The study adopted a mixed-method research design. Data were collected using a telephone survey (n=85), for which respondents were selected using simple random sampling. Qualitative data were gathered using key informant discussions, and in-depth interviews (n=10). Descriptive analysis and regression analysis were undertaken to analyse the data. The findings revealed that only about 24% of respondents are utilizing the PAEAS. The services included providing technical information, farm visits, and conducting specialized training programs. According to the results, there was a positive relationship between farmers' attitudes and their use of PAEAS ($P<0.05$). The educational level of the respondents were positively correlated ($P<0.05$) with a higher likelihood of service utilization highlighting the impact of knowledge and awareness on the adoption of PAEAS. The majority (76%) of the respondents did not use PAEAS. The reasons for the reluctance to participate in PAEAS included financial constraints, fear of taking risk, low awareness and cultural and perception barriers. The study underscores the need to address the barriers hindering wider adoption and to promote the educational aspects that facilitate positive attitudes towards these services.

Keywords: Extension and Advisory Services, Private Extension, Tambuttegama

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Wastewater and Manure Production from Livestock Farms in Malwathu Oya Cascade System in Mannar, Sri Lanka

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Manure and wastewater generated from livestock farms contribute to the pollution of water bodies. This study was conducted to evaluate livestock farming characteristics, wastewater, and manure production from livestock farms in the Malwathu Oya cascade system in Mannar. Livestock farms (n=124) were selected from 14 Grama Niladhari divisions within the Madhu, Nanattan, and Musali Divisional Secretariat to represent the livestock-rearing farms in Malwathu Oya Cascade System. Grama Niladri divisions were selected based on their land area exposed to the Malwathu Oya and distance from Malwathu Oya. A stratified random sampling method was used to select cattle, goat, and poultry farms from each Grama Niladhari division. A descriptive analysis was conducted using SPSS version 26. Manure production of each farm was predicted considering average milk production from cows and, the number of animals in each farm. The sample consisted of 37.66% goat farms as the predominant livestock followed by cattle (36.3%) and poultry (25.97%) farms. Cattle (58%), goats (71%), and poultry (68%) are reared mainly semi-intensively. Polluted water used in these farms is directly released to nearby water bodies at a rate of 62 L/day without any treatment. The average daily manure production of Sahiwal, Jersey, and cross-breed of Sahiwal and Jersey rearing farms was 243 kg, 385 kg, and 434 kg, respectively. The rate of manure released to the environment by Jersey, cross-breed of Sahiwal and Jersey, and Sahiwal breeds was 5.34 kg/hour, 3.03 kg/hour, and 2.18 kg/hour, respectively. Farmers pay poor attention to compost production from cattle and goat manure. Cattle and goats predominantly graze in tank beds, paddy lands, and roadsides leading to substantial nutrient retention in the environment near Malwathu Oya. Proper grazing management and farm waste management practices should be introduced to mitigate the potential water pollution of the Malwathu Oya Cascade System in Mannar, Sri Lanka.

Keywords: Compost production, Excreta production, Livestock, Water pollutants, Water quality

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Will Novel Fertilizer Technologies and Fertilizer Management Practices Deliver Financial and Environmental Benefits while Ensuring the Social Acceptance in Sri Lanka?

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Despite the wealth of novel fertilizer technologies available globally, Sri Lanka continues to rely predominantly on conventional urea for nitrogen application in rice cultivation. This study explores the potential of novel fertilizer technologies to mitigate environmental pollution and improve social benefit in the paddy sector. Cost-benefit analyses of potential novel technologies suggest that incorporating urease inhibitors with urea and utilizing controlled-release urea (CRU) could significantly increase social profit. Comparisons reveal that urease inhibitor-treated urea, direct application of inhibitors, and CRU reduce nitrogen loss by 79%, 56%, and 56% respectively compared to conventional urea fertilizers. Moreover, the analysis indicates that direct application of inhibitors, inhibitor treated urea and CRU are more socially beneficial compared to bio fertilizers, integrated nutrient management practices and organic fertilizers. Key informant interviews were conducted to investigate determinants, social acceptance, and constraints related to adopting novel nitrogen fertilizer technologies. Results suggest that technical cognition and social capital positively influence technology adoption. Also, social acceptance of key stakeholders was analyzed using multi criteria decision analysis method. The social acceptance among farmers and agricultural research and production assistants remains low towards inhibitor technologies and CRU. However, fertilizer importers show positive attitudes towards these technologies. The main constraints for adapting these technologies include farmers' lack of knowledge and market factors such as high initial investments, consumer assurances, and government regulations. Addressing these challenges requires national policies aimed at increasing social benefits rather than solely focusing on financial or environmental gains. This necessitates incentives such as cost-sharing programs and financial investments, as well as strengthened extension systems to scale up the adoption of novel fertilizer technologies.

Keywords: Cost-benefit analyses, Fertilizer, Nitrogen, Nutrient use efficiency, Social profit, Technology adoption

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Willingness to Pay for Social and Ethical Aspects of Selected Fast-Moving Consumer Goods: A Study on Supermarket Consumers in Kandy District of Sri Lanka

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In the current world, consideration of social and ethical aspects (SEA) has become a lifestyle phenomenon or a trend. However, within the Sri Lankan context it seems a limited number of related studies are available to understand the consumers' willingness to pay (WTP) for SEA of fast- moving consumer goods (FMCG). This study determines the level of awareness among the consumers regarding the SEA in selected FMCG categories under two groups, factors determining their extent of consideration, and whether the WTP for SEA changes with the extent of consideration of SEA. Selected 2 product categories include livestock product category containing animal meat products and dairy products, industrial product category containing personal care products and baby products. Study is based on the Kandy municipal area supermarket customers with 100 participants that are randomly selected using the systematic sampling method. Data was collected through a survey using a questionnaire. Collected data was analyzed both descriptively and by using STATA 15 software and regression models. Among the participants only 19% were aware about the SEA of products. Results explained among the demographic factors considered, there is no statistically significant behavior between extent of consideration in SEA and age or awareness of the participants while gender has significant behavior between extent of consideration in SEA for industrial products. Product price and packaging have a significant difference with extent of consideration in SEA for both product categories whereas product brand and the availability also have a significant consideration when purchasing livestock products. Among the SEA, animal welfare and charitable contributions are considered significantly for both product categories. Environmental conservation, health and wellness and transparency initiatives are also considered for livestock products. For both product classes there is a significant difference between WTP for SEA with the extent of consideration of the SEA of products.

Keywords: Consumer awareness, Environmental conservation, Ethical and social considerations, Price premium, Willingness to Pay

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Process Optimization to Extract Oleoresin and Essential Oil

from the Leaves of Allspice [Pimenta dioica (L.) Merill.] and Screening of Its Essential Oil Composition, Antioxidant Capacity and Potential to Develop New Products
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3MT® (Three Minute Thesis) Competition

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Digital Detection of Frying Oil Rancidity Levels and Colour Profiles Using a Mobile Application
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Co-authors: Mendis B.E.P., Rajapakse R.P.N.P., Rengaraj T. and De Silva U.K.S.K.

1st runner-up: V.P.I. Bhagya
Consumer Awareness and Acceptance of Insect-Based Food and Feed in Sri Lanka
Co-authors: Weththasinghe P., Weerasooriya S.A. and Jayawardana B.C.

2nd runner-up: W.P.T. Wijenayake
Isolation and Characterization of Root Nodule Rhizobia from Non-Edible Legume Crops in Anuradhapura District to Formulate Bio-Fertilizer for Edible Legume Cultivation
Co-authors: Hemachandra P.A.I.U.

ResearTOON Competition

Winner: W.M.A.W.Y.C. Weerasekara
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Co-authors: Rajapaksha R.M.C.P. and Edirisinghe S.S.

1st runner-up: L.M.S.M. Kalhari
Potential Gelatin Replacement in Set-Yoghurt: Use of Exopolysaccharide-Producing YoFlex® Premium 6.0 Starter Culture
Co-authors: Vidanarachchi J.K., Jayawardene L.P.I.N.P., Gunathilaka W.L.C.M., Weerasingha W.V.V.R. and Priyashantha H.

2nd runner-up: T.A.D.M. Imesha
Development of Gelatin Free-Set Yoghurt with Seaweed Phycocolloids
Co-authors: Weththasinghe P., Jayawardana B.C., Vidanarachchi J.K., Wijesekara W.L.I. and Dhamsara M.J.

Research Storybook Competition

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Digital Detection of Frying Oil Rancidity Levels and Colour Profiles Using a Mobile Application
Co-authors: Somaratne G.M., Rathnayake P.P.A.J., Samarasekara M.A., Bandara C.Y., Wijelath W.A.G.E. and Madusanka U.G.Y.

1st runner-up: D.V.S. Abeysinghe
Process Optimization to Extract Oleoresin and Essential Oil from the Leaves of Allspice [Pimenta dioica (L.) Merill.] and Screening of Its Essential Oil Composition, Antioxidant Capacity and Potential to Develop New Products
Co-authors: Mendis B.E.P., Rajapakse R.P.N.P., Rengaraj T. and De Silva U.K.S.K.

2nd runner-up: E.M.D.D. Ekanayaka
Effect of Stocking Density on Growth, Feed Conversion and Survival of a Critically Endangered Freshwater Fish Labeo lankae (Sri Lankan Orange-fin Labeo) Under Captivity
Co-authors: Athauda A.R.S.B., Walpita C.N. and Mudalige A.R.

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