

Proceedings

Faculty of Agriculture Undergraduate Research Symposium

FAuRS - 2024



Faculty of Agriculture
University of Peradeniya
Sri Lanka

10th April 2025

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Research Symposium***

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Organized by



Faculty of Agriculture
University of Peradeniya
Sri Lanka

Faculty of Agriculture Undergraduate Research Symposium

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Message from the Vice Chancellor



It gives me great pleasure to extend my warm greetings on the occasion of the Undergraduate Research Symposium (FAuRS) 2024 of the Faculty of Agriculture, University of Peradeniya. I wish to congratulate all undergraduate students who are presenting their research at this important academic forum.

The Faculty of Agriculture has a long-standing tradition of promoting research and innovation that contribute to the advancement of sustainable agriculture and national development. Undergraduate research is a vital part of this mission, as it nurtures intellectual curiosity, analytical thinking, and creativity among students. Through such initiatives, our young researchers gain invaluable experience in addressing real-world agricultural challenges while strengthening their capacity for independent inquiry.

This symposium provides an excellent platform for undergraduates to share their research findings, exchange ideas, and receive constructive feedback from academics, professionals, and peers. It also encourages interdisciplinary collaboration an essential element in tackling the complex issues faced by modern agriculture.

I take this opportunity to express my sincere appreciation to the FAuRS 2024 Organizing Committee, and all staff members for their dedication and efforts in successfully organizing this annual event. I fervently hope that your findings will reach the farmers of this country.

I extend my best wishes to all participants for a successful and inspiring FAuRS 2024.

Prof. Terrence Madhujith
Vice Chancellor,
Faculty of Agriculture
University of Peradeniya

Message from the Dean



I am very happy to extend this message on the occasion of the Faculty of Agriculture Undergraduate Research Symposium (FAuRS) 2024. As we build upon a rich legacy of over 75 years, the Faculty of Agriculture at the University of Peradeniya remains Sri Lanka's premier institution for agricultural education and research, committed to shaping future leaders and innovators.

The journey of our Faculty, established in 1948, is a testament to a culture of innovation and academic excellence. A significant milestone in our history was the integration of a mandatory research component into our undergraduate curriculum in 1975. This pioneering step was designed to cultivate a spirit of inquiry and equip our students with essential research skills from an early stage. This tradition of scholarly investigation, initially nurtured through departmental-level symposia, evolved into the unified, faculty-wide symposium we celebrate today, which was inaugurated in 2014.

FAuRS remains a cornerstone of our academic calendar, offering final-year students an invaluable platform to present their research findings to a diverse audience of peers, academics, and industry experts. Beyond disseminating knowledge, the symposium fosters critical skills in scientific communication, critical thinking, and professional networking. Furthermore, I commend the students who have volunteered for the organising committee, thereby honing their leadership and management abilities. These experiences are vital in preparing our graduates to confidently address the complex challenges facing the agricultural sector.

The success of an event of this magnitude is the result of tireless effort and dedication. I extend my heartfelt congratulations and sincere gratitude to the FAuRS Coordinator and the entire Organising Committee for their meticulous planning and execution. To our student presenters and all graduating students, I offer my warmest congratulations. Your research represents the culmination of years of hard work and intellectual curiosity, and we are proud to witness your accomplishments.

I invite all participants to engage actively in the sessions, and FAuRS 2024 will be a stimulating and rewarding experience for everyone.

I wish the symposium a resounding success.

Prof. B.C. Jayawardana
Dean, Faculty of Agriculture
University of Peradeniya
March 18, 2025

Message from the Coordinator



It is with great pleasure and a profound sense of pride that I forward this message as the Coordinator of the 10th Faculty of Agriculture Undergraduate Research Symposium (FAuRS 2024). Celebrating a decade of excellence, FAuRS has firmly established itself as the flagship event of our Faculty's academic calendar, growing in scope and prestige each year. It serves as a vital platform for uncovering, developing, and showcasing the diverse talents of our undergraduates.

FAuRS provides an unparalleled platform for our final-year undergraduates to present the culmination of their research efforts to a discerning audience of academics, industry experts, and peers. Through participation in technical sessions and a diverse array of open competitions, our students sharpen their scientific communication skills, build invaluable professional networks, and gain the confidence needed to transition from academia to their professional careers.

This year's proceedings showcase the impressive scope of our students' research, comprising over 275 abstracts from our three esteemed degree programs: BSc in Agricultural Technology & Management, BSc in Food Science & Technology, and BSc in Animal Science & Fisheries. The contributions are organised according to the eight academic departments of study, highlighting the comprehensive nature of our curriculum.

An event of this scale is a collaborative endeavour. I extend my deepest gratitude to the Dean of the Faculty of Agriculture, Prof. B.C. Jayawardana, for his unwavering support and guidance. My sincere appreciation goes to the dedicated members of the FAuRS 2024 Organising Committee, the Editorial Board, session chairs, and evaluators, whose commitment has been the driving force behind this symposium. I am also grateful to the Heads of Departments, the academic and non-academic staff, our generous sponsors, and our enthusiastic student volunteers who have all contributed immensely to making this day a success.

FAuRS 2024 will be a memorable and enriching experience for all participants. To our graduating students, I wish you the very best in all your future endeavours. May the knowledge and skills you have gained here propel you to great heights.

Dr. W.M.T.P. Ariyaratne
Coordinator, FAuRS 2024
March 18, 2025

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Reconstructing Phylogeny of *Argyreia* Species (Convolvulaceae) Found in Sri Lanka

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Argyreia is a genus within the family Convolvulaceae which comprises climbing shrubs and vines primarily distributed across tropical Asia and retain physical dormancy (PY) as the ancestral seed dormancy trait. This study reconstructs the phylogenetic relationships of 5 *Argyreia* species (*A. nervosa*, *A. osyrensis*, *A. kleiniana*, *A. hirsuta*, and *A. thwaitesii*) out of 10 currently recorded in Sri Lanka to evaluate the evolutionary patterning of dormancy traits. The chloroplast *matK* gene region was amplified for these species and analysed using Maximum Likelihood (ML) and Bayesian Inference (BI). Phylogenetic reconstructions resolved a strongly supported monophyletic clade for the studied *Argyreia* species (posterior probability [PP] = 1, bootstrap [BS] = 91.73%), distinct from outgroup *Ipomoea* species. Within this clade, PY-retaining species (*A. nervosa* and *A. osyrensis*) formed a highly supported subclade (PP = 0.98, BS = 83.45%), consistent with the ancestral status of PY. Conversely, non-dormant (ND) species (*A. kleiniana*, *A. hirsuta*, and *A. thwaitesii*) clustered with moderate support (PP = 0.5, BS = 66.9%), indicating a derived divergence from PY lineages. Notably, *A. thwaitesii* and *A. hirsuta* formed a sister pair (PP = 0.54, BS = 75.18%), suggesting shared evolutionary traits. These results confirm PY as the ancestral state in *Argyreia* and ND as a derived trait, highlighting that seed dormancy traits are traceable through molecular phylogenetics. The study underscores the utility of *matK* gene region in elucidating functional trait evolution and further posits that integrating phylogenetic placement with fruit morphology could predict dormancy traits in unstudied species, advancing the understanding of trait diversification in this genus.

Keywords: Seed dormancy, Molecular phylogenetics, *Argyreia*, *matK* region, Sri Lankan flora

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Assessment of Vegetative Growth and Yield Related Traits of a Collection of Prospective Cultivars of Yard-long Bean (*Vigna Unguiculata*)

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Yard long bean (*Vigna Unguiculata*) is immensely important as a vegetable crop in Sri Lanka. There is a variety of indigenous yard long bean germplasm in Sri Lanka. Studying their morphological variability is essential for identifying superior genotypes and utilization in future breeding programs. The current research aimed at determining the genetic diversity among 14 genotypes of yard long bean based on morphological characteristics. A field study was conducted at the *Landmark* Agro Seeds farm in *Mihinthale* during the 2024/2025 *Maha* season. The field experiment followed a Randomized Complete Block Design with three replicates with each replicate having 10 plants per plot in each of the fourteen genotypes. Data on pod length (PL), pod diameter (PD), pod weight (PW), and yield (YLD) were recorded including *Mahaweli Mae*, *Polon Mae*, and *Sukhumvit Mae*. Data were subjected to Analysis of Variation and mean separation procedure followed by deriving Pearson correlation coefficients in Minitab software. Correlation analysis showed significant relationships among traits, particularly between PL and YLD ($r = 0.92$, $P < 0.01$), indicating longer pods contributing to higher yields, and between inter-node length (INL) and YLD ($r = 0.94$, $P < 0.01$), highlighting the positive correlations between INL and yield. PD and PL also showed a strong correlation ($r = 0.81$, $P < 0.01$), confirming that thicker pods tending to be longer. ANOVA revealed significant differences among the genotypes and Tukey's HSD test revealed *Maya MS Mae* having the highest pod weight ($P < 0.05$) and yield (506.68 ± 283.01), while *Polon Mae* recorded the lowest yield (130.12 ± 78.26). These findings emphasize the significance of morphological characterization in improving productivity and adaptation of yard long bean, supporting breeding programs aimed at developing high-yielding, disease-resistant varieties.

Keywords: Genetic diversity, Yard-long bean, Morphological traits, Breeding programs, Sri Lanka.

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Morphological and Molecular Characterization of a Panel of King Coconut Var. ‘*Rath Thembili*’

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King coconut (KC) (*Cocos nucifera* var. *Aurantiaca*) is a variety of coconut native to Sri Lanka and serves as a highly valuable germplasm resource. Evaluating and identifying germplasm resources is an indispensable step in breeding processes, playing a critical role in selecting and improving new varieties. Previous studies indicate that KC germplasm in the Kadugannawa area exhibits significant genetic diversity. KC individuals (n=22) were selected from home gardens in Kadugannawa, and data on 17 quantitative and qualitative morphological traits, including nut circumference, leaflet length, and kernel thickness, were analyzed using Principal Component Analysis (PCA). The highest contribution of traits revealed that the sweetness of the nut water accounts for 8.42% of the total variation. Based on the PCA, the seven most diverse samples were chosen for molecular analysis. Barcoding amplification was conducted after evaluating the *rbcL*, *matK*, and *trnH-psbA* barcoding regions using existing data from NCBI. The *trnH-psbA* region was selected due to its highest number of variation sites (60) in alignments, as determined by Geneious software. The sequenced results from the samples exhibited low signal levels due to contamination of extracted DNA from secondary metabolites. For further analysis, one SSR and one ISSR marker were tested with the most diverse individuals. SSR analysis did not reveal any variation, showing identical bands, while ISSR analysis demonstrated polymorphic loci. Bioinformatic analysis performed using data available in NCBI resulted in the phylogenetic tree for this variety. In conclusion, The KC population diversity should be characterized in terms of molecular, morphological, and biochemical traits, highlighting its significant potential for future conservation and breeding strategies. ISSR markers can be recommended for genetic diversity analysis of *Rath thembili* with additional samples and more markers.

Keywords: King coconut, Morphological descriptors, DNA Barcoding, *trnH-psbA*

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Molecular Characterization of a Panel of Rice Cultivars for Allelic Diversity in Yield-related Functional Markers

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Globally, rice (*Oryza sativa*) is cultivated as a cereal crop to meet over half of the world's nutritional requirements. Rice yield is a complex agronomic trait that the quantitative action of several genes determining the phenotype. The objective of the current research was to assess the allelic diversity of yield-related parameters in a panel of selected Sri Lankan rice varieties. A panel of 15 rice cultivars, including the top ten yielders introduced by the Department of Agriculture, two exotic cultivars, and three breeding lines, was genotyped at eight yield-related SSR marker loci. A pot experiment was carried out to analyze early growth parameters that are related to yield parameters. Summary statistics were derived, and cluster analysis was performed to derive a UPGMA dendrogram for molecular data using Darwin software. Principal Component Analysis, Cluster analysis, and Pearson correlation coefficient analysis were performed for morphological data using Minitab software. A total of 46 alleles were detected across eight loci with a mean value of 5.75 alleles per locus. All the selected markers were highly polymorphic, with the marker RM204 recording the highest number of eight alleles in the specific loci, followed by RM5709 and RM142, recording seven alleles per locus. The polymorphism information content (PIC) ranged from 0.117 (RM26499) to 0.864 (RM142), with an average of 0.6544. In conclusion, very high allelic diversity was recorded at yield-related SSR marker loci within the top 10 yielding rice varieties in Sri Lanka, indicating the potential for further yield increase in these varieties by gene pyramiding.

Keywords: Yield Parameters, Rice, Allelic diversity, SSR markers, Molecular characterization

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Dissecting the Adaptive Landscape of Alternative Splicing in Rice Under Abiotic Stresses

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Rice is one of the staple and economically important crops in the world, and it is highly vulnerable to abiotic stress conditions such as drought, heat, and salinity. There are multiple stress response mechanisms in rice plants. According to past Genome-Wide Analysis, these regulatory mechanisms are regulated by genes. Furthermore, alternative splicing is a post-transcription modification, which allows stress response by changing the transcriptome and thereby generating novel stress-responsive mechanisms. Further, splicing factors, various regulatory genes, and related mechanisms induce alternative splicing events under stress conditions, which result in spatial and temporal variations of translated proteins. This functional contribution of alternative splicing as a stress response has not been studied. This study has been conducted using the transcripts of *Oryza sativa* ssp. Japonica cv. Nipponbare from NCBI (National Center for Biotechnology Information) under drought, heat, and salinity for 7 timeframes including 1 hour, 3 hours, 6 hours, 12 hours, 24 hours, 36 hours, and 48 hours compared to control, which results in dynamic patterns of isoform switching, the significance of the isoform usages for 10 top switched genes in each 21 stress and timeframe combinations. Additionally, the distribution of alternative splicing events among the genes, isoform fractions, and stress conditions are visualized under each stress time combination compared to control. This dynamic nature of transcripts manifests the biological functions of genes and their regulatory mechanisms under stress conditions, supporting plenty of stress responses. Also, the distribution of the isoforms overlaps the drought, heat, and salinity stress conditions. Moreover, the dissection of alternative splicing events in rice under stress opens avenues to develop climate-smart rice varieties, enhance food security in climate-vulnerable regions, and collaborate molecular research.

Keywords: Alternative splicing, drought, salinity, heat, *Oryza sativa*

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Morphological Identification and PCR Optimization of Two *Ganoderma* (Ganodermataceae, Polyporales) Species Collected in Central Province, Sri Lanka

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Ganoderma (Ganodermataceae, Polyporales) is a wood-decaying genus with rigid, woody fruiting bodies. With over 300 species, the genus *Ganoderma* is found in many parts of the world; in contrast, a few species, such as *G. lucidum*, are widely recognized for their ethnomedicinal value and high demand in food and supplements due to their bioactive properties. The diversity of *Ganoderma* species in Sri Lanka remains unexplored. During an investigation into the diversity of *Ganoderma* species around the University of Peradeniya, Sri Lanka, ten species were collected. Field photographs and notes were taken, and the samples were taken to the laboratory at the Department of Agricultural Biology, Faculty of Agriculture. Among the ten samples collected, two were selected for further analysis. Mycelial cultures were established in Potato Dextrose Agar (PDA) under aseptic conditions using inner sections of fruiting bodies. Cultures were maintained in dark conditions at room temperature for 2-3 weeks. Detailed macro- and micro-morphological analyses of the basidiocarps and cultures were conducted, and the samples were identified as *Ganoderma cf. applanatum* and *G. cf. angustisporum*. Genomic DNA was extracted using the CTAB method (fungi-optimized), followed by rDNA-ITS amplification and sequencing for molecular identification, with fungal-specific ITS5 and ITS4 primers. PCR conditions were optimized by conducting a temperature gradient, incorporating bovine serum albumin (BSA) as a PCR enhancer, and adjusting the MgCl₂ concentration in the reaction mixture. The occurrence of *G. applanatum* and *G. angustisporum* in Sri Lanka was first reported in October 2024 as new records. DNA sequence results are still pending for final confirmation of the species. This study highlights the abundance of *Ganoderma* spp. at the University of Peradeniya, an area that remains largely unexplored. Additionally, these findings provide foundational data to support future taxonomic and phylogenetic research on *Ganoderma* species in Sri Lanka.

Keywords: *Ganoderma*, CTAB method, fungi, macro-micro-morphological analysis, ITS

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Development of an Effective Trapping System for Female Melon Fly (*Bactrocera cucurbitae*)

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The melon fly, *Bactrocera cucurbitae*, is a destructive pest of cucurbit crops locally and globally, causing yield losses of 30 – 100%. Existing control methods, especially chemical insecticides and male annihilation techniques, have limitations. This study was conducted with the objective of assessing selected bait materials to attract female *B. cucurbitae*, aiming to develop female-targeted trapping system. Laboratory experiment on life cycle study at 25–32°C, 65–75% RH, had developmental durations (days): egg 1.27±0.08, larvae 5.83±0.68, pupa 7±0.77. and adult 12.7±0.78 days. Six baits: hydrolyzed yeast, fishmeal, cow dung, bird droppings, and rotten cucumber were evaluated using a Y-tube olfactometer. Lac Gro protein bait was used as a standard control. There was a significant variation in attraction among baits ($F_{(5,24)} = 6.25$, $P < 0.05$). Attraction (%) in descending order were: bird droppings (71% ± 8%), cow dung (66% ± 13%), rotten cucumber (65% ± 7.1%), and Lac Gro bait (62% ± 9.3%), yeast (47% ± 4%) and fishmeal (42% ± 5.1%). Selected baits were field evaluated in a cucumber field at Adhikarigama, Kandy district in a cucurbit field. Trapping duration was seven days. When rotten cucumber was used as a bait, the traps had the highest mean attraction 99.33±14.05 flies per trap (80% of total capture), predominantly females (75.67%), whereas all other baits had an average of 4.73±1.71 flies. The disparity between the attractions in lab and field, may be associated with influences of abiotic factors, odor competition, wind dispersal, and host plant proximity. Rotten cucumber, which had higher attraction indicates its role as a natural oviposition site, emitting host-specific volatiles that attract egg-bearing females. This study concludes that the potential of using rotten cucumber as a bait to trap female fruit flies *B. cucurbitae*.

Keywords: Female-targeted trapping, Y-tube olfactometer, Rotten cucumber bait

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Laboratory and Field Evaluations of Boric Acid Based Gel against Common Domestic Ants in Sri Lanka

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Ants are common household pests, invading various buildings (restaurants, hospitals, warehouses ...etc.) in search of food and water. Ant management requires diligent efforts and the combined use of mechanical, cultural and often chemical control methods. Use of eco-friendly gel formulations is one of the promising means of ant control. Boric acid-based gel has been studied, global research on their efficacy is limited, yet no published studies in Sri Lanka. This study aimed to address this gap by evaluating the efficacy of boric acid-based gel under laboratory and field conditions against common domestic ants. Preliminary trials were conducted to determine the optimal ingredient ratio for the bait (T1: sugar powder, T2: fish meal powder, T3: sugar powder: fish meal powder (1:1), and T4: sugar powder: fish meal powder (3:1)). The T4 was selected based on ant visitation rates in three locations. Laboratory bioassays were conducted using T4 + agar treatment with four different boric acid concentrations namely 0.25%, 0.5%, 1%, 2%. Three commonly present ant species *Tapinoma melanocephalum* (ghost ants), *Monomorium pharaonis* (Pharaoh ants), and *Anoplolepis gracilipes* (yellow crazy ants) were selected for the bioassay with four replicates per treatment, each containing ten ants. The treatment was introduced to the ants on the first day and commercial bait (Optigard, 0.01% thiamethoxam), was used as the positive control. Mortality was recorded over five days. The gel solution with 2% boric acid was selected based on the mortality data ($p < 0.05$). A field evaluation at three different locations demonstrated a sharp decline in ant numbers post-baiting 533.3 to 1.3, 146 to 15.3, and 295 to 87.6. However, a gradual increase in populations afterward indicated the need for repeated gel applications. These findings confirm the effectiveness of boric acid-based gel and emphasize further research for optimized application strategies in Sri Lanka.

Keywords: boric acid gel, ant management, household pests, boric acid

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Assessment of Low-Cost Germination Enhancing Methods for Selected Weed Species in Coir and Development of a Seedling Guide

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Coir, a natural fiber from coconut husks, a key agricultural export of Sri Lanka. As one of the world's leading coir exporters, which faces challenges maintaining coir quality due to weed seed contamination. Posing a serious biosecurity risk. National Plant Quarantine Service implements a 21-day grow-out test to ensure the quality of coir, but seed dormancy often makes seeds undetectable. This study aims to identify low-cost methods to break dormancy and suppress germination of seven prevalent weed species in coconut-growing areas. Namely *Crotalaria pallida*, *Cuscuta reflexa*, *Mimosa pigra*, *Leucaena leucocephala*, *Mimosa pudica*, *Amaranthus viridis*, and *Chromolaena odorata*. I evaluated the effectiveness of KNO₃ at concentrations of 0.1%, 0.4%, and 0.75% (w/v); exposure at 323K for 10, 30, and 60 minutes; and varying coir depths of 0.5 cm, 1.5 cm, and 2.5 cm. Germination was monitored over 21 days and analyzed using binomial generalized linear models. Tukey-adjusted contrasts methodology was used to compare between treatments. The first phase of study was conducted to identify the most effective dormancy-breaking method for each species. Optimal dormancy breaking method for germination were: 50°C for 30 min treatment for *A. viridis*, *C. pallida* and *C. reflexa* seeds; 50°C for 60 min for *L. leucocephala* and *M. pigra* seeds; 50°C for 10 min for *M. pudica* and; 0.75% (w/v) KNO₃ for *C. odorata*. The second phase aimed to identify the most effective coir depth for seeds treated with the best dormancy-breaking treatment. Optimal coir depths for maximum germination were: 0.5cm of *M. pigra*, *L. leucocephala*, *A. viridis*, and *C. reflexa*; 1.5cm for *C. pallida* and *M. pudica* and 2.5cm for *C. odorata*. A seedling identification guide was developed to improve early weed detection accuracy. Implementing these strategies complies with international biosecurity standards, safeguarding Sri Lanka's coir industry and global ecosystem from invasive weed species.

Keywords: Low-cost germination method, Potassium Nitrate, Heat treatment, Coir depth, Seed dormancy

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Genetic Diversity Analysis of a Segregating Population of Pineapple (*Ananas comosus*) using Molecular Markers

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Genetic diversity analysis is essential for the effective breeding and conservation of pineapple (*Ananas comosus*), a commercially significant tropical fruit crop. This study aimed at assessing the allelic diversity of an F₁ segregating population of pineapple using Simple Sequence Repeat (SSR) markers. The F₁ population developed at the Fruit Research and Development Institute (FRDI), Horana, Sri Lanka has been derived by crossing *Kew*, *Mauritius* and *Gal Annasi*. DNA was extracted from a total of 26 progeny using an optimized CTAB protocol method and Molecular characterization was conducted at 4 SSR loci (TsuAC004, TsuAC010, TsuAC018 and TsuAC039), which amplified polymorphic loci, revealing the segregating nature of the progeny. Genetic relationships among the progeny were evaluated using Unweighted Pair Group Method with Arithmetic Mean (UPGMA) clustering, and a dendrogram was constructed using DARwin software. Resulting clusters distinguished three main clusters (A, B and C), reflecting the segregation of alleles inherited from the parental lines. Cluster A included two progeny plants while 19 and 5 progenies were grouped in clusters B and C respectively. Summary statistics calculated using Cervus software revealed 5 to 6 alleles per locus and mean expected heterozygosity (HE_{exp}) between 0.722 and 0.817. Observed heterozygosity (H_{Obs}) ranged from 0.000 to 0.077. The Polymorphic Information Content (PIC) varied from 0.657 to 0.773, classifying the markers as highly informative for genetic diversity analysis. Findings of the study confirmed the segregating nature of F₁ population and highlighted the potential of SSR markers as a reliable tool for genetic diversity assessment in pineapple. The observed genetic variations can be utilized for selecting superior genotypes to optimize the hybridization strategies in future breeding programs at the FRDI in the development of improved pineapple cultivars.

Keywords: Pineapple, Segregating Population, Genetic Diversity, SSR Markers

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Evaluation of *Trichoderma asperellum* Bio-Priming on Seed Germination and Vigor of *Black Cora* & *Kekulu* Common Bean (*Phaseolus vulgaris* L.) Varieties

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Trichoderma species are commonly used as biological control agents against phytopathogens and *Trichoderma* fungi enhance seedling growth by improving vigor, nutrient uptake, pathogen resistance, and overall health. The present study was conducted to evaluate the effects of *Trichoderma asperellum* biopriming at varying concentrations (0.5–3.5%) on seed germination and vigor in two common bean (*Phaseolus vulgaris* L.) varieties. *Kekulu* and *Black Cora* which are the most popularly grown bean varieties were selected for the study. The experimental design was Completely Randomized Design (CRD) and six different concentrations of priming along with hydro-priming and a negative control were tested on each of the two varieties. Data were recorded five days after germination and were analyzed using Analysis of Variance procedure followed by Tukey Mean separation procedure in MINITAB software. Seedling parameters (shoot length (SL), root length (RL), and total length (TL)) recorded significant differences of seed priming in all traits in variety *Kekulu*, ($p < 0.05$) recording the highest effect on Shoot length (23.53 cm) root length (20.62 cm), and total length (44.15 cm) of the seedling at 3% concentration (T6). However, Tukey tests indicated no statistical superiority over hydropriming (T8) or control (T9). There was no significant response for variety *Black Cora*, to the selected priming concentrations and tested *Trichoderma* species ($p > 0.05$) for root, shoot or total length of the seedling. Non-responsiveness of the variety *Black cora* may probably be due to its inherent high vigor and it may be the reason for wide cultivation of variety. This study indicates that *T. asperellum* biopriming enhanced *Kekulu* seedling growth, but the lack of significant differences between optimal concentrations (T6) and controls suggests the need to explore alternative *Trichoderma* species or combined priming strategies for greater effect for which further studies are recommended.

Keywords: *Phaseolus vulgaris*, biopriming, seed vigor, *Trichoderma asperellum*

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Molecular Diversity of *Flightin* in Insecta and Designing of Targeted Small Interfering RNA

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The green peach aphid (*Myzus persicae* Sluzer) is a significant agricultural pest, infesting various plants through feeding and transmitting over 100 viruses. Many commonly used conventional insecticides have become less effective due to the development of resistance in *M. persicae*, necessitating alternative control strategies. RNA interference (RNAi) has arisen as a promising, eco-friendly perspective for pest management by inducing gene silencing. We studied the molecular diversity of the *flightin* gene which is responsible for insect flight, contributing to *flightin* muscle elasticity and overall wing function. Additionally, we designed targeted double-stranded RNA (dsRNA) to stop its function. Deformation of wings will result in reducing the aphid's ability to move from plant to plant, resulting in reduction in onward transmission of a virus. To evaluate the molecular diversity of *flightin*, PSI-BLAST, MAFFT, and Geneious Prime were employed as bioinformatics tools. Molecular variation of the *flightin* exhibits high conservation in aphids. Based on the two mRNA transcripts found in *M. persicae*, siDirect was used to design two specific 100 base pair dsRNAs targeting each transcript with 100% identity and query cover. Notably, the designed dsRNAs revealed potential cross-species effectiveness against other aphid pest species targeting *Rhopalosiphum maidis*, *R. padi*, *Acyrtosiphon pisum*, and *Metopolophium dirhodum* within the range of 95-100% query cover. There is not a significant similarity between each dsRNA and mRNA transcripts of *Apis cerana*, *A. dorsata* and *A. florea* which are main bee pollinators that ensure their safety. These findings emphasize the potential of suppressing the function of *flightin* as a virus transmission reduction method through *M. persicae* and related aphid pests with minimal off-target effects, without affecting the beneficial pollinators. The application of targeted dsRNA demonstrates a sustainable alternative to synthetic insecticides, offering a precise and earth-friendly strategy for managing aphid-borne plant viruses.

Keywords: Pest control, Aphid-borne viruses, RNA interference, dsRNA, *flightin*, *Myzus persicae*

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Screening Selected Sri Lankan Rice Germplasm for Starch Synthesizing Genes and Associated Phenotypes

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Low-glycemic index (GI) rice is an important target in Sri Lankan and International rice breeding programs due to its health benefits. Starch, the main component of rice endosperm, consists of amylose and amylopectin, with their ratio determining the GI with higher ratios leading to low GI. This ratio is primarily regulated by starch-synthesizing genes which are *Granule-Bound Starch Synthase I (GBSS1)*, *Soluble Starch Synthase I (SSS1)*, and *Starch Branching Enzyme I (SBE1)*, all located on chromosome 6. The present study was conducted to identify genetic and phenotypic variations in amylose content in selected Sri Lankan rice germplasm. A total of 16 rice varieties were used for the analysis. Phenotyping for amylose content (AC) of those 16 varieties was done using the iodine colorimetric method. Five distinct clusters were predicted, with amylose contents ranging from 1.1 % to 27.2%, including superior clusters: CIC 300(25.9%), Ceylon purple rice (26.2%), Super kernel 06 (26.7%), Red fragrant (26.8%), Bg 403(27.2%). The 16 rice varieties were screened for genetic variations targeting starch synthesizing genes using linked SSR markers Wx, SSS, and SBE. However, based on PCR fragment size on 2% agarose gels, distinct genetic differences could not be visualized among the varieties. Bioinformatics analysis was conducted to identify variations in *GBSS1*, *SSS1*, and *SBE1* using 53 Sri Lankan rice accessions from the 3000K Rice Genome Project. Two known mutations in *GBSS1* (c.671A>C, c.1243C>T) were detected in 16 accessions out of 53 accessions. Five exonic mutations (c.86G>T, c.178C>A, c.220A>G, c.232G>T, c.258G>T, c.1312A>G) in *SSS1* and two exonic mutations (c.545C>A, c.2156T>C) in *SBE1* were identified among the selected accessions. These findings highlight significant genetic diversity in these genes within Sri Lankan germplasm highlighting the importance of further studies screening genetic variability in the local rice germplasm.

Keywords: Amylose content, Glycemic index, *GBSS1*, *SSS1*, *SBE1*

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Evaluation of the Repellent Property of Selected Essential Oils and Plant Extracts in Comparison with Prallethrin 1.24% (W/V) VP Against *Culex* sp.

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Some mosquito species function as major vectors of human diseases, posing significant public health risks worldwide. Among them, *Culex* spp. transmit pathogens responsible for Filariasis, Japanese Encephalitis and West Nile Virus. In domestic surroundings, mosquito population suppression has been achieved through an integrated approach mainly focusing on habitat management. Prallethrin based products are widely used to repel adult mosquitoes. However, the product may have an impact on human and environmental health. Hence, there is a need for human friendly mosquito repellents. Objective of this study was the evaluation of repellent property of selected essential oils and plant extracts against *Culex* sp. Oils of citronella, eucalyptus, lemongrass, rosemary, clove and cinnamon were used as essential oils while neem, turmeric, holy basil, snap ginger, and garlic were used as plant extracts. Prallethrin was used as the standard control. Repellent property was evaluated using Y-tube olfactometer using adult *Culex* sp. There was a significant variation of the repellent property among the tested materials ($\chi^2 = 29.6$, $df = 11$, $P < 0.05$). Citronella ($94.4 \pm 2.8\%$) had the highest repellency followed by lemongrass ($93.9 \pm 3.1\%$). Of the botanicals, holy basil leaf extract ($80.1 \pm 3.8\%$) had the highest repellency followed by garlic ($79.5 \pm 3.2\%$). Repellent property of some of the products decreases significantly with time within six hours. The results of this study confirm the potential of using citronella and lemongrass from essential oils and holy basil and garlic from plant extracts as repellents against the *Culex* sp. However further research is needed to develop an effective application method.

Keywords: Mosquito repellents, Natural alternatives, Y-tube olfactometer, Volatile compounds

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Morphological Identification, Optimization of DNA Extraction and PCR Protocols for Identification of Candidate Tree Pathogens in Symptomatic Plant Species of Central Province, Sri Lanka

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Plant pathogens associated with diseased or symptomatic forest tree species and their diversity have been least studied in Sri Lanka. Therefore, the present study was conducted to detect and identify candidate plant pathogens isolated from symptomatic tree species growing in three natural ecosystems: the Riverstone and Pitawala Pathana regions of the Knuckles Forest Range and the Hanthana Forest Reserve bordering the University of Peradeniya. Using both morphological and molecular methods, microorganisms were isolated by culturing symptomatic plant parts and were identified morphologically through macroscopic and microscopic observations. DNA extraction methods were optimized by comparing the standard CTAB, modified CTAB, SDS-proteinase K, and two commercial kits. The ITS region of the extracted fungal DNA was amplified using ITS1 and ITS4 primers and an annealing temperature within the range of 49–55°C. Symptomatic plant samples comprised leaf spots (59.4%), blight (31.3%), scabs (3.1%), branch swelling (3.1%), and other uncategorized symptoms (3.1%) across 25 different tree species. Among the isolates, *Pestalotiopsis* spp. (37.5%) and *Colletotrichum* spp. (25%) were the most abundant in symptoms, while 25% were unknown species, followed by *Pseudocercospora* spp. (6%), *Curvularia* spp. (3%), and *Septoria* spp. (3%). The modified SDS-proteinase K method yielded high-quality DNA and annealed the same optimally at 51°C with ITS1 and ITS4 primers using PCR. This study provides important insights into the morphological and molecular identification of candidate plant pathogens affecting tree species in natural ecosystems in the Central province of Sri Lanka. The isolated fungi were preserved and repositied in the Plant Pathology and Microbiology Laboratory of the Department of Agricultural Biology, Faculty of Agriculture, University of Peradeniya, for future research.

Keywords: Knuckles, Hanthana, Forest plant pathology, DNA extraction, PCR amplification

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Assessment of the Diversity of Moth Species in Two Selected Locations of Sri Lanka

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The majority of the species in the Order Lepidoptera, the third-largest insect order, are moths. Moths play an important ecological role as pollinators, prey and pests. Despite their ecological significance, moth diversity in Sri Lanka has been poorly studied. This research was conducted with the objectives of assessing the moth diversity in two locations within the wet zone and dry zone and examining the effects of time of the day, humidity and temperature on the level of moth activity. Moth diversity was studied at Dilmah One Earth Climate Change Centre, Nawalapitiya (6°58'17.06"N 80°35'38.64"E) and Mahailluppullama Subcampus (8°5'52.61"N 80°26'31.57"E) using a light trap (light tent). The moth counts were recorded on an hourly basis between 19:00 and 00:00 hour for seven days at each location, together with temperature and humidity. The moths were photographed and a sample of moths were collected for identification. At Dilmah Centre, (Up country wet zone), 81 moth species belonging to 19 families were recorded. Thirty four species were pests. 38% of moths belonging to the Family Crambidae. Moth diversity was reflected by Shannon's diversity (2.48-2.99) and Pilon's evenness (0.83-1.00). At Mahailuppallama Subcampus, 56 moth species were found belonging to 13 families. Ten species were pests. 53% of moths belongs to the Family Erebidae. Shannon's diversity and Pilon's evenness were 1.97-2.87 and 0.66-0.96 respectively. The level of moth activity was positively correlated with relative humidity and moth activity was not influenced by ambient temperature at Dilmah Centre, whereas moth activity was negatively correlated with both the parameters at Mahailuppallama. Irrespective of the climatic factors, highest moth activity was recorded from 19:00 to 20:00 hour at both locations.

Keywords: Lepidoptera, Moths, Diversity, Evenness, Ecology

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***In-situ* Morphological Characterization and Molecular Assessment of a Collection of Coffee (*Coffea* spp.) Grown in Home Gardens in Sri Lanka**

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Information on genetic variability is a prerequisite for improvement of yield and quality of coffee. However, information on the genetic variability of coffee germplasm in Sri Lanka remains scarce. The objectives of the present study were to do an *in-situ* morphological characterization and a molecular assessment of home garden grown coffee in Sri Lanka. Fifty-eight coffee genotypes were collected from Kandy, Kurunegala, Kegalle, Galle, Gampaha, and Matale districts. Morphological assessment was done based on 23 quantitative and 23 qualitative traits. Principal component and cluster analyses were performed based on 23 quantitative traits of 58 coffee genotypes. The first and second principal components accounted for 82.05% and 10.67% of the total variability, respectively. Principal Component Analysis revealed that the number of flowers per axil, leaf width, seed, and berry-related traits as the principal characters to discriminate explored coffee genotypes. Quantitative traits based cluster analysis grouped the coffee genotypes into fourteen clusters. A total of 19 alleles were amplified at the two SSR marker loci, including 12 alleles for AJ250254 and seven alleles for AJ250257. Polymorphic Information Content (PIC) values were 0.8631 in AJ250254, and 0.8036 in AJ250257. The minimum allele frequency was 0.033, and the maximum was 0.233. Most allele frequencies were found to be concentrated around 0.033 to 0.133. Observed heterozygosity was as low as 0.0333 for AJ250254 and 0.0000 for AJ250257. The dendrogram based on SSR marker data showed 11 clusters. In conclusion, a considerable variation was observed in the morphological traits among coffee genotypes. Despite the polymorphic nature of the two SSR markers, it is recommended to use more markers for molecular characterization. The diversity of coffee genotypes in both quantitative and qualitative traits revealed by the present study can be used for trait improvement in coffee breeding programs.

Keywords: Principal component analysis, SSR markers, Dendrogram, Quantitative traits, Qualitative traits

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Whole Genome Assembly of Sri Lankan Honey Bees (*Apis cerana* Fabricius)

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Apis cerana Fabricius is endemic to most of Asia, where it has been used for honey production and pollination services for thousands of years. The genome of *A. cerana* has been sequenced by several countries using various sequencing technologies. Here, we present a referenced-based genome assembly of Sri Lankan *A. cerana* using Illumina NovaSeq paired-end sequencing and the Galaxy bioinformatics platform, aligned with the NCBI reference (AcerK-1.0). The assembled genome spans 4.4 Gbp and exhibits high completeness (98.6% BUSCO score: 5,900 complete single-copy, 7 duplicated, 36 fragmented, and 48 missing out of 5,991 BUSCO groups), with 32.62% GC content and 96.61% chromosomal mapping accuracy (Bowtie2). Gene annotation identified 10,216 genes, including 10,141 protein-coding genes, of which 8,807 have orthologs in NCBI's nr database, and 1,232 are unique. Functional analysis revealed 10,825 protein domains representing 3,752 protein families, offering key biological insights. The variant analysis demonstrated 0.87% genetic divergence from the 223 Mb reference genome, comprising 1,624,343 SNPs and 308,357 indels (Ts/Tv ratio: 3.87%), highlighting substantial diversity with strong signatures of selection in climate adaptation and foraging genes. Repetitive elements were minimal (0.05%), including 24 SINEs, 381 LINEs, 61 LTR elements, 213 DNA elements, and 866 unclassified repeats. These genetic features reflect evolutionary fine-tuning to Sri Lanka's unique ecosystems. This high-quality assembly serves as a foundational resource for selective breeding programs aimed at enhancing honey production and disease resistance in *A. cerana*, while advancing the broader understanding of Asian honey bee genomics and supporting sustainable beekeeping development in Sri Lanka.

Keywords: *Apis cerana*, Genome assembly, Genome annotation, Variant analysis

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Genome Assembly and Annotation of the Dwarf Honey Bee (*Apis florea* Fabricius)

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The dwarf honey bee (*Apis florea*) is one of the major pollinators in Asia, and remains understudied despite its ecological significance. This study focuses on the genome assembly and annotation of *A. florea* drones. Genomic DNA was extracted using the Qiagen Blood and Tissue Kit and sequencing was carried out using the Illumina NovaSeq platform. Reference-based genome assembly was conducted using the NCBI reference sequence (Aflo_1.1) on the Galaxy bioinformatics platform. Our assembly spread 6984 scaffolds, 3.5 Gbp total bases with a GC content of 33.72%. Reads mapping using Bowtie2 showed 95.52% alignment to the assembly, while BUSCO assessment revealed high completeness (96.9% complete single-copy orthologous, 0.1% duplicated orthologous, 1.8% fragmented orthologous, and 1.2% missing). The variant analysis identified 787,591 SNPs and 264,066 Indels, with a Ts/Tv ratio of 3.60%, indicating strong purifying selection. Repeat analysis showed low repetitive content (0.04% interspersed repeats), including 19 SINEs, 351 LINEs, 69 LTRs, and 197 DNA elements with 687 unclassified repeats that indicate the novel regions. Functional prediction resulted in 10,216 protein-coding genes belonging to 3,775 gene families containing 10,807 protein domains, 105 conserved motifs, and 270 domain repeats. Comparative genomics identified 8,984 genes with orthologous in the NCBI nr database, while 1,119 genes were unique to *A. florea*, potentially underlying species-specific adaptations. This study advances our understanding of this ecologically important pollinator through the assembly and annotation of its genome. Future research on dwarf honey bee behavior, adaptation, gene diversity, structural variants across *Apis* species, and comparative genomics will be greatly aided by the findings of this study.

Keywords: Dwarf honey bee, *Apis florea*, Whole Genome Sequencing

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Isolation and Characterization of Soil Antagonistic Microorganisms for Development of Microbial Consortia for the Management of Bacterial Wilt Caused by *Ralstonia solanacearum* and Plant Growth Promotion in Tomato

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Bacterial wilt caused by soil-borne *Ralstonia solanacearum* is identified as the greatest threat to tomato cultivation in Sri Lanka, resulting in significant economic losses. Due to the adverse effects of chemical control, biological control of plant diseases is of prime importance as a sustainable and environmentally safe alternative. The use of Microbial Consortia (MC) in plant disease management is a novel trend worldwide. This study aimed to isolate and characterize soil microbial antagonists to develop MC against *R. solanacearum* for controlling bacterial wilt and promoting plant growth in tomatoes. Bacteria and fungi were isolated from the rhizosphere and bulk soil samples of healthy and bacterial-wilt-affected fields. Three bacterial isolates (TTRB2, TTRB4, and TTBB6) out of 30 and 1 fungus (TTRF3) out of 4 were antagonists against *R. solanacearum in vitro*. Based on the compatibility of the antagonists, consortium 1 (TTRB2, TTRB4, TTBB6) and consortium 2 (TTRB2, TTRB4, TTRF3) were developed. Meanwhile, individual isolates were tested for plant growth-promoting traits (nitrogen fixation, phosphate solubilization, IAA production, and seed germination) *in vitro*. Accordingly, TTRB4, TTBB6, and TTRF3 showed nitrogen fixation. TTRB2 and TTRF3 showed phosphate solubilization. TTRB4 showed IAA production. In the germination test, seeds treated with MC showed a significant ($p < 0.05$) increase in plumule length, while no treatment had a significant effect on radicle length. There was no significant effect ($p > 0.05$) of the treatments on tomato plant height or the number of leaves in the plant house experiment. The results indicated a disease incidence of 33% in both plant groups treated with TTRB2 and positive control. Based on morphological analysis, the bacterial isolates were preliminarily identified as *Bacillus* spp., while the fungal isolate was identified as *Trichoderma* sp. The two MC can be potential candidates as dual-purpose inocula for both bacterial wilt control and plant growth promotion in tomato upon performance validation in field trials.

Keywords: *Ralstonia solanacearum*, Tomato bacterial wilt, Microbial consortia, Antagonism, Plant growth promotion

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Effects of Disease Severity Stage on Molecular Detection of Causative Pathogen of Weligama Coconut Leaf Wilt Disease

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Weligama Coconut Leaf Wilt Disease (WCLWD) is one of the devastating diseases in the Southern province of Sri Lanka, causing drastic yield reductions. The causative pathogen of WCLWD is phytoplasma, which is an intra-cellular obligate pathogen. Accurate molecular detection of phytoplasma is important for effective disease management especially due to its lengthy latent period, during which the disease could be spread from non-symptomatic infected palms. This study aimed at assessing the effect of disease severity stage; mild moderate and severe, on molecular detection of phytoplasma using Polymerase Chain Reaction (PCR) and investigating possibilities for enhancing PCR accuracy. Two sampling rounds were conducted in 30 selected WCLWD palms, with 10 each from mild, moderate and severe disease categories using 10 healthy coconut palms as control white leaf disease affected sugarcane as the positive control. DNA was extracted from the midrib of milky white emerging bud leaf tissues using CTAB method, and nested PCR (primers P1 and Tint nested with Ru3 and fu5) was performed to detect phytoplasma. Extracted DNA was purified using Qiagen DNA purification kit to evaluate the effect of DNA purification on PCR. PCR results were assessed and compared between pre-purified and purified DNA samples. Results revealed higher PCR positivity in the moderate stage. PCR positivity for pre-purified DNA was 20%, 30% and 0% respectively for mild, moderate, and severe stages. Upon DNA purification PCR positivity increased to 30%, 60% and 30 % respectively for mild, moderate and severe palm categories. None of the healthy controls showed PCR positivity. In conclusion, DNA purification improved the quality of extracted DNA and efficiency of PCR detection. Moderate disease severity stage was identified as the best stage for detection of WCLWD phytoplasma. The findings would be useful in WCLWD management programs.

Keywords: Disease severity, Phytoplasma, Polymerase Chain Reaction, Weligama Coconut Leaf Wilt disease

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Morphological and Molecular Characterization of King Coconut Form '*Bothal thembili*'

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Bothal thembili (BT) is one form of the coconut variety *Aurantiaca*. This research was carried out with the objective of characterizing morphological and molecular diversity of BT germplasm. Twenty BT samples and 22 control samples were used in molecular characterization. BT samples were collected from Middeniya, Rathnapura and Kaluthara. Fruit and stem morphology data were recorded following IPGRI descriptors and genotypic data were recorded at 4 coconut-specific microsatellite loci. Morphological data were analyzed by General Linear Model procedure and principal component analysis in Minitab. Cluster analysis, based on genotypic data was performed by shared allele method in Powermarker software. Results revealed significant differences ($P < 0.05$) between Tall, King Coconut (KC) and BT. No significant differences were observed among plants in leaf and inflorescence morphologies. Fruit morphology was significantly different among varieties for different descriptors. In score plot analysis there were three distinctive clusters; Tall, KC and BT. No specific clustering patterns were observed among BT for all morphological traits based on the area. SSR locus CAC 65 was recorded to be the most informative among the SSR markers tested, including CnCir E2, CAC 68 and CNZ 10. Hierarchical clustering of genotypic data resulted in two main clusters; Tall and Yellow Semi Tall formed one cluster while the other varieties formed a separate cluster including Dwarf and *Aurantiaca*. Although, BT is classified under *Aurantiaca*, in current study it was clustered with Dwarf showing a close relationship with them. Within BT cluster samples scattered regardless of area sampled emphasizing low genetic variation within BT and forming a single ecotype. This research would be useful in breeding and germplasm conservation of BT. Also the study emphasizes the need for further research on the genetic diversity of BT populations in comparison to other coconut varieties.

Keywords: King coconut, *Bothal thembili*, Morphological descriptors, Molecular characterization

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Deducing Evolutionary Relationships of *Myristica* spp.

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The genus *Myristica* contains 173 species including *Myristica fragrans* Houtt., which is commonly known as nutmeg. *Myristica fragrans* is native to Moluccas and Banda islands of Indonesia, and it is cultivated as a spice in many countries including Indonesia, India, Malaysia and Sri Lanka. In Sri Lanka, three *Myristica* spp. are found; *Myristica fragrans*, *Myristica dactyloides* Gaertn., and *Myristica ceylanica* A. DC. The current study is focused on reconstructing the evolutionary relationships of *Myristica* spp. based on the chloroplast *psbA-trnH* intragenic spacer region. Accordingly, sequences of 54 accessions were retrieved from NCBI representing: *Myristica malabarica* (7), *Myristica beddomei* (6), *Myristica magnifica* (6), *Myristica andamanica* (2), *Myristica yunnanensis* (7), *Myristica globosa* (1), and *Myristica fragrans* (25). From Sri Lanka, three accessions of *M. fragrans* and two accessions of *Myristica dactyloides* were obtained. All 54 *psbA-trnH* sequences were aligned, curated, and trimmed to a 289-bp region common to all retrieved sequences. The phylogenetic tree was reconstructed using the Maximum Likelihood approach, rooting the tree with the outgroup *Knema attenuata*. Phylogenetic tree revealed clustering of Sri Lankan *M. fragrans* accessions with exotic accessions of *M. fragrans*. The two accessions of *M. dactyloides* clustered into a non-monophyletic clade with *M. malabarica*, *M. beddomei*, and *M. magnifica*. The haplotype network involving the target *psbA-trnH* region revealed 19 haplotypes, with distinct genetic variations among the considered species. The low bootstrap support at the clades and lack of monophyly within the species indicates that the barcoding marker *psbA-trnH* is not ideal for resolving the evolutionary relationships of *Myristica* species. Future research must be conducted to reconstruct the phylogenetic relationships targeting different genes and more accessions belonging to *M. dactyloides* from different localities to better resolve its position in the phylogenetic tree. Further, the evolutionary relationships of *M. ceylanica* should be established within the genus.

Keywords: Barcoding, Haplotype network, Maximum likelihood phylogenetic analysis, *Myristica dactyloides*, Phylogenetics

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Evaluating the Efficacy of a Hydrotalcite-Fragmented DNA Nanocomposite in Controlling Southern Blight of Watermelon caused by *Sclerotium rolfsii*

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Southern Blight (SB), caused by *Sclerotium rolfsii*, is a destructive soil-borne disease of watermelon (*Citrullus lanatus*). Fragmented genomic DNA (FgDNA) of pathogens acts as a biotic elicitor, triggering host plant resistance when applied exogenously. Nano-enabled biotic elicitors (nanocomposites) have been explored for plant disease management. This study evaluated the efficacy of a nanocomposite formulated with hydrotalcite and FgDNA of *S. rolfsii* as an elicitor treatment in reducing SB incidence compared to non-formulated FgDNA. The study also assayed defense enzyme activity in treated plants. Watermelon seedlings (var. Sugar Baby) were treated with three distinct nanocomposite formulations, prepared with 1, 2, or 3 µg of FgDNA combined with 1 g of hydrotalcite. The same concentrations of FgDNA without hydrotalcite were applied for comparison, along with control treatments. Elicitor treatments were applied as a soil drench at the three-leaf stage of the seedlings, followed by *S. rolfsii* inoculation five days later. SB incidence, the number of sclerotia per pot, and plant dry weight were quantified 14 days post-inoculation. Peroxidase and total phenol activity were measured as defense enzymes on days 1, 3, 5, and 7 post-elicitor treatments. All elicitor treatments significantly ($P < 0.05$) reduced SB incidence compared to pathogen-inoculated, untreated plants. The nanocomposite formulated with 2 µg of FgDNA and 1 g of hydrotalcite achieved the highest disease control (63%). Elicitor-treated pots also exhibited a significantly lower number of sclerotia than untreated pots. Phenol content was significantly higher in plants treated with all elicitor treatments compared to the control treatments, with a notable increase observed on the fifth day post-treatments. These findings indicate that the hydrotalcite-FgDNA nanocomposite and non-formulated FgDNA effectively control SB, highlighting their potential as biotic elicitors in plant disease management.

Keywords: Nano-enabled biotic elicitors, PAMP-triggered immunity, Defense enzymes

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Introgression and Screening for the '*Rathu Heenati*' Alleles Associated with BPH Resistance

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The Brown Planthopper (BPH), *Nilaparvata lugens*, is a major pest threatening rice (*Oryza sativa*) production globally, causing severe yield losses through feeding and transmission of virus. *Rathu Heenati* [International Rice GenBank Collection (IRGC) Accession 11730], traditional Sri Lankan rice variety, is recognized for its broad-spectrum resistance to BPH, primarily due to the *Bph3*. This study aimed to study the *Bph3* allele in silico followed by molecular marker assays to facilitate introgression of BPH resistance from *Rathu Heenati* into Bg352, a high-yielding but susceptible elite variety, using marker assisted backcrossing, and to screen the parental lines for resistant alleles with molecular markers. Crosses between *Rathu Heenati*, and Bg352 produced BC1F1 plants after successfully completing the F1 generation. DNA was extracted from parental lines using the CTAB method, followed by PCR amplification with Simple Sequence Repeats (SSR) markers RM589 and RM19291, which were associated with the *Bph3* Quantitative Trait Loci (QTL) on chromosome 6. However, screening of parental lines revealed that RM589 was monomorphic, amplifying fragments of similar sizes in both parents, while RM19291 amplified only in Bg352, failing to produce a PCR product in *Rathu Heenati*. These results indicated that neither marker can effectively distinguish resistant from susceptible alleles in this population, likely due to variations in the primer binding site. To overcome this, alternative approaches are recommended, sequencing candidate gene identification and designing of novel marker systems. Cross-pollination involved emasculating Bg352 panicles and pollinating with *Rathu Heenati* (BC1F1) which was carried out as part of ongoing research efforts to introgress BPH resistance into Bg352. Successful introgression of BPH resistance into Bg352 could enhance rice production by reducing pesticide reliance and mitigating crop losses, but it requires robust screening tools tailored to the genetic diversity of *Rathu Heenati* and Bg352.

Keywords: Brown Planthopper (BPH), *Rathu Heenati*, *Bph3* QTL, Marker-assisted selection (MAS), Backcrossing

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Morphological Variation of *Apis cerana* Across Different Agro Ecological Regions and Survey of Bee Keeping Practices in Sri Lanka.

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Apis cerana Fabricius (1793) has been utilized for honey production in Sri Lanka, however annual yields remain insufficient to meet national demand. There is significant potential to increase production. For centuries, *Apis mellifera* has been selectively bred, still *A. cerana* has not. Studying its variation is essential to initiating bee breeding. The diversity of *A. cerana* in Sri Lanka is poorly understood, creating a research gap. This study analyzed its variation across agroecological regions and a survey was conducted to gather information on differences in beekeeping management practices and challenges. In this study, 720 pollen carrying foraging worker bees were collected from 72 maintained beehives, covering all seven agro climatic regions and 24 agro-ecological regions in Sri Lanka. These regions included WU1, WU2b, WU3, WM1a, WM2b, WM3b, WL1a, WL2b, WL3, IU1, IU2, IU3b, IM1a, IM2a, IM3b, IL1b, IL2, IL3, DL1b, DL2a, DL2b, DL3, DL4, and DL5. A total of 35 morphometric characters were selected based on previous studies. Parametric data were analyzed using one-way ANOVA and Tukey's test, while non-parametric data used the Kruskal-Wallis test. Principal cluster analysis identified clusters, followed by Multivariate Cluster Analysis in PAST using a Bray-Curtis dendrogram with 1,000 bootstraps. The analysis showed significant differences ($p < 0.05$) in all morphological traits across agroecological zones, forming four distinct clusters identified based on branching pattern of dendrogram, as U1 cluster, DL3-DL4 cluster, DL5 cluster, separate cluster with the remaining zones. The findings indicate morphological variation across agroclimatic zones, requiring further molecular study for confirmation. A face-to-face survey of 96.7% of 60 Sri Lankan beekeepers identified weather changes as the main challenge. The 8-framed beehive, recommended by the department, was the most used, adopted by 70% of farmers and as primary pests, ants and geckos were identified.

Keywords: *Apis cerana*, Morphology, Agro ecological zones, Sri Lanka, Survey

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Allele Profiling of Selected Sri Lankan Rice Accessions for Major Seedling Stage Heat Tolerance Genes

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Heat is a major abiotic stress which affects rice cultivation. In the current study allelic variations in five major heat tolerance genes: *HTS1*, *TT1*, *TT2*, *HTAS* and *SLG1* were profiled across a selection of Sri Lankan rice accessions. Based on a genomic sequence alignment consisting of 62 rice accessions, single nucleotide polymorphism (SNPs) and insertion and deletion (InDels) variants were identified for each of the five genes. Considering previously reported diagnostic SNPs/InDels, allele profiles for the five heat tolerance genes were developed to reveal the heat response alleles carried by each rice accession. For the genes *HTS1* and *HTAS*, all tested accessions reported the tolerance allele and for the genes *TT1* and *SLG1*, all reported the susceptible allele. For the gene *TT2*, only 14 varieties including the Sri Lankan varieties At354, Bg304, Bg90-2, Bg94-1, 3210, A69-1, *Sigardis* and *Kulakaruppan* reported the tolerance allele. The tolerance reference N22 carried the heat tolerance alleles only at the genes *HTS1* and *HTAS* (type-1). However, some known susceptible varieties carried tolerance alleles at *TT2* in addition to *HTS1* and *HTAS* (type-2). This indicates the possibility that the tolerance in N22 could be controlled by other major genes that were not assessed in the current study. Out of the Sri Lankan rice accessions 79% was grouped to type-1, and the remaining to type-2. To improve the heat tolerance of Sri Lankan rice accessions the tolerance alleles of the two genes *TT1* and *SLG1* could be introgressed. Of the five genes studied none were found to be co-expressing, however, *TT1*, *TT2*, *HTS1* and *HTAS* co-express with other genes involved in plant stress responses. In future research the allele profile could be improved by including other heat tolerance genes and profiling can be extended to rice varieties commonly used in breeding programs.

Keywords: Heat tolerance at seedling 1, Heat tolerance at seedling stage, Thermotolerance 1, Thermotolerance 2, Slender guy 1

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Morphological and Molecular Characterization of Easy Peeling Germplasm of Cultivated Cinnamon in Sri Lanka

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Ceylon cinnamon is a highly valued export crop known for its superior quality, including low coumarin content and distinct organoleptic properties. However, the industry faces challenges due to a shortage of skilled peelers and high processing costs. This study aimed to identify and characterize easy-peeling germplasm in cultivated cinnamon through morphological and molecular analyses to support breeding programs, reduce peeling costs, and promote mechanized peeling. Ten samples, locally known as "*Peiris Kurundu*," were selected based on their straight stems and ease of peeling. Morphological characterization involved measuring leaf length, width, petiole length, which were assessed using a cinnamon morphological index. The analyzed samples exhibited morphological index scores (MIS) ranging from 30.03 to 38.3, confirming their classification as cultivated *C. zeylanicum*, whereas the control variety, *Sri Gemunu*, had an MIS of 40.3. Statistical analysis using Dunnett's test revealed that all easy-peeling samples were significantly different ($P < 0.05$) from *Sri Gemunu* in stem erectness. Microscopic examination of leaf midrib anatomy showed similar anatomy among samples. Molecular analysis involved DNA extraction and PCR amplification of a selected region in the chloroplast YCF region. Sequence analysis revealed that eight samples aligned with *Sri Gemunu*, while two accessions exhibited a 17-bp indel. When aligned with endemic wild cinnamon relatives, six wild varieties exhibited the same indel for the same region. Since the analyzed samples had significantly erect stems compared to department released *Sri Gemunu* and were categorized as cultivated *C. zeylanicum* they can be released as a new cultivar or considered as a potential breeding resource after considering a biochemical analysis. These findings provide valuable insights for strengthening cinnamon breeding programs, improving selection efficiency, enhancing production, and understanding current status of cultivated germplasm in Sri Lanka.

Keywords: Cinnamon, *Peiris Kurundu*, Molecular Characterization, Morphological Characterization, Easy Peeling

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Assessment of Hybridity in Horana Papaya Hybrid¹ Using Molecular Markers

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Papaya (*Carica papaya*) is one of major fruit crop which widely cultivated in Sri Lanka for its nutrient benefit with high carotin and vitamin C content. In economic aspect, papaya plays a huge role both in commercial and small-scale cultivations contributing to country's economy. Hybrid papaya (horana papaya hybrid1) seeds are in high demand due to their improved characteristics. However, it has been reported that only approximately 80% of seeds exhibit true hybrid characteristics which compromise crop quality and results financial losses. This emphasizes need of early and reliable hybridity identification. This study was carried out to determine hybridity of horana papaya hybrid1 seedlings in the fruit research and development institute, Horana. A PCR based marker system was used and four primer combinations namely, CPY, BGAL, SSR 35 and SCAR marker svp were tested to distinguish true F1 hybrids from parental lines. To optimize PCR conditions various annealing temperatures were tested with all primers. Thirty-five hybrid seeds were planted and DNA was extracted by modified CTAB method followed by PCR amplification and agarose gel electrophoresis, alongside with two parental lines. The SSR 35 marker was selected as it effective to discriminate the hybrids and parents by the presence of distinct double bands in hybrids, confirming their heterozygosity, whereas single bands were observed in parents. However, some samples exhibit unclear bands, highlighting the need for further refinement of the protocol to improve reproducibility. In addition to the molecular analysis, a morphological characterization was conducted using the IPBGR descriptor in order to obtain an overview of parental and hybrid traits, providing insights to phenotypic variations underlying genomic differences. This is the first study on papaya hybridity using molecular markers in Sri Lanka, addressing a critical research gap, and making a significant contribution to the field.

Keywords: SSR markers, hybridity testing, papaya, Horana papaya hybrid1, molecular markers

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Complete Chloroplast Genome of *Dysphania aristata* and Comparative Analysis with Relative *Dysphania* Species

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The chloroplast (cp) genome plays a significant role in plant evolution, phylogenetics and species identification. *Dysphania aristata*, a species belonging to *Amaranthaceae* family, has not received much genetic attention despite having many ecological and medicinal values. In this study, we report the assembly, annotation, and comparative analysis of the complete chloroplast genome of *D. aristata*, sequenced using Illumina sequencing technology. The assembled chloroplast genome exhibited the typical circular quadripartite structure consisting of a large single-copy (LSC) region of 84,262 bp, a small single-copy (SSC) region of 17,892 bp, and inverted repeats (IRs) of 25,148 bp each, with a total length of 152,450 bp. Cp genome annotation identified 75 protein-coding genes, 36 transfer RNA genes, and eight ribosomal RNA genes. To gain an insight into the genome's coding efficiency, a codon bias analysis was performed. Its results indicated a non-random distribution of synonymous codon with a strong preference for AT-rich codons and AAA(Lysine), AAT(Asparagine) and ATT(Isoleucine) being the most frequently used. Phylogenetic analysis based on complete chloroplast genomes placed *D. aristata* in a clade with *Dysphania schraderiana*, *Dysphania botrys*, *Dysphania pumilio*, and *Dysphania ambrosioides* within the *Amaranthaceae* family. Comparative analysis with related species revealed variations in genome size, gene order, and sequence identity, providing further information of taxonomic and evolutionary distinction within the genus *Dysphania*. To explore the repetitive sequence landscape, a simple sequence repeats (SSR) analysis was performed. It showed a total of 47 SSR which can be used for population genetics, species identification and evolutionary studies. This study provides the complete chloroplast genome of *Dysphania aristata* enhancing the genomic resources for the *Amaranthaceae* family. These findings contributed to a deeper understanding of chloroplast genome evolution, codon usage patterns, and phylogenetic relationships while providing valuable SSR markers for further genomic studies.

Keywords: *Dysphania*, *Amaranthaceae*, Chloroplast genome, Phylogenetic relationships, Comparative analysis

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Diversity Assessment and Morphological Characterization of a Selected Panel of Traditional Rice Accessions

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This study investigates the morphological diversity of 42 traditional rice varieties conserved at the Rice Research and Development Institute (RRDI), Batalagoda, Sri Lanka. The research aims to assess genetic diversity, morphological characteristics and identify high-yielding varieties for breeding and conservation programs. Quantitative and qualitative traits were scored and analyzed using Principal Component Analysis (PCA). The first six principal components of the 20 quantitative traits captured 83.7% of the total variance, with PC1 primarily associated with reproductive output. Key yield-contributing traits; per panicle weight (PPW) and number of filled grains (NFG) showed strong positive correlations. PCA of 18 qualitative traits scored revealed the first seven PCs explaining 73.3% of the variance, with PC1 being dominated by panicle-related traits. Several strong correlations were observed between qualitative traits; stigma color (SS) and apiculus color (AC) ($r = 0.55$) and secondary branching (SB) and branching attitude (BA) ($r = 0.786$). Strong positive correlations were observed among yield-related traits, specifically total panicle weight (TPW), number of filled grains (NFG), and overall yield. Moderate positive correlations were observed between flag leaf length (FLL), panicle length (PL), and per panicle weight (PPW) and yield. Furthermore, the analysis identified negative correlations indicative of potential trade-offs; between filled grain percentage (FGP) and the number of unfilled grains (UGP), and between culm height (CH) and grain weight. For yield comparison purposes Bg 94-1 was used as control accession and the yield of Bg 94-1 was 23.71g/per plant. *Pokkali* (445), *Balakara* (602), and *Herath* 310 (682) accessions showed higher yields than the control. Although there are several accessions with the same name, they belong to different clusters once cluster analysis is done. The study highlights the importance of conserving traditional rice germplasm and their potential for use in breeding programs to enhance food security and agricultural sustainability in Sri Lanka.

Keywords: Traditional rice, Morphological characterization, Cluster analysis

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Identification of Brown Planthopper Resistance in Selected Advanced Sri Lankan Rice Lines through Molecular Screening

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Rice (*Oryza sativa* L.) is the main staple food crop for over half of the global population, including Sri Lanka. Brown planthopper (BPH) [*Nilaparvata lugens* (Stål)] is one of the most destructive pests in rice, causing significant yield losses up to 80% worldwide. Chemical control methods are the commonly used approach for managing BPH infestation, but long-term use of pesticides contributes to the development of pesticide resistance in insect pests. Introduction of BPH resistance into rice is the most effective and sustainable pest control method. The research was conducted during the *Maha* season (2024/25) to screen the BPH resistance genes in 20 advanced rice lines developed by the Rice Research and Development Institute (RRDI), Bathalagoda, Sri Lanka. A total of 90 advanced plants were selected in the field, focusing on their promising important economic characters. Molecular screening was carried out using 2 SSR markers: RM589 and RM463 for *Bph3* and *Bph2*, respectively. Out of the selected 90 plants, all plants contained at least one selected BPH-resistance gene/QTL, including all selected advanced rice lines; 81 contained the *Bph2* gene, and 88 contained the *Bph3* gene/QTL. Out of the selected 90 rice plants, 81 contained both *Bph2* and *Bph3* genes/QTL. These gene pyramided, all advanced rice lines, exhibiting strong potential for the development of BPH-resistant rice varieties.

Keywords: Advanced rice lines, *Bph2*, *Bph3*, BPH-resistance, Rice

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Morphological Characterization and Molecular Markers-Based Genetic Diversity Analysis of Avocado Accessions in Sri Lanka

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Avocado (*Persea americana*), a member of the Lauraceae family is widely recognized as a health-promoting fruit due to its high content of monounsaturated and polyunsaturated fats, which help lower LDL cholesterol levels. In addition, avocado is also rich in thiamin, riboflavin and vitamin A. Avocado is assumed to have been introduced to Sri Lanka around 200 years ago by the Dutch. However, Sri Lankan avocado accessions remain largely uncharacterized to date. This study aimed to characterize 15 avocado accessions maintained in an ex-situ germplasm collection at the Fruit Research and Development Institute, Horana, Sri Lanka, using both molecular and morphological markers. Molecular characterization was performed using four Short Sequence Repeat (SSR) markers previously developed for this species. A total of 20 distinct amplification fragments were detected for the microsatellite markers, ranging from four to six alleles per locus. All the four microsatellite markers were highly informative with an expected heterozygosity higher than 0.5, indicating their effectiveness in differentiating accessions. Microsatellite binary matrix was used to construct a similarity matrix in the NTSYS-pc 2.10e, followed by the un-weighted pair group arithmetic mean analysis (UPGMA) in the SAHN program to construct a dendrogram. Five major clusters were obtained from the dendrogram. The largest cluster containing four accessions, further subdivided into two smaller clusters. Morphological characterization was conducted using 15 qualitative morphological traits based on the International Plant Genetic Resources Institute (IPGRI) descriptors for avocado. The Shannon-Weiner diversity index for these traits ranged from 0.2449 for leaf shape to 1.459 for tree shape. This inaugural approach of molecular and morphological characterization of selected avocado accessions in Sri Lanka provides valuable insights into their genetic diversity, supporting improved germplasm management, breeding programmes and conservation.

Keywords: Avocado, IPGRI descriptors, SSR markers, Morphological traits, Genetic diversity

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Phenotypic Evaluation of Submergence Tolerance in Selected Exotic Rice (*Oryza sativa* L.) Lines

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Submergence stress is a major threat to rice cultivation in flood-prone regions, resulting substantial yield losses. This study evaluated the submergence tolerance of 9 high-yielding exotic rice lines (ERL), tolerant reference IRRI-119 and susceptible reference Bg 360. Thirty plants for each rice line/variety were planted in three replicates and were submerged for 14 days under 1 m of irrigated water. A control experiment was maintained without subjecting to submergence. Submergence tolerance was assessed based on survivability (SP) and root length reduction (RR). Submergence stress significantly ($p < 0.05$) affected the SP and RR of the tested rice lines/varieties. At the tolerant spectrum, ERL IR-20LT-2250 (91.81%) and IR-21LT-1764 (71.28%) showed no significant difference ($p > 0.05$) to the tolerance reference IRRI-119 (71.38%). A similar trend was observed in these two ERL with respect to RR (IR-20LT-2250: 11.81% and IR-21LT-1764: 13.72%), IRRI-119 (10.32%) and four other ERL, reporting minimal RR indicating tolerance. At the susceptible spectrum, five ERL (IR-19A-7420, IR-19A-8065, IR-19A-9160, IR-19A-7759, IR-19A-9193; SP range 28-52%) showed no significant difference ($p > 0.05$) to the susceptible reference Bg 360 (27.89%). Based on RR, except for IR-19A-7420, all other ERL showed no significant difference ($p > 0.05$) to Bg 360 and IR-19A-9000 (RR range 37-48%), reporting the highest RR indicating susceptibility. Based on both SP and RR, the ERL IR-20LT-2250 and IR-21LT-1764 can be recommended as submergence tolerant, and IR-20LT-2250 even outperforms the tolerance reference IRRI-119 considering SP. Future research should focus on evaluating the performance of ERL IR-20LT-2250 and IR-21LT-1764 for other agronomic traits to realize their breeding potential.

Keywords: Induced submergence, Root length reduction percentage, Submergence stress, Survivability

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Unraveling the Genome of the Sri Lankan Giant Honey Bee

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The giant honey bee (*Apis dorsata* Fabricius), known as the rock honey, is primarily found in South and Southeast Asia and plays a vital role as both a pollinator and a honey producer. Despite the ecological and economic significance, only two whole genome sequencing projects have been conducted on *A. dorsata*. This study focuses on the whole genome assembly and annotation of *A. dorsata* in Sri Lanka. DNA was extracted from *A. dorsata* drones and sequenced using the Illumina NovaSeq sequencing system. Genome assembly was conducted as a reference-based assembly using NCBI reference genome assembly (PRJNA174631). Genome assembly and annotation were carried out using the Galaxy platform. The quality of raw reads was assessed using FastQC. Bowtie2 was used for the alignment process. Quality assessment and completeness of the assembled genome were performed using the Quast and BUSCO tools, respectively. The assembled genome spans 230.6 Mb with 95.9% completeness. RepeatMasker identified 6% of repeat regions in the assembled genome. During annotation, 12,006 genes were predicted using Augustus. Using InterProScan, 10,937 protein domains representing 4,005 protein families were identified. Ortholog identification was performed using eggNOG Mapper. Identified gene densities, single nucleotide polymorphisms (SNPs), and indels were visualized using Circos. This annotated genome provides a basis for future genomic and conservation biology studies on *A. dorsata* by revealing genetic variations (SNPs and indels), orthologous relationships, and gene and protein functions. The findings contribute to understanding the species' efficiency as a pollinator and its potential applications in biotechnology. The presence of diverse protein families suggests specialized adaptations, possibly related to *A. dorsata*'s pollination behavior, flight endurance, and environmental resilience. Furthermore, this study offers the initial setup for the comparative and population genomics between both the Sri Lankan and global *A. dorsata* populations.

Keywords: Giant Honey bee, *A. dorsata*, Genome assembly, Genome annotation

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Identification of Fungal and Bacterial Contaminants in a Banana Tissue Culture Laboratory

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Microbial contamination is a major challenge in the banana tissue culture industry in Sri Lanka. Common contaminants include *Cladosporium*, *Penicillium*, *Aspergillus*, and bacterial species like *Pseudomonas*. Culture media contamination is a key problem in the selected tissue culture laboratory. Identification of fungal and bacterial contaminants frequently encountered in the laboratory is important to implement an effective control plan. Hence, the study aimed to identify and characterize fungal and bacterial contaminants and possible sources of contamination using morphological and molecular techniques. Contaminated culture bottles were obtained from the laboratory. Those bottles were opened inside a laminar flow cabinet, and fungal and bacterial contaminants were cultured in potato dextrose agar (PDA) and nutrient agar (NA) plates, and incubated at 40°C for 2-3 days. Three replicates from each contaminant were made. Sub-culturing was done to obtain pure cultures. Microscopic and macroscopic characteristics of pure cultures were examined. KOH and Gram staining tests were conducted for bacterial isolates. Molecular characterization was done using PCR and sequencing of 16S rDNA and nuclear ITS genes for bacterial and fungal isolates, respectively. *Cladosporium* sp. and *Aspergillus* sp. were identified as possible fungal contaminants, and two bacterial isolates were identified based on Gram testing and colony characteristics. To assess potential contamination sources, explants, culture media and air samples from culture rooms were tested. No contamination was detected in explant and culture media plates; however, PDA plates exposed to air in culture rooms exhibited fungal growth, suggesting airborne contamination. This study was able to identify two possible fungal and bacterial contaminants and contaminated air as the possible source of contamination. Further identification is necessary through optimization of DNA extraction and PCR protocols. Implementing enhanced sterilization protocols, antimicrobial treatments, and air sanitation measures, such as HEPA filtration and UV sterilization, could effectively reduce contamination risks, particularly from airborne bacterial contamination.

Keywords: Tissue culture, molecular, contamination, Bacteria, Fungi

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Price incentives and Market Distortions in Sri Lanka's Poultry Industry: Trends in Nominal and Effective Rates of Protection

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Sri Lanka's poultry industry has evolved into a highly developed, vertically integrated sector, driven by private investments and advanced technology. However, policy-induced price distortions continue to escalate production costs and hinder global competitiveness. This study examines degree of protection provided to the poultry industry during 2013 to 2024. A Price Incentive Analysis (PIA) framework, focusing on Nominal Rate of Protection (NRP) and Effective Rate of Protection (ERP) was adopted using data gathered from secondary sources and key informant interviews. Findings reveal significant price disparities between domestic prices and equivalent world prices along the poultry value chain. The average NRP for broiler chicken and eggs stood at -11% and +19%, respectively during 2013-2024, indicating that while broiler producers faced disincentives owing to market imperfections, layer farmers were given some protection. Maize and soybean meal, the key poultry feed inputs, remained highly protected due to import duties, non-tariff barriers, and foreign exchange constraints, driving up costs and reducing efficiency. Their NRP stood at +17% and +26%, respectively. The ERP's which reflects the overall impact of policy incentives and disincentives show a negative protection to broiler chicken and a positive protection for eggs. The average ERP for broiler and eggs was -19.7% and +16.7%, respectively, indicating that input costs outweighed price protection for chicken and sustained price incentives despite high input costs for eggs. To improve market efficiency and competitiveness, the study recommends reducing import tariffs for feed raw materials, eliminating maize import quotas, improving domestic feed production efficiency, providing duty rebates for exporters, and expanding export market access. Despite its Avian Influenza-free status and growth potential, Sri Lanka's poultry sector remains constrained by protectionist policies and market distortions. With domestic reforms and trade liberalization, it can transition to a globally competitive industry, ensuring sustainability and market integration.

Keywords: Poultry industry, Price Incentive Analysis, Nominal Rate of Protection, Effective Rate of Protection, Trade policies

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Geographic Distribution of Food Outlets: Sector-Wise Insights into Accessibility and Diets

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This study examines the geographic distribution of food outlets and its impact on dietary patterns across urban, rural, and estate sectors in Sri Lanka, with a focus on the Kandy District. The research addresses spatial disparities in food accessibility and their implications for nutrition outcomes while incorporating household income as a key determinant of dietary diversity. Using a descriptive research design, the study maps food outlet density and proximity and analyzes their correlation with household dietary diversity scores and income levels. Data were collected through GPS-based spatial mapping of food outlets and household surveys across selected Grama Niladhari (GN) divisions in urban, rural, and estate areas. Spatial analysis using ArcGIS revealed significant sectoral disparities: urban areas exhibited high food outlet density and accessibility, while estate and rural sectors faced limited access to diverse food sources. Regression analysis indicated a positive relationship between food outlet density, proximity, and dietary diversity, with household income acting as a moderating factor higher-income households exhibited greater dietary diversity regardless of location, while lower-income households in rural and estate areas faced significant nutritional constraints. These findings highlight the need for targeted policy interventions, including mobile markets for estate areas, incentives for healthy food retailers in rural zones, and financial support programs to enhance food affordability. This research contributes to food security and public health discourse by providing actionable insights for improving equitable food access and nutrition outcomes in diverse geographic settings.

Keywords: Food environment, Geographic distribution, Dietary diversity, Food accessibility, Urban-rural disparities, Retail food outlets, Spatial analysis

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An Assessment of the Market Orientation of Up-Country Protected Agriculture Vegetable Farmers

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Protected Agriculture (PA) practices were introduced to Sri Lankan farmers in the late 1990s, with various government institutions subsequently engaging in their promotion and adaptation. This study examines the degree and nature of market orientation among vegetable farmers in the Welimada and Bandarawela areas, specifically comparing fully and partially funded participants under the Smallholder Agribusiness Partnership Program (SAPP). Using stratified and snowball sampling methods, data were collected from 75 farmers (35 fully funded and 40 partially funded) through a structured questionnaire and analyzed using descriptive statistics and Wilcoxon rank-sum tests. Analysis revealed that partially funded farmers demonstrated a significantly higher degree of market orientation than fully funded farmers in both PA and open-field farming contexts ($P < 0.05$). This pattern was particularly evident in decisions related to crop selection, produce quality, and selling methods. These findings underscore the importance of funding structure in enhancing beneficiary commitment to achieving project success, suggesting that cost-sharing arrangements may foster greater market responsiveness. The research offers valuable insights for agricultural policy development and program design, implying that partial funding models may better promote sustainable agricultural development in Sri Lanka by fostering a stronger market orientation among farmers.

Keywords: Market orientation, Production orientation, Protected agriculture, Cost-sharing, Beneficiary selection

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Intention to Adopt an Online Marketplace for the Vegetable Sub-Sector; Comparison of Current Sri Lankan Practices with E-Nam

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The adoption of digital marketplaces in agriculture can transform traditional supply chains by enhancing market access, improving price transparency, and increasing farmer profitability. The purpose of this study is to evaluate the intention to adopt an online marketplace for the vegetable sub-sector in Sri Lanka, compare current supply chain practices with India's e-National Agriculture Market (e-NAM), assess potential benefits, and recommend adaptations for effective implementation. Using the Technology Acceptance Model (TAM), the research surveyed 60 vegetable farmers in Dambulla Pradeshiya Sabha. A representative sample was taken using stratified random sampling. Responses were analyzed with descriptive statistics, correlation, and regression in SPSS. Findings revealed strong adoption intention, with 95% of farmers expressing positive Perceived Usefulness (PU), Perceived Ease of Use (PEOU), Attitude Toward Using (ATU), and Behavioral Intention to Use (BI). Regression analysis supported TAM hypotheses: PEOU significantly influenced ATU ($\beta = 0.907, p < 0.001$), PU significantly impacted ATU ($\beta = 0.984, p < 0.001$) and BI ($\beta = 0.975, p < 0.001$), ATU significantly predicted BI ($\beta = 0.984, p < 0.001$), and PEOU significantly affected PU ($\beta = 0.896, p < 0.001$), explaining 80.3%–96.8% of the variance (R^2). Current practices in Sri Lanka showed inefficiencies, with 75% of farmers facing unstable prices and 68.75% facing middleman commissions. A comparative analysis of e-NAM and Sri Lanka's vegetable supply chain reveals that e-NAM has improved price discovery, reduced reliance on intermediaries, and minimized food mileage. Farmers acknowledge the benefits of digital trading, including improved profits and expanded market opportunities. The study recommends government-backed initiatives to improve digital literacy and logistics infrastructure. Findings suggest that an online marketplace modeled after e-NAM, tailored to the Sri Lankan context, can enhance market efficiency and increase farmer profitability while modernizing the country's agricultural sector.

Keywords: Online marketplace, Technology Acceptance Model, vegetable sub-sector, e-NAM, Digital agriculture

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Factors Influencing the Stakeholders' Intention to Adopt a Mobile App for Marketing of Underutilized Fruits

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Sri Lanka's rich biodiversity encompasses numerous underutilized fruit species with significant nutritional and economic potential, including Katuanoda, Ugurassa, Nelli, Mangosteen, and Gaduguda. Despite their value, these fruits remain marginalized in the market due to fragmented supply chains that create inefficiencies among different stakeholders, including producers, sellers, and consumers. This study examines the factors influencing stakeholders' intention to adopt a mobile application designed to increase the visibility and accessibility of underutilized fruits. The study examines how perceived ease of use, perceived usefulness, trust, compatibility, and cost influence adoption intentions, which is guided by the Technology Acceptance Model (TAM) and complementary theoretical frameworks. A primary survey was conducted with 100 stakeholders in the Kandy district using a combination of snowball and systematic sampling methods. Data was analyzed using Spearman's Rank Correlation, and scale reliability was confirmed through internal consistency measures. Data analysis revealed strong positive relationships between all examined factors and stakeholders' intentions to adopt the proposed technology. The findings indicate that successful mobile applications for marketing underutilized fruits must be user-friendly, trustworthy, compatible with existing practices, and cost-effective. Therefore, this research contributes to the understanding of technology adoption in niche agricultural markets, providing practical guidance for application developers and policymakers seeking to promote underutilized fruits while supporting smallholder farmers and enhancing consumer access to diverse, nutritious food options.

Keywords: Underutilized fruits, Technology acceptance, Digital mobile app, Adoption intention, Agricultural marketing

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The Effect of Non-Tariff Measures (NTMs) on High-End Value-Added Coconut Exports from Sri Lanka: A Gravity Model Analysis

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This study examines the impact of Non-Tariff Measures (NTMs) on Sri Lanka's high-end value-added coconut exports using a gravity model approach. The research focuses on how Sanitary and Phytosanitary (SPS) measures, Technical Barriers to Trade (TBT), and Other NTMs affect trade flows to major markets, including the United States, Germany, the Netherlands, China, and India, from 2014 to 2023. The Poisson Pseudo Maximum Likelihood (PPML) estimator is employed to address heteroskedasticity and zero trade flows, ensuring robust results. A gravity model was estimated using a panel dataset consisting of NTMs at the 6-digit level, tariffs, GDP, distance, and population for 12 countries covering 20 value-added coconut products. Results indicate that TBT measures negatively impact Sri Lanka's coconut exports, while SPS measures and other NTMs have positive but less substantial effects. Tariff rates have shown an increasing trend over the years, while NTM frequencies remain stable, suggesting a shift towards non-tariff regulations. Country-wise analysis of NTMs showed that developed countries imposed a higher frequency of NTMs than developing countries. The gravity model suggests that the GDP of importing countries, distance, the population of Sri Lanka, the population of the importing country, and tariffs positively influence exports, while Sri Lanka's GDP negatively affects them. The study highlights the importance of improving certification processes, enhancing processing facilities, and establishing bilateral agreements to reduce trade costs. Policy recommendations include investing in certification programs, promoting high-value coconut products, and strengthening trade policies through regional cooperation. This research provides valuable insights for policymakers and exporters to navigate the complex regulatory landscape and enhance Sri Lanka's competitiveness in the global high-end coconut market. Effectively addressing NTM-related barriers could significantly boost export performance and economic growth for Sri Lanka's coconut industry.

Keywords: Non-Tariff Measures (NTMs), High-end value-added Coconut products, Gravity model, PPML estimator

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Impact of Water Access on Farmers' Economic Well-being in the Context of Ridiyagama Reservoir

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Water access is a crucial factor influencing agricultural productivity and farmer livelihoods. This study evaluates the impact of water access variability on the economic well-being of farmers in the Ridiyagama reservoir area, where irrigation plays a pivotal role in sustaining rice production. Ridiyagama, located in the Hambantota district of Sri Lanka, is a key agricultural region relying on the Ridiyagama Reservoir for irrigation. The reservoir supports paddy farming across multiple distributor canals, yet significant disparities exist in water distribution, affecting farmer productivity and economic stability. The objectives of the study were to assess the variations in water access among paddy farmers, examine how these differences influence community actions, and analyze the relationship between water access and key economic indicators such as paddy productivity, income levels, and subjective well-being. A mixed-method research approach was employed, combining qualitative and quantitative techniques. Primary data were collected from 70 randomly selected paddy farmers across seven distributor canals using structured questionnaires. The Water Accessibility Index (WAI) was constructed to evaluate water access variability. Descriptive statistics and regression analyses were used to determine the relationship between water access and economic outcomes. Findings indicate significant disparities in water access among paddy farmers, with notable effects on productivity and community engagement. The study revealed that increased water access positively influenced paddy productivity ($P < 0.05$). However, its effect on income levels was statistically insignificant ($P = 0.775$). Interestingly, a negative correlation was observed between water access and subjective well-being, suggesting that improved water availability may introduce additional socio-economic pressures on farmers. Community-driven water management strategies were found to mitigate some of the adverse effects of access variability. The study highlights the necessity of equitable water distribution policies and the enhancement of community-based irrigation management systems. Future research should explore additional socio-economic factors influencing farmer well-being beyond water access.

Keywords: Water access, economic well-being, farmers, irrigation, Sri Lanka

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Assessing Consumers' Willingness to Pay for Solar Energy: A Comparative Study from Central Province

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Sri Lanka's increasing electricity demand and heavy reliance on fossil fuels highlight the urgent need for sustainable energy alternatives. Solar energy is a promising solution, yet adoption remains low due to financial, social, and behavioral constraints. This study assesses consumers' willingness to pay (WTP) for solar-generated from the Ceylon Electricity Board (CEB) in the central province, focusing on socio-economic, environmental, and behavioral factors influencing their preferences. A structured online questionnaire was used to collect data from 197 respondents, covering diverse demographic and income groups. The Ordered Probit Model (OProbit) was applied to analyze the probability of consumers falling into different WTP categories. The results indicate that education level, environmental awareness, and perceptions significantly impact WTP. Middle-income households exhibit a higher WTP than higher-income groups, suggesting affordability concerns and alternative investment preferences. Additionally, trust in solar energy reliability, social influence, and cost-saving potential emerged as crucial determinants. The findings reveal that awareness alone does not necessarily translate into higher WTP; financial incentives and confidence in solar energy's long-term benefits play a more significant role. To enhance adoption, policymakers should implement financial incentives such as subsidies and flexible payment plans, strengthen public awareness campaigns, and establish transparent policies to build consumer trust. By addressing affordability concerns and emphasizing long-term cost savings, Sri Lanka can facilitate a smoother transition towards renewable energy, aligning with national sustainability goals.

Keywords: Willingness to pay, Solar generated electricity, Ordered Probit Model, Consumer preferences, Renewable energy

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Social and Economic Contributions to Variations in Aspirations: The Case of Children in Secondary Education and Their Families Living in RPC Tea Estates

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Tea is a main plantation crop grown in Sri Lanka and it is a labor-intensive sector in Sri Lanka, but labor outmigration from Regional Plantation Companies (RPC) has become one of main reason for the reduction of the productivity in the tea sector. What motivates potential workers to go out of working in this sector? This study examines the aspirations of children about work or non-work in the estate in secondary education and their families living in RPC estates, focusing on socioeconomic factors which are influenced for children's career decision. The data were collected using a semi-structured questionnaire and by conducting interviews with secondary school children living in RPC estate housing and an estate worker living in the same household. All the population, that is children in secondary school whose at least one parent is a tea harvester in the relevant estate, were used and the population size is 53. The study uses the Expectancy Theory to analyze aspirations about work or non-work in the estate in relation to socioeconomic variables such as household and housing condition, worker skill development and available finance resources. Results demonstrate that all the children aspire to work in outside the tea estate, even if their attitudes towards estate work varied somewhat, due to social stigma, lack of career opportunities available for them in the estate and limited technological integration to tea harvesting practices. Parental aspiration also significantly shapes children's career decision. Statistical analysis using PLS-SEM ($P < 0.05$) confirms that household and housing condition and aspirations of parent about their children significantly affect for their children career choices, but available finance and worker skill development do not significantly affect for aspirations of children about work or non-work in the estate. The findings suggest the need for policy interventions, career guidance programs, infrastructure development and integration of new technology to tea harvesting practices.

Key words: Aspirations, career decision, labor-intensive, outmigration, RPC tea estates

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Evaluating the Economic Effects of a Uniform Tariff on Rice Imports in Sri Lanka: A Partial Equilibrium Analysis

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Frequent and unpredictable policy shifts have become the norm in many agriculture markets in Sri Lanka over the recent past discouraging investment, limiting the growth and expansion of the sector. The overall objective of this study is to assess the economic effects of rice import liberalization through a uniform ad-valorem tariff. It documents the existing framework of price controls and variable trade policies and uses 56 partial equilibrium models calibrated for the period April 2020 to December 2024 to simulate the effects of uniform ad-valorem tariff under three rates. The analysis revealed that rice and paddy sectors have been regulated through Maximum Retail Price (MRP) on rice, Guaranteed prices (GP) on paddy, Special Commodity Levy (SCL) on imports, temporary import suspensions, and Import Control Licenses during the study period. The economic effects of uniform tariff in rice imports were assessed under three tariff rates namely, 0%, 15%, and 25% using the 56 static partial equilibrium models calibrated for business-as-usual (BAU) scenarios in each month. The simulation results revealed that, a uniform tariff of 15% benefits consumers by reducing retail prices by 4.48% and increases social welfare by 1.54% from the BAU. This social welfare gain is driven by both higher consumer surplus and increased government revenue. Even though a 0% tariff increases social welfare by 1.68%, this increase is driven by a rise in consumer surplus. This study recommends a uniform tariff of 15% in place of multiple distortionary measures in rice and paddy markets in Sri Lanka as the first step in a reform process.

Keywords: Price control mechanisms, Trade policy, Social welfare, Government revenue

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Egg Consumption Amid Crisis: How Backyard Poultry Shields Households from Economic Shocks in Rural Areas of Kopay?

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The economic downturn in Sri Lanka severely affected household food security, particularly limiting access to essential animal protein sources like eggs due to high prices. This study investigated the role of backyard poultry in stabilizing household egg consumption and reducing economic vulnerability during periods of economic crisis in rural areas of Kopay. It also examined the key factors that affect egg consumption and expenditure on eggs and also evaluated how backyard poultry contributes to household resilience by supplementing income and enhancing social network through sharing eggs. Primary data collected from a stratified random sample of 186 households (69 households with backyard poultry and 117 households without backyard poultry) in two GN Divisions (J/271 & J/272) in Kopay DS division using a pre-tested structured questionnaire was used for analyses. Descriptive statistics, paired t-tests, and difference-in-difference regression analysis were the key analytical used. The results revealed that households with backyard poultry sustain their egg consumption ($p < 0.05$) during the peak crisis period compared to households without backyard poultry. Further, households with backyard poultry earned an additional income by selling eggs during the peak crisis period and also maintained their social capital through sharing eggs with neighbors and relatives. These findings illustrate the importance of backyard poultry as a coping mechanism during economic hardships.

Keywords: Economic crisis, Backyard poultry, Egg consumption, Resilience

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Employee Churn among Temporary Agency Workers: The Case of a Food Processing Factory in Biyagama.

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Employee churn among Temporary Agency Workers (TAWs) is a significant issue in labour-intensive industries, particularly in Sri Lanka's manufacturing sector. This study investigates the root causes behind the employee churn decision of TAWs in factory settings while considering the influence of demographic factors by using the unfolding model of voluntary turnover as a theoretical framework. The research was conducted at a manufacturing company of processed fruits and vegetables for the export market which is located in Export Processing Zone in Biyagama. Data were collected from 39 former TAWs of the company via telephone interviews using a structured questionnaire. Thematic analysis was used to categorize responses into four decision pathways. The findings revealed that majority of the respondents had follow path one and path two in decision making process indicating that their decision to quit was triggered by a shock event. The results further revealed that younger workers who are belong to 20-30 years old age group were the most susceptible to work related shock such as harsh working conditions. The study also found that some workers who searched alternative jobs before quitting had followed other path that deviate from traditional decision paths. The findings of this study are important for the organizations to implement strategic interventions in reducing high churn rate among TAWs in the manufacturing industry.

Keywords: Employee churn, Temporary Agency Workers, Unfolding model, work-related shocks

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Variation in Home Food Environment and its Effect on Diets and Women's Health Outcome across Urban, Rural and Estate Populations

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This research investigates the relationship between socio-demographic factors and the home food environment (HFE) and its impact on food diet and women's health status across urban, rural, and estate regions within the Kandy District of Sri Lanka. The study addresses a critical gap in understanding how socio-economic disparities shape home food environment & dietary behaviors within households across regions, contributing to the rising burden of diet-related Non-Communicable Diseases (NCDs). A cross-sectional survey of 150 households (50 per region) collected data on socio-demographics, dietary diversity, anthropometric measurements and about non-communicable diseases. Quantitative analyses, including multiple linear regression, ANOVA, and binary logistic regression, were conducted. Findings reveal significant regional disparities in HFE, with urban households demonstrating superior food access and diversity compared to rural and estate areas. Income emerged as the most crucial socio-demographic factor affecting HFE, with wealthier households reporting better food availability and variety. Region played a pivotal role, with estate households experiencing the poorest food environments due to economic limitations and geographical isolation, while rural households displayed moderate home food environment, highly influenced by income. Education and household size had minimal effects on HFE, emphasizing that structural factors such as location and income outweigh individual attributes in determining the quality of the home food environment. The study also identifies a modest association between HFE and women's health outcomes, including BMI, Central obesity and NCD risk, though dietary diversity alone did not significantly predict health status. These findings underscore the critical role of socio-demographic factors, particularly income and region, in shaping HFE and influencing women's health outcomes

Keywords: Home food environment, Food diet, Socio-demographic factors, Anthropometric measurements, Non-communicable disease

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Variability in Task Completion Time among Temporary Agency Workers: The Case of a Processed Gherkin Manufacturing Factory in *Biyagama*

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Temporary agency workers (TAW) are increasingly deployed by industries particularly during peak seasons and for short term projects. Due to inconsistency and uncertainty of assigned tasks, task completion time serves as a reliable performance indicator for temporary agency workers. This study analyzes task completion time variability among temporary agency workers in a processed gherkin manufacturing company in export processing zone in *Biyagama*. It examines the impact of task characteristics, worker characteristics, environmental factors and social factors on task completion time. A mixed- method approach was employed and the research involved task Identification, workflow segmentation and direct observation of TAW in 2 production sections (sorting section and de-brine section). Key informant interviews were conducted followed by a month-long data collection from 37 TAWs. Data were analyzed by using thematic coding, descriptive statistics, and regression analysis. The findings indicate notable variation in task completion times across different tasks and worker groups. Physical discomfort (PD) emerged as the most influential factor ($P < 0.05$), leading to frequent breaks and reduced efficiency. Task difficulty ($P < 0.001$) and engagement in other works ($P < 0.001$) also significantly impacted on TCT. Social Loafing is notably higher and team work and collaboration is notably lower in workers performing multiple tasks. High TCT variability affects negatively on operational efficiency in temporary labor-intensive settings. Addressing PD through ergonomic interventions, structured task allocations and strategic automations is essential for optimizing productivity. The study underscores the necessity for revised Human Resource (HR) policies to reduce physical discomfort and role ambiguity among TAWs.

Keywords: Task Completion Time, Temporary Agency Workers, Physical Discomfort, Task Difficulty

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A Study of Motivations for Starting Additional Businesses Among Pluriactive Farmers in Imaduwa, Galle

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While some farmers continue to farm as their primary livelihood, some others tend to be pluriactive as they diversify their income-generating activities alongside farming due to the inadequacy and uncertainty of farming income. Farmers may practice pluriactivity as a survival and capital accumulation strategy. Pluriactive farmers may start additional businesses due to either necessity (push) or opportunity-driven (pull) motivations. This study aims to analyze what motivates farmers to engage in pluriactivity by investigating the types of startup motivation, examining whether the nature and number of businesses conducted by pluriactive farmers vary according to the type of motivation, and analyzing whether farmers motivated by pull motives are more likely to be pluriactive. The research was conducted at 13 *Grama Niladari* Divisions in Imaduwa, Galle. The research employed quantitative methods, including a questionnaire survey with 111 farmers who engaged in multiple businesses. Data analysis employed non-parametric tests (Chi-square and Kruskal-Wallis) due to the non-normality of the dataset. Findings revealed three distinct startup motivation categories (push, pull and mixed) with a significant association between motivation type and pluriactivity ($P < 0.05$). Furthermore, among pluriactive farmers, those driven by pull motivations demonstrated significantly higher pluriactivity levels than others ($P < 0.05$). These findings have important implications for rural employment enhancement and poverty reduction initiatives, offering valuable insights for policymakers and development agencies in designing targeted support programs for rural entrepreneurship that facilitate business expansion among farmers.

Keywords: Push motivation, Pull motivation, Mixed motivation, Pluriactivity, Farmers

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Value Chain Analysis of Soursop: A Case Study of Sri Lanka's Leading Fruit Juice Companies

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Soursop (*Annona muricata L.*) is an underutilized fruit which is used for value added product making. For this study Sri Lanka's top two Soursop nectar companies with the largest market share is connected. Among them the company with larger market share are currently manufacturing fruit cream additional to fruit nectar. The study is done mainly contacting the manufacturer, collector and farmers. The primary & secondary activities of the company is mainly considered into the data collection. The data that gathered transferred into observation to design the value map. The study is done to find out inefficiencies and future potentials of the value chain of these two companies comparatively. Qualitative Data survey is done to obtain questionnaires & in-depth interviews from manufacturers, their collectors and their supplier farmers. Value maps are plotted for both companies & findings are analyzed through McKinsey Matrix. The findings revealed that the top largest market share holder is comparatively improved than other company majorly in Inbound Logistics, Process, Outbound Logistics, Sales & Marketing, R&D & HR Practices. There are some potential opportunities found that can be used in product operations, R&D sectors, HR management, Farmer engagement & marketing & sales improvement using digital media to improve the value chain efficiency.

Keywords: Soursop, Value chain inefficiencies, Comparative analysis, Qualitative data survey, Competitive advantage

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Effectiveness of the Targeting Approach in Addressing Food-Insecurity: A Study of the Aswesuma and other Beneficiary Programmes in the Rathnapura District

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Food insecurity continues to be a problem for Sri Lankans, as the country slowly bounces back from the 2022 economic crisis. This study aims to assess the state of food security among households of Rathnapura district, with emphasis on the most vulnerable groups of people. Effectiveness of the Proxy Means Test (PMT) by gauging the efficiency using 6 key dimensions and 22 indicators, in its capacity to effectively pick out food-insecure households under the program. This study assesses the performance of welfare programs in addressing food insecurity in the Aswesuma, Elderly Allowances and Disability allowances. This study utilizes the mixed-method with secondary quantitative data from World Food Programme data, complemented with data gathered from Focus Group Discussions. Quantitative estimation makes use of the Consolidated Approach for Reporting Indicators (CARI) to measure food security in Food Consumption Score (FCS), Livelihood Coping Strategy Index (LCSI), Reduced Coping Strategy Index (rCSI), and Food Expenditure Share (FES). Recipients of each programme and beneficiaries from any programme pooled were compared. Regression analysis is applied for investigating interaction between types of households, program participation as beneficiaries, and FES. Results indicate that the beneficiaries are poorer in terms of food security than non-beneficiaries. Food security was lower among disability allowance recipients than those in the other two beneficiary programmes, when FCS are compared. The Aswesuma allowance recipients have the highest dependence on coping strategies. Food security was higher among elderly and any benefit receivers compared to other recipients' groups. Household characteristics like education, school-age children outside schools, and decision-making authority of the households have the significant roles in determining the share of benefit consumed as food. The research indicates that the targeting strategy was partially effective in preventing food insecurity in the Rathnapura District.

Keywords: Food security, Vulnerability, Proxy Means Test, Aswesuma, Consolidated Approach for Reporting Indicators

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Environmental Accountability in Regional Plantation Companies of Sri Lanka: Role of External Pressure, Managerial Motivation and Financial Performance

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The main objective of the study is to identify the underlying motivations behind the Voluntary Environmental Disclosures (VED) made by Regional Plantation Companies (RPCs) in Sri Lanka. Of 24 regional plantation companies, 22 disclosed environmental information, which served as the primary focus of the study. The study employed a mixed-method approach, where both qualitative and quantitative methods were used. Primary data were gathered from managers who were directly involved in environmental reporting, and secondary data were gathered from annual reports. The quality of environmental disclosure was assessed using Clarkson et al.'s (2008) environmental disclosure index, and the quantity was assessed using the number of sentences employed to explain environmental reporting. Descriptive statistics and correlation tests were used to analyze the collected data. The findings of the study show that, although the plantation sector leads in environmental reporting, the majority of them lack both quantity and quality. Among the factors examined —stakeholder pressure, institutional pressure, and managerial motivation —institutional pressure shows the highest pressure on VED. Further findings reveal that within the five stakeholder groups, competitors exert the highest pressure. Institutional pressure operates mainly through normative isomorphism, and managers are more concerned with gaining legitimacy than repairing or maintaining it. However, there is no significant correlation between external pressures, managerial motivation, and financial performance on VED. The findings of the study underscore the need for RPCs to enhance their disclosure practices, thereby strengthening their legitimacy and contributing more effectively to environmental sustainability.

Keywords: Voluntary Environmental Disclosure, External Pressure, Managerial Motivation, Financial Performance

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Efficiency Analysis of Intensive Shrimp Farming in Puttalam District Sri Lanka

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This study examines the technical efficiency (TE), allocative efficiency (AE) and economic efficiency (EE) of shrimp farming in the Puttalam district, Sri Lanka, using Data Envelopment Analysis (DEA) under an input-oriented constant returns to scale (CRS) approach. Output quantities, input prices along with input quantities such as labor, feed, post larvae, dolomite, chlorine and lime were used in the analysis. The findings reveal that the mean TE, AE and EE of shrimp farms are 80.63%, 79.01%, and 63.76% respectively, indicating significant potential for efficiency improvements. The study also mainly investigates the key factors influencing inefficiency. The results suggest that increased total cultured area is associated with lower inefficiency. Descriptive analysis indicated that approximately 70% of the shrimp farms were profitable, while the remaining 30% were non-profitable. Notably, all non-profitable farms reported being affected by disease outbreaks, underscoring the significant impact of disease on farm profitability. Another critical finding of this study is that feed cost plays a crucial role in shrimp farming. It accounts for 55% of total production cost. Therefore, it is recommended that tax reduction for imported commercial feed, improve feeding practices and monitor FCR to enhance cost efficiency. Policy interventions such as technical training, cooperative participation and improved disease management frameworks are recommended to support shrimp farmers in achieving higher efficiency levels. The findings of this study provide valuable insights for policymakers, researchers and industry stakeholders to make informed decisions that improve the economic efficiency and sustainable shrimp production in Sri Lanka. Strengthening shrimp farming policies and supporting farmers with better knowledge and technical resources will help drive the sector towards greater productivity and resilience in the future.

Keywords: Technical Efficiency, Allocative Efficiency, Economic Efficiency, Shrimp Farming

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An Assessment of Market Orientation Towards Protected Agriculture and Open Field Farming among Protected Agriculture Farmers in Mahaweli System-H

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This study examines the degree and nature of Market Orientation (MO) among Protected Agriculture (PA) farmers who received greenhouses from the SMART Green House project within the Mahaweli System-H while identifying factors that influence their MO. The study also compares their degree and nature of MO towards Protected Agriculture Farming (PAF) with that of Open Field Farming (OFF). The research examines eight strategic marketing dimensions, including crop selection (what to produce), method of production (how to produce), time of production (when to produce), quality of produce (of what quality), method of selling (how to sell), time of selling (when to sell), choice of markets (where to sell), and form of selling (in what form to sell). A descriptive research design employing a quantitative approach was used with a randomly selected sample of 92 farmers who continued with PAF. Data were collected using a structured questionnaire and analyzed using descriptive statistics and multiple linear regression. Results revealed that farmers in PAF exhibit a higher degree of MO towards PAF activities than their OFF activities. Their higher MO towards PAF was evident in terms of “when and how to produce” and “of what quality”, while the same farmers showed a higher MO towards OFF in terms of “what to produce” and “where to sell”. Education level, particularly tertiary education, has a significant influence on the degree of MO ($P < 0.05$). In this study, gender, farming experience, and primary employment did not demonstrate significant relationships with MO. The findings could be particularly important for the Mahaweli Authority of Sri Lanka, enabling them to validate their investments, identify areas for improvement, and develop targeted interventions that enhance market-oriented production in protected agricultural systems.

Keywords: Protected Agriculture, Market Orientation, Marketing Strategies, Open Field Farming, Education

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The Impact of the Environmental, Task and Team Characteristics on Operational Error Rate: The Case of Food Processing Company

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Operational errors in food processing companies significantly impact productivity, safety, and quality. This study investigates how environmental, task, and team characteristics influence operational error rates in a food processing company. Environmental factors such as temperature, lighting, noise levels are assessed to determine their influence on worker performance and error rates. Additionally, the quality of the inputs and team-related aspects, such as communication effectiveness, experience levels, and collaboration, are also examined to assess their role in reducing or exacerbating errors.

The research was conducted at a food processing company in Biyagama. Within a span of a month, the factory floor was observed and key informants were interviewed. A survey was conducted on a sample of 115 participants working in the slicing area, a section with high probability of error occurrence. The data were analyzed using thematic analysis, descriptive statistics, and inferential statistics. Preliminary findings highlight that team error depends on quality of inputs, because the process changes when a low quality batch of inputs are brought in and the focus on fixing the problem is heightened. Based on these preliminary analyses the conceptual model was subjected to minor amendments. Survey results indicate that when batches are poor quality, the increased scrutiny results in less effects of environmental and team level characteristics. However, when input quality is normal, the effects of environmental and team level characteristics can be observed. It is crucial to pay attention to these usual error causing factors to prevent potential issues from arising. Under normal input quality conditions, by identifying specific environmental, task, and team-related factors that contribute to errors, this research will assist companies in implementing targeted interventions. Also for reducing error rate of normal quality batch, improving quality assurance component of raw material is important. Ultimately, this research contributes to the broader understanding of error management in industrial settings and supports efforts to achieve sustainable improvements in manufacturing efficiency.

Keywords: Operational Errors, Food Processing, Environmental, Task, Team Characteristics, Quality Assurance, Error Reduction/Management

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Assessing Socio-Economic and Environmental Implications of Household Food Waste in Sri Lanka Using an Index-Based Approach

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Food waste is one of the most pressing challenges in today's world, affecting food security, environmental health, and sustainable living. This research takes a novel approach to address this problem by developing a Food Waste Index (FWI), a comprehensive tool designed to measure household food waste patterns and assess the impact on three Sustainable Development Goals (SDGs): SDG 2 (Zero Hunger), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action). Data from 1010 households was collected to represent the whole country. Principal Component Analysis (PCA) was performed as a dimension reduction technique in developing the index. Household-level data was collected to uncover the primary drivers of food waste. The study highlighted how excessive food waste not only limits progress in ending hunger (SDG 2) but also leads to significant environmental consequences (SDG 13). Furthermore, unsustainable food consumption patterns undermined efforts to establish responsible production and consumption systems (SDG 12). During the analysis phase, it was identified that Hambanthota, Kegalle, Mathale, Nuwara Eliya and Polonnaruwa Districts have higher index values reflecting the best performance in reducing household food waste in considering achieving SDG 2. Monaragala, Rathnapura, and Trincomalee Districts have higher index values reflecting the best performance in reducing household food waste considering achieving SDG 12. Gampaha, Galle, Hambanthota, Nuwara Eliya and Rathnapura districts have higher indexes reflecting the best performance in reducing household food waste considering achieving SDG 13. The Food Waste Index provided a linkage for assessing the impact of the sub-indicators for the SDGs and that will lead to actionable insight for policymakers, households, and communities as a practical benchmark to reduce household food waste. It will be a powerful and achievable step in paving the way for the successful realization of these SDGs by 2030.

Keywords: Household Food Waste Index, Household Food Waste, Principal Component Analysis, Sustainable Development Goals.

Optimal Crop Allocations for Home Gardens in the Knuckles Region: A Simulation Analysis Using a Linear Programming Model

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The Knuckles region has a significant economic potential for generating higher income for smallholder farmers. This study proposes optimal crop combinations in home gardens in the Knuckles region under alternative agricultural practices and marketing arrangements. The specific objectives are (i) to identify the key characteristics of a typical home garden in the Knuckles region, (ii) to perform a cost-benefit analysis (CBA) for the coffee, pepper, and clove in home gardens, (iii) to develop a Linear Programming (LP) model to determine optimal crop allocation for a profit-maximizing farmer, and (iv) to simulate optimal crop mixes with Department Export Agriculture (DEA) recommendations, and a buyback arrangement for clove. Labor outmigration was treated exogenous to the model. Data were collected from the Dankanda area via Key Informant Interviews (KII) and secondary sources. The KII revealed that the average cultivable land in existing Knuckles home gardens and coffee, cloves, and pepper are the predominant crops. The CBA indicates that pepper generates the highest Net present Value (NPV) followed by coffee and clove with existing farmer practices, yields and prices and value addition is a costly operation in absence of established marketing options. The simulation results of the LP model indicate the potential increase profits with adoption of DEA recommendations and marketing options. Labor is a binding resource in the area and out-migration will act as a challenge to improve incomes from homegardens.

Keywords: Profitability analysis, Cost-benefit analysis, Home Gardens, Land use planning

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Adaptation to Water Scarcity: Coping Strategies and Farmer Organizations' Role in Thambuththegama, Mahaweli System-H

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The Mahaweli System-H has necessitated adaptive coping strategies to ensure equitable resource distribution and agricultural sustainability. This study examines the strategies employed by farmers and assesses the role of farmer organizations in collective water governance. Data were collected through surveys and interviews with farmers and farmer organizations, utilizing a quantitative approach incorporating correlation analysis and *Likert* scale-based assessments. Findings reveal that 94% of farmers rely on agro-wells as an alternative water source, while 6% depend on drainage canals. Regarding cropping adaptations, 60% cultivate both paddy and other field crops (OFC), whereas 20% have shifted entirely to perennials. The study highlights that factors such as land location, ownership status, and farmer education levels significantly influence water management choices. However, farmer organizations face challenges in effective water governance due to ambiguous boundaries, inequitable decision-making, and weak rule enforcement. These limitations reduce their ability to regulate collective water management effectively. Addressing these gaps requires strengthening governance structures, enhancing monitoring mechanisms, and improving institutional support to ensure long-term sustainability. The study's insights are crucial for policymakers and stakeholders aiming to enhance collective water governance frameworks. By reinforcing institutional capacity and promoting inclusive decision-making, sustainable water management practices can be fostered, ultimately securing agricultural resilience in Mahaweli System-H and similar irrigated regions.

Keywords: Coping Strategies, *Ostrom's* Principles, Farmer organizations, Mahaweli System-H

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Quality of Life of Tea Harvesters and Its Variations Based on Off-Estate Employment of Their Household Members

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Despite the significant contributions to Sri Lanka's national output, net foreign exchange, and employment, the tea estate industry is facing challenges due to workforce shrinkage from labor outmigration to other sectors of employment. Estate residents seek more attractive off-estate job opportunities due to poor living conditions that directly impact the different aspects of their quality of life (QOL). This study identifies the types of off-estate jobs that household members of tea harvesters engage in and examines how QOL of the tea harvesters varies depending on the nature of their household member's job in terms of their presence at home. The study was conducted at a tea estate belonging to a Regional Plantation Company (RPC) based in Hatton, Sri Lanka, using a mixed-method approach with a semi-structured questionnaire survey. WHOQOL-BREF model was used to conceptualize the four QOL domains (Physical, Psychological, Social, and Environmental). Data were gathered through face-to-face interviews with 57 estate employees (Female-37, Male-20) using the WHOQOL-BREF scale translated into Sinhala and Tamil, behavioral measures of QOL, and open-ended questions. Exploratory factor analysis was conducted to create a QOL variable. Regression analysis with QOL as the dependent variable revealed a marginally significant relationship between the nature of off-estate employment in terms of presence at home and the estate employee's QOL ($p < 0.05$), and a significant relationship between gender, behavioral measures of social relationships, and psychological QOL of the tea harvester. Thematic analysis of qualitative data revealed that physical QOL is not significantly affected by off-estate employment, social relationships are considerably affected leading to emotional loneliness, and the environmental domain is positively affected only for those whose household member earns more than or around 100,000 LKR monthly and sends it home. Additionally, job dignity and concerns about family members' safety impacted psychological QOL. The findings of this study can help estate management and relevant authorities understand the estate community's tendency to seek off-estate employment and its effects on their QOL.

Keywords: Off-estate employment, Tea harvesters, Quality of Life, WHOQOL-BREF, Behavioral Measures

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Concentration of Consumer Purchasing in Rice Market: A Study in Semi-Urban Areas of the Western Province, Sri Lanka.

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Rice is a staple food in Sri Lanka, contributing approximately 45% of total caloric intake, with an annual per capita consumption of 107 kg. Understanding consumer purchasing behavior is crucial for assessing market efficiency and competition, particularly in semi-urban areas where retail structures are shaped by price variations, supply chains, and consumer preferences. This study examines the concentration of consumer purchasing in rice markets within the Western Province, focusing on brand preferences, purchasing behavior, and consumption patterns. A quantitative methodology was employed, with data collected through structured interviews with 26 retailers and 60 randomly selected households. The Herfindahl-Hirschman Index (HHI) was used to measure market concentration, revealing that the rice market in the Yagoda area is highly concentrated, with an HHI score of 2605. Major brands such as Mihijaya, Araliya, and Nipuna dominate sales. However, brand preference results differed due to a rice scarcity during the research period. Despite this constraint, the most preferred brands were Araliya, Nipuna, and Mihijaya, respectively. A significant proportion of households primarily obtain rice through purchases from local retail markets, rather than through self-cultivation or receiving it from relatives. Most households procure rice from local grocery stores rather than supermarkets or self-sustaining sources. Locally milled rice by weight is the most preferred way of purchasing rice followed by 5kg branded rice packs. An average of 1.16 kg of rice is cooked in one household per day. There are 3.9 members in average in a household. Consumption patterns vary by household demographics. Brand preference is influenced by factors such as cooking texture and taste. These insights provide valuable implications for market regulation, consumer welfare, and retail strategies in semi-urban rice markets.

Keywords: Market concentration, Rice brands, Purchasing behavior, Consumer preferences, Rice market structure

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Assessing Effects of Climate Change and Climate-Smart Interventions on Paddy Farming: An Analysis Using the APSIM Model

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Addressing the impacts of climate change on agriculture presents significant challenges, necessitating the rapid adoption of Climate-Smart Agriculture (CSA) strategies. This study analyzes the effects of changes in rainfall and temperature, along with selected CSA interventions, on paddy yield and profitability. Future climate scenarios for the period 2026–2030 were generated using an ARIMA model which was trained and validated with daily climate data from 1990 to 2023. APSIM simulations based on the above generated future climate scenarios without any CSA interventions, projected yield increases ranging from 26% to 38% in Wet Zone low country, Intermediate Zone mid country, and Intermediate Zone up country indicating a positive climate change induced yield effect. Moderate to low yield gains ranging from 4.5% to 15%, were observed respectively in Intermediate Zone low country and dry zone moderate-yielding areas. In contrast, several regions showed yield reductions under the anticipated climate change. Low-yielding areas in dry zone experienced a slight decline of 6.5%, while high-yielding areas in the same zone recorded a more substantial yield loss of 21.2%. The most significant yield declines were seen in the wet zone mid country and up country areas with reductions up to 40%. The study specifically assessed the economic effects of Alternate Wetting and Drying (AWD) in the intermediate zone low country where a cost-benefit analysis was conducted for the period 2020–2030. The results revealed that implementing AWD increases the Net Present Value (NPV) from LKR 80,806 to LKR 114,421 per ha per year. In scenarios without climate change, the NPV rose from LKR 78,489 to LKR 115,080 per ha per year under the AWD intervention. These findings show that CSA interventions are not only agronomically and environmentally effective but also economically viable solutions for climate-resilient paddy production in selected regions in Sri Lanka.

Keywords: Resilient farming, Cost-Benefit Analysis, Alternative Wetting and Drying

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An Analysis of Ethical and Cultural Determinants of Food Waste

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Food wastage is a major problem with various social, economic, and environmental impacts in the world. This study focuses on the cultural and ethical considerations of food waste by adopting a quantitative research design to arrive at conclusion through statistical inference from the findings of eighty households. The main factors under consideration are socio-demographic characteristics, personal beliefs, perceived social norms, behavioural intention, purchase behaviour, household management, environmental concerns, economic factors, cultural aspects, and ethical concerns. Descriptive analysis was carried out using frequencies, measures of central tendency and variability, Pearson correlation test, stepwise multiple regression analysis, and Cronbach alpha coefficient was used to establish internal reliability of each research instrument. It was confirmed that female, higher age, higher education level and high levels of the behavioural intent directly affect food waste behaviour. Therefore, rest of the factors did not have effects as hypothesized. It is important to note that with respect to ethical concerns, a negative relationship emerged indicating the discrepancy between self-reported ethical standards and actual behaviour. These findings show that there is the need to undertake strategies based on identified demographics to ensure improvement on translating ethics to action. The study suggests interventions, increasing people's awareness, and more investigations into the reason behind the inconsistency of ethical sense and the actions regarding food waste.

Keywords: Food Waste, Ethical Determinants, Cultural Determinants, Socio-Demographics, Behavioural Intervention

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A Study of Factors Affecting Undergraduate Business Operators' Intentions to Continue Their Businesses: Study Conducted at the University of Peradeniya

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Entrepreneurship and new business creation are recognized as key drivers of economic growth. Entrepreneurial intention serves as a fundamental antecedent of entrepreneurial behavior. While some undergraduates operate different types of businesses during their studies. After they complete their studies, their decisions vary from continuing their businesses or transitioning to paid employment. This study examines the factors affecting undergraduate business operators' intentions to continue entrepreneurial activities upon graduation at the University of Peradeniya. Based on the Theory of Planned Behavior framework and incorporating other factors, this research addresses a notable gap in the entrepreneurship literature that is exclusively focused on initial business formation rather than the intention to continue businesses. Data were collected through a primary survey administered to 80 undergraduate business operators identified through snowball sampling. Using Structural Equation Modeling (SEM), the study analyzed the relationships between intention to continue business and several potential determinants. The results indicate that students' intention to continue with their businesses is significantly affected by attitude towards continuing business, perceived behavioural control, motivation and gender ($P < 0.05$). Notably, continuation intentions are not significantly influenced by subjective norms, perceived entrepreneurial skills, and risk-taking propensity. One of the main findings from this research is that students who already run businesses may have paid less attention to what others think, and they have been less influenced by others' opinions. These results provide valuable insights for higher education institutions and policymakers seeking to foster sustainable business operators among university students, suggesting that targeted interventions focusing on attitude development and enhancing self-efficacy could effectively encourage graduates to be successful business operators.

Keywords: Entrepreneurship, Entrepreneurial intention, Theory of Planned Behavior, Undergraduate business operators, Business continuation

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Analysis of Factors Influencing Digital Marketing Adoption and Performance in Small-Scale Food and Agri-Businesses

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This study examines the factors influencing digital marketing adoption among small-scale food and agri-businesses in Kandy and Kurunegala districts and assesses its impact on business performance. Employing a mixed-methods approach, primary data were gathered through face-to-face interviews with 101 business owners/managers, selected via snowball sampling. Data were analyzed with methods including descriptive statistics, chi-square tests, paired t-tests, logistic regression, and multiple linear regression. Findings reveal that perceived usefulness, perceived ease of use, resource availability, and access to financial and technological resources significantly drive digital marketing adoption. Adopters exhibited higher gross profit margins (32.45% vs. 25.41% for non-adopters) and improved self-assessed business performance scores. Education level strongly correlated with adoption, with higher-educated owners more likely to adopt digital tools. Among the theoretical frameworks—Technology Acceptance Model (TAM), Diffusion of Innovations (DOI), and Resource-Based View (RBV), DOI model provided the best fit. The study highlights digital marketing’s critical role in enhancing business performance within Sri Lanka’s agricultural SME (Small and Medium Enterprises) sector. Recommendations for increasing adoption include targeted training, resource support, and awareness campaigns.

Keywords: Digital marketing, Technology adoption, Small-scale enterprises, Food and agriculture sector, Business performance.

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Contribution of Household Food Waste towards Food Insecurity in Sri Lanka

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Food Insecurity and food waste are critical global issues, particularly in developing countries like Sri Lanka, where the interaction between these two phenomena remains underexplored at the household level. This research aims to address this gap by exploring the key variables influencing household food insecurity and the relationship between food waste and food insecurity. Employing secondary data, the study uses the Food Insecurity Experience Scale (FIES), according to Food and Agriculture Organization (FAO), to assess the levels of food insecurity among households in Sri Lanka. The objectives include, finding factors affecting food insecurity, examining the variations in food insecurity levels across different household food waste categories and investigating the simultaneous relationship between household food waste and food insecurity through a simultaneous equation model. Findings indicate that socio-economic factors, such as income, household size, household location, food-purchasing behavior, food-making behavior, education and occupation levels play a crucial role in determining food insecurity levels. The simultaneous equation model further clarifies the complex interdependency between food waste and food insecurity. The findings indicate a significant bidirectional relationship between the two variables, highlighting their interdependence within a simultaneous equations' framework. The analysis reveals that food waste significantly impacts food insecurity and conversely, food insecurity influences food waste levels ($P < 0.05$). This research provides a nuanced understanding of the household-level dynamics of food insecurity and food waste in Sri Lanka, offering valuable understanding for policymakers and stakeholders.

Keywords: Food Insecurity, Household Food Waste, Food Insecurity Experiencing Scale, Simultaneous Equation Model

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Valorization of Fish Waste into Nutrient Enriched Biochar by Hydrothermal Pyrolysis

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Fish processing waste occupies a significant proportion of organic wastes generated both domestically and commercially. Hydrothermal conversion (HTC) is a thermal treatment process that converts the moisture-rich biomass into solid (hydrochar), liquid and gaseous products. Thereby in this study, fish processing waste was hydrothermally converted to nutrient enriched hydrochar while recovering nutrients from vaporous nitrogen products using a wet scrubber and a ready-made biochar dry scrubber. A laboratory scale HTC reactor was used and the operational temperature was controlled at 350°C, 450°C and 550°C with controlled pressure of 2 kPa and 4 kPa. One-hour retention time was maintained with six different conditions of hydrothermal pyrolysis. A wet scrubber was used to condense vaporous nitrate products, which produces a nutrient rich liquid while a dry scrubber condenses vaporous ammonia, which produces a nutrient enriched biochar. Characteristics of produced hydrochar, liquid product and enriched biochar were analyzed and compared. Results revealed that the hydrochar with pyrolysis condition of 4 kPa - 350°C has the highest available nitrogen (64.49 mg/kg) which includes available nitrate (27.27 mg/kg) and available ammonium (37.22 mg/kg). In the same pyrolysis condition, produced hydrochar had the highest average biochar recovery of 52.48% (wb). Wet scrubber water collected under the pyrolysis condition of 2 kPa - 550°C has the highest available nitrogen (26.93 mg/kg) which includes only available nitrate. Ready made biochar filled dry scrubber with the pyrolysis condition of 4 kPa - 550°C has the highest available nitrogen (37.37 mg/kg) including available nitrate (0.11 mg/kg) at negligible amount but available ammonium (37.26 mg/kg) at a significant level. According to the results, nutrient enriched hydrochar, nutrient rich liquid and nutrient enriched biochar can be optimised by changing the pyrolysis conditions. This study showed that HTP integrated with wet and dry scrubbers is a feasible way of recovering gaseous nitrogens in pyrolysis of nitrogen rich fish waste.

Keywords: Biochar scrubber, Fish waste, Hydrochar, Nitrogen recovery

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Mapping Carbon Sequestration Hotspots Using Remote Sensing and Geographical Information Systems: A Case Study in Central Province of Sri Lanka

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With the increase of global warming, carbon sequestration has become a major area of interest at present. Sustainable development goals (SDG) 12 (Responsible consumption and production), 13 (Climate action), and 15 (Life on land) are aligned with carbon sequestration. The Central Province of Sri Lanka has been identified as a critical carbon sink. Lack of proper identification of the carbon sequestration hotspots and cold spots in the Central Province is a drawback for the precise conservation of hotspots and restoration of cold spots. This study aims at precisely mapping carbon sequestration hotspots and cold spots in the Central Province using remote sensing, and geographical information systems. The carbon sequestration hotspot map was developed using seven parameters which include soil organic carbon content, normalized difference vegetation index, land use and land cover, land surface temperature, soil pH, slope, and mean annual rainfall. Soil organic carbon content, which has a 36% impact level, was the most influential parameter on carbon sequestration potential, whereas the mean annual rainfall, with a 2% importance level, has the least impact. Horton Plains and the forest reserves in the Nuwara Eliya district serve as the most significant sequestration hotspots. Urbanized areas in Kandy, Matale, Dambulla, and Wasgamuwa National park are identified as the significant sequestration cold spots. The developed carbon sequestration potential map has a correlation coefficient (R^2 value) of 0.76 with the soil carbon sequestration map of the Food and Agriculture Organization.

Keywords: SDG, Carbon sequestration, Hotspots, Cold spots, Correlation

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Development of a Yolov5 & Midas-Based System for Real-Time Bell Pepper Fruit Localization for Robotic Harvesting

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Traditional bell pepper harvesting workflows are challenged by fruit damage, labor inefficiency, and poor detection of occluded or immature fruits. This study proposes a real-time workflow that integrates YOLOv5 for bell pepper detection and the Midas depth estimation model to enhance 3D localization for robotic harvesting. The workflow aims to increase accuracy, reduce wastage, and enable autonomous harvesting in greenhouse environments. A dataset of 1,400 images was collected from Sri Lankan greenhouses, annotated into "harvestable" (ripe) and non-harvestable" categories. After preprocessing via video frame extraction and resizing, the YOLOv5 model was trained on an 80-20 split, achieving a mean Average Precision (mAP@0.5) of 0.912. For harvestable bell peppers, the system demonstrated high precision (0.976) and recall (0.96), which ensures the reliability of the system in the identification of ripe fruits. Depth estimation using Midas further enhanced spatial localization accuracy, which is critical for guiding the robotic arm during harvesting. However, challenges persisted in classifying non-harvestable (86% accuracy) and background misclassification (48–52%). Best confidence thresholds (0.661) yielded precision-recall trade-offs, providing an F1-score of 0.87. The system demonstrated real-time processing potential, with inference rates suitable for dynamic environments. YOLOv5-Midas integration greatly enhances the effectiveness of bell pepper detection for robot harvesting; however, future research must address existing limitations through the implementation of dynamic thresholding, the inclusion of multi-sensor fusion, and the expansion of datasets. This study showcases the prospects of deep learning and computer vision in precision agriculture, presenting a scalable solution to improve yield quality and working efficiency in bell pepper production.

Keywords: YOLOv5, Midas, Fruit localization, Real time, Robotic harvesting.

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Performance Analysis of Floating Treatment Wetlands (FTWs) in Urban Lakes using Transpiration

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Floating Treatment Wetlands (FTWs) have emerged as a sustainable and eco-friendly solution for mitigating urban lake pollution. The performance evaluation of FTWs is not straight forward since there is no specified inflows and outflows for the wetland island. This research focuses on evaluating the performance of FTWs in urban water bodies using transpiration as a key mechanism for pollutant uptake. The study was conducted through two experimental setups: a controlled mesocosm study at the Meewathura Experimental Station and a field study at Kandy Lake, Sri Lanka. Class-A pan was used to measure the evaporation. The *Canna sp.* were used in 40 cm depth PVC pipes with nutrient added water for mesocosm study. The weight loss of, the mesocosm was measured as transpiration. A relationship between evaporation in Class-A pan and the transpiration in mesocosm was established. Four FTW units planted with *Canna sp.* were established in Kandy Lake. Available nitrate (AN) and available phosphate (AP) concentrations in water and total nitrogen (TN) and total phosphorus (TP) plant biomass was measured weekly. Findings revealed that transpiration by plant is 4 and 9 times higher than the evaporation in initial and development stage of the growth of the plant, respectively. A strong correlation (R^2 of 0.95 for TN and R^2 of 1.0 for TP) between nutrient loss in water due to transpiration and nutrient uptake by plant was found in mesocosm study. Using the information on AN and AP in water and transpiration by plants in Kandy lake, the removal rate of nutrient was estimated. The estimated removal rate was highly correlated with the measured TN and TP in the plant in FTWs in Kandy Lake with R^2 of 0.47 for TN and R^2 of 0.42 for TP. The results support the potential of using transpiration-based models to estimate nutrient removal rates in urban lake environments

Keywords: Floating treatment wetlands, Urban lakes, Transpiration, Nutrient removal, Mesocosm study

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Design and Development of a Food Waste Reduction Toolkit for Restaurants and Cafes

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Food waste Management is a critical issue in the restaurant industry, with profound environmental and economic implications. Factors such as inaccurate demand forecasting, inadequate inventory management, and the absence of structured waste reduction strategies contribute significantly to this problem. This study focuses on addressing food waste in Sri Lankan restaurants, specifically within the Kandy Municipal Area, by designing a predictive model aimed at minimizing waste. The proposed solution is implemented as a toolkit within Microsoft Excel, offering an accessible platform for optimizing food preparation and purchasing decisions. The model predicts food demand from the historical data and then integrates variable factors such as weather, promotion, food traffic, food demand, and special events to make the decision on the number of items to be produced without waste and keep operational efficiency. The model's efficacy was tested using both hypothetical and real-world datasets, demonstrating its adaptability and capacity to enhance resource allocation efficiency. The study supports further strengthening of data-driven decision-making for waste management in restaurants. The proposed model provides a structured approach to waste reduction and efficiency enhancement at the same time as it is concerned with sustainability. Future works will focus on integrate the system into mobile platforms to enhance accessibility and enable real-time implementation.

Keywords: Data-driven Decision-making, Demand forecasting, Food waste management, Predictive modelling

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Design of a Miniature Garden Waste Size Reducer for Efficient Waste Management and Resource Recovery

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Proper garden waste management in urban households minimizes the environmental impacts and promotes sustainable resource recovery. Particle size plays a crucial role in biodegradation processes of waste and shredders or choppers are needed for this process. However, appropriate machines for household waste management are not readily available in the market. Urban and semi-urban households typically generate about 10 kg of fresh and dry garden waste per week and need a small and cost-effective particle size-reducing machine. Therefore, a miniature garden waste chopping and shredding machine was designed and developed using two pulverizing mechanisms: chopping attachment with two knife blades and shredding with four chain hammers. Two radial fan blades were fitted on the other side of the chopping blade to pump out the chopping continuously. Both shredding and chopping can be done by changing the attachment and the machine was operated by a 220 W single-phase motor. A belt and pulley was used as the power transmission mechanism. Rittinger's constant, Bond's Work Index, and Kick's constant were calculated to estimate the power requirements for size reduction operations for different particle sizes at different running speeds. The chopper is capable of chopping fresh or dry stalks and branches and the shredder is also efficient for fresh and dry foliage materials. The final particle size of chopping and shredding depended on the rpm of the chopping and shredding attachment. In addition, the fitted sieve size affected the particle size of the shredder. The machine has a chopping capacity between 80 – 200 kg/h with a particle size range between 4 - 10 mm and the shredding capacity was 4 - 8 kg/h at 1700 RPM and 2900 RPM. The Rittinger's and Kick's constants and the Bond's Work Index were dependent on the particle size at a given rpm.

Keywords: Garden waste management, Energy-efficient, Hammering action, size reduction, foliage

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Assessment of Extreme Rainfall Indices to Identify Extreme Rainfall in Nilwala Basin, Sri Lanka

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Nilwala River basin in Southern Sri Lanka is highly prone to extreme rainfall events caused due to monsoon and inter-monsoon rainfall systems prevail over Sri Lanka. Hence, it is important to identify the trends and frequency of occurrence of extreme events over this region, because of their negative impacts over different sectors including agriculture, biodiversity, and livelihoods. This study examines rainfall extremes that have implications for water resource management and disaster preparedness in the basin. Daily rainfall station data from 1995 to 2025 were obtained from Meteorological and Irrigation Departments of Sri Lanka and due to their inconsistency CHIRPS (Climate Hazards Group InfraRed Precipitation with Station data), were cross-validated with the station records and used for the study. Four ETCCDI (Expert Team on Climate Change Detection and Indices) extreme precipitation indices such as annual maximum one-day rainfall, annual maximum five-day rainfall, annual total precipitation exceeding 95th percentile, and annual total precipitation exceeding 99th percentile was calculated. A trend analysis was performed on a year-to-year and seasonal basis using the Mann-Kendall test and Sen's slope estimator, whereas a spatial analysis was performed for the mapping distribution of extreme rainfall across the basin. The results revealed that annual total rainfall exceeding 99th and 95th percentiles of Panadugama, Pitabeddara, Thalagahagoda and Urawa stations showed an increase in frequency of extreme rainfall. Furthermore, annual maximum five-day rainfall alone showed significant trends at Pitabeddara and Urawa, indicating an intensifying trend of prolonged rainfall in these areas. Moreover, significant increases of extreme rainfall events could be more likely to be observed during Southwest monsoon and Second Inter-monsoon rainfall seasons which would cause flooding, landslides and threats to livelihoods in Nilwala region.

Keywords: Nilwala river basin, Extreme rainfall indices and trends, CHIRPS data

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Assessment of Occurrence and Fate of Microplastic Contaminants in Animal Manure

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Animal manure commonly applied as organic soil amendments in crop cultivation is a beneficial by-product of animal husbandry. The application of animal manure could improve the properties and processes of agricultural soil while supplying essential plant nutrients. However, the application of low-quality manure that contains pollutants including microplastics (MPs) can be entered into agricultural soil. This results in the degradation of the quality of the agroecosystem and causes a risk to human health since MPs can move via food chains. However, there is no scientifically proven evidence for the level of MP contamination in agroecosystems from animal manure in Sri Lanka. Therefore, this study was to assess the level of MP contamination quantitatively and qualitatively in four types of animal manure including cattle, poultry, swine, and goat. Animal manure samples were collected from three segments in the manure value chain; Animal farms (source), manure sales centers (intermediary points), and agricultural farm fields (end users). Microplastic extraction was done by digesting the manure using a dual digestion protocol (Fenton's reagent and 69% HNO₃ digestion) and density separation with NaCl solution. Six measurements were obtained from the extracted MP samples including count, mass, colour, shape, total area, and total length. It was revealed that all types of manure available at sources are contaminated with MPs (142 – 12,468 particles/kg or 11 – 1,532 mg/kg). Moreover, among the studied manure, swine manure showed the highest contamination level up to $1,160 \pm 125$ mg/kg while goat manure remained at the lowest contamination (23.5 ± 7 mg/kg) at the source. It was also found that transparent (59.2%) and white (33.7%) particles were prominent colours. Fragments (54.4%) and fibers (24.6%) were the dominant shapes indicating that ingestion of plastics through animal feed and secondary contamination throughout the market value chain are the dominant contamination processes. The amount of MP contamination increased along the manure market value chain (311% increase in Poultry and 17% increase in cattle) confirming that not only the origin of the manure but also secondary contamination along the value chain accounted for the MP contamination.

Keywords: Agroecosystems, Contaminants, Manure, Microplastic, Value chain

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Investigating the Performance of Paddy Husk Derived Biochar as a Reactive Material to Reduce the Environmental Impact from Hair Dye Mixed Wastewater

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Water quality in Sri Lanka is declining due to increasing pollution, including wastewater from salons which is unrecognized but critical. The rising use of personal care products contributes to contamination, which conventional treatment methods fail to remove effectively. Despite that, this study attempts to assess the use of Column-Based Water Treatment Plant (CBWTP) as a sustainable filtration system to treat salon wastewater. Biochar derived from Paddy husk and coconut shells, and bricks were tested for their adsorption efficiency, and pollutant removal capacity using CBWTP. Seven material combinations were analyzed, ranging from 100% biochar to 100% bricks. Results showed that bricks had a higher adsorption capacity than biochar. The highest porosity was found in the 35% bricks–65% paddy husk biochar and 75% bricks–25% coconut shell biochar combinations. The longest hydraulic retention time was recorded for 65% paddy husk biochar–35% bricks and 50% bricks–50% coconut shell biochar mixtures. The best nitrate removal efficiency was observed in 75% bricks–25% coconut shell biochar and 65% paddy husk biochar–35% bricks combinations. Bricks proved to be highly effective in adsorption, while biochar enhanced porosity and hydraulic retention time. Paddy husk biochar performed better in retention and removal efficiency, whereas coconut shell biochar contributed to increased porosity. The combination of 75% bricks–25% coconut shell biochar and 65% paddy husk biochar–35% bricks yielded optimal results for nitrate removal, making them the most suitable for salon wastewater treatment. Thus, implementing CBWTP using these combinations can significantly reduce water contamination, providing an efficient and eco-friendly solution to improve wastewater management in salons and protect freshwater ecosystems.

Keywords: Bricks, Paddy husk biochar, Column based water treatment plant, Hair dye, Removal efficiency

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Development of a Robotic Pull-Up Mechanism for Early-Stage Weed Removal

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Weeding is a tedious task which requires lot of energy, capital and hazardous environmental effect when using chemicals. Early stage weed removal can reduce the competition between crops and weeds while reducing the energy requirements. This study aimed to design and evaluate a robotic weed pull-up mechanism for early stage weed removal in row crops, capable of uprooting weeds without damaging crops or causing significant soil disturbance. The weed pull-up gripping mechanism consists of two stepper motors controlled by a microcontroller, attached with a weed gripping mechanism enabling precise gripping and individual weed removal. Uproot of weed required smooth gripping which facilitates through the rack and pinion mechanism attached with soft fingers. The gripper movements until it reaches base of the weed, determined by a level wheel which is attached to the gripping system. Field tests were conducted to identify the required forces to pull up the weeds at an early stage for different weed heights. Results demonstrated that the gripping mechanism achieved over 80% weed removal efficiency proving its potential as a sustainable alternative to chemical herbicides. The trials were conducted with different soil moisture levels to identify the pull up forces, which later can be used to operate robotic systems with minimum energy levels. The developed gripping mechanisms further can be linked with vision systems to identify the weeds pull up for autonomous robotic applications.

Keywords: Robotic weeder, Precision agriculture, Arduino-based automation, Weed removal efficiency, Sustainable farming

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Identification of Potential Zones for Artificial Groundwater Recharging using GIS and Remote Sensing: A Case Study in Anuradhapura District, Sri Lanka

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Groundwater resources are under growing danger in terms of both quantity and quality, particularly in dry regions where these resources serve a vital role in domestic, agricultural, and industrial purposes. In the Dry Zone of Sri Lanka, despite the issues of low rainfall, high evaporation, scarcity of surface water resources and high population growth, artificial recharge of groundwater has not been given much attention. Groundwater recharging addresses issues of public health, food sustainability, climate resilience, and water security in SDGs. This study aims to delineate artificial groundwater recharge potential zones in the Anuradhapura District using GIS and Remote sensing techniques. This region is facing water scarcity in dry season of the year. An integrated approach of GIS, Remote sensing and Analytical hierarchy methods was applied for this study. Hydrological and Geological variables such as rainfall, land use, soil, slope, drainage density, and shear line density were the key parameters that were calibrated to generate a recharge potential map. The GIS tools were used to overlay each layer's effect on groundwater recharging. Based on the output potential map of artificial recharge of groundwater, the area was classified into three distinct potential zones: Low potential (11.27%), Moderate potential (60.60%), and High Potential (28.17%). Finally, the resulting map accuracy was validated using groundwater levels from 20 wells in the study area. The results showed that this approach has resulted noticeably accurate results. Small check dams (nala bunds), check dams, recharge wells, and percolation tanks were recommended for the study area by analyzing the structure's specific requirements. Therefore, the results of the current research will be very helpful for policy makers to plan sustainable groundwater management strategies in the future.

Keywords: Groundwater, Artificial recharging structure, AHP, SDG's

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Rice Crop Growth Monitoring and Yield Assessment Using Remote Sensing and GIS: A Study in Batticaloa District of Sri Lanka

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Rice crop yield is influenced by climatic conditions, water availability, and agronomic practices. Monitoring paddy growth and assessment of yield are useful in ensuring food security. The objective of this study was to monitor paddy crop growth and to predict yield in the Batticaloa District using remote sensing and Geographic Information Systems (GIS). The study was restricted to the Yala season due to high cloud coverage in the Maha season. Sentinel-2 Level-2A satellite images from 2023 and 2024 Yala seasons were used to compute Normalized Difference Vegetation Index (NDVI), Normalized Difference Water Index (NDWI), and Red-edge index, to analyze crop health and stress variations. Paddy cultivated areas were extracted using supervised classification of satellite images and ground truth data were collected through field surveys and interviews. The study further explored the relationship between vegetation indices and yield using regression models. Multi temporal assessment of NDVI, NDWI and Red-edge indices shows a specific pattern, and the vegetation indices come to peak values during 8 weeks after planting. The NDVI-based yield prediction model exhibited a R^2 of 0.70, while the Red-edge model showed an R^2 of 0.69, indicating strong correlations between these indices and yield. The predicted yield for the 2024 Yala season was approximately 5046 kg/ha (NDVI) and 5005 kg/ha (Red-edge), compared to the actual yield of 4497 kg/ha. The Root Mean Square Error values for NDVI and Red-edge models were 12.21% and 11.29%, respectively. These findings demonstrate the effectiveness of remote sensing in monitoring rice crop health and yield estimation and the potential for integrating remote sensing with advanced technologies to enhance precision agricultural practices in Sri Lanka. Future work should focus on increasing prediction accuracy using high spatial resolution imagery, enhanced ground truth data, and machine learning applications.

Keywords: Remote sensing, Rice, Vegetation indices, Satellite imagery, Yield

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Performance Assessment of Floating Treatment Wetlands (FTWs) in Urban Lakes Using Machine Learning

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The application of Floating Treatment Wetlands (FTWs) in urban lake restoration has been increasing in the recent past. However, assessing their performance remains challenging due to the influence of multiple influencing factors. At the same time, Machine Learning (ML) tool has become popular in environmental studies since it accounts complex interactions with large datasets. This study aims to predict and optimize FTW treatment performance using ML in Kandy urban lake in Sri Lanka. This research consists of two parallel components: ML model development and a field experiment. The field study was conducted in Kandy Lake, using four FTW units planted with *Canna sp.* Weekly water and plants analyses were performed over six weeks from February to March 2024, monitoring nitrate and phosphate concentrations, dissolved oxygen, turbidity, rainfall, water and atmospheric temperature. In addition, lake area, area of FTW and depth of water were obtained from past literature. Data mining was done using keywords (FTW and other terms used to address it) in the Scopus, Google Scholar and PubMed. Out of 500 cited papers, 6 were selected based on the data consistency and access and 192 datasets were obtained for the model. Data preprocessing was done before the model training by handling missing values (kNN), scaling (StandardScaler), normalizing (power transformer) and feature engineering. For ML model development, five algorithms—Random Forest (RF), XGBoost (XGB), Support Vector Machine (SVM), Decision Tree (DT), and Linear Regression (LR)—were trained to predict nitrogen (N) and phosphorus (P) removal efficiencies (RE) using the dataset of 12 selected input variables, including design, hydraulic, water quality, lake, plant, and climate parameters. Training, testing and validation of models were performed using 70%, 15% and 15% of data set, respectively. RF, SVM, and XGB outperformed other models, achieving R^2 values of 0.72, 0.61, and 0.58 for N RE and 0.78, 0.59, and 0.68 for P RE. RF demonstrated the best predictive accuracy and was used to generate predictions for the field experiment. Model predictions was satisfactory with the RE for N ranging from 53% to 70% and RE for P ranging from 53% to 63%. These findings highlight the potential of ML-based modelling to improve FTW performance assessment, contributing to data-driven decision-making for urban lake restoration.

Keywords: Floating treatment wetlands, Supervised learning, Urban lakes, Performance assessment

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Development of a Control System for Multi-Ingredient Spice Milling

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The spice milling industry that processes multiple ingredients depends on specific ratios of mixing to achieve uniformity and quality in the final product. Unfortunately, most existing control systems are imprecise and lack a high degree of automation and real-time monitoring. This study was aimed at designing an automated control system for a multi-ingredient spice milling process at Ruhunu Food Company, a Sri Lankan-based company. The proposed system operating at the company employs an Arduino Mega as the primary controller, and handling a TFT display, and an ESP32 for cloud connectivity. Five rotary valve motors for spices are set to certain operational time limits which correspond to the required ratio of spices dispensed from the silos. A rotary encoder and limit switches ensure that control is exercised accurately, while the system is validated and safe. The user interface displays the actual ratios of spices contained in the sub mixture, the state of the system, and some other operational parameters, and allows the user to issue commands through predefined input mechanisms. Additionally, the implementation of an emergency switch increases safety levels. The criteria for system performance included the accuracy of the robot control system in achieving predefined mixing ratios, response time, and accessibility. The results of the implementation demonstrate that the accuracy and automation changes in ratio control achieved by this method improved in comparison to manual or semi-automated methods. Control of this type will likely enhance efficiency in the spice milling industry, reduce the chances of human error, and benefit most companies in this trade.

Keywords: Spice milling, Arduino Mega, Rotary valve control, Automation, Cloud integration, Real-time monitoring

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Development of a Real Time Coconut Plantation Management System Using Drone Images and AI

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Coconut plantations are a key plantation in Sri Lanka's agricultural sector, contributing significantly to the economy. However, their productivity is increasingly threatened by biotic and abiotic stresses, such as diseases, water stress, and nutrient deficiencies. Traditional methods for monitoring plantation health are labor-intensive, time-consuming, and dependent on individual judgement. To address these challenges, this study integrates drone-based remote sensing and artificial intelligence (AI) for stress detection in coconut palms. High-resolution multispectral data were collected using drones to assess plant health. Vegetation indices were extracted to identify stress indicators. The CAT Boost machine learning model was employed to classify coconut trees based on their stress conditions. The model's performance was evaluated using R^2 (coefficient of determination) and Mean Absolute Error (MAE). The results showed high predictive accuracy, with $R^2 = 0.7790$ and MAE = 0.1406 for water stress detection, $R^2 = 0.7879$ and MAE = 3.6512 for nutrient stress detection, and $R^2 = 0.7067$ and MAE = 5.6061 for disease and pest stress detection. The findings indicate that AI-driven analysis of drone imagery provides a cost-effective, scalable, and time-efficient approach for early stress detection in coconut plantations. The technology supports precision agriculture by enabling timely interventions, efficient resource use, and improved crop health. Applying remote sensing and machine learning, it advances smart agriculture and sustainable plantation management. The proposed methodology has the potential to be expanded to other perennial crops and making it a valuable model for modern agricultural practices.

Keywords: Drone based remote sensing, AI in agriculture, Stress detection, Machine learning

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Development of Gripping Mechanism and Evaluation for Tomato Robotic Harvesting

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The increasing global demand for tomatoes requires efficient harvesting solutions to reduce high operational costs, labor shortages, inefficiency of the harvesting process, and fruit damage through manual methods. This study focuses on designing a robotic gripper integrated with a fruit detachment mechanism for tomato harvesting. The gripper consists of a rigid, three finger electric design driven by a DC gear motor which can grip tomatoes with diameters ranging from 35 mm to 78.9 mm and weights from 45 g to 115 g. The motorized screw mechanism ensures precise finger adjustments at its full closure to securely grasp 35 mm tomato with 11.63 screw rotations. Force-Sensing Resistors (FSR) sensors are embedded in the gripping contact surface which enables real-time monitoring of applied pressure, thereby preventing damage to fruits. The FSR sensors were calibrated to measure pressure force in Newtons, and an optimal threshold pressure of 0.65 N was established for the effective and delicate handling of tomatoes. A stepper motor was used in the mechanism employed for fruit detachment, enabling controlled rotation and accurate separation of the tomato from its stem. The entire system is operated using an ESP32 microcontroller, enabling effortless integration and functionality of the gripping and detachment. Experimental trials showed successful handling of tomatoes with different size diameters with minimal damage while using a maximum of 11 s to the total process. The proposed design surpasses the limitations of manual harvesting by enhancing efficiency, precision and minimizing fruit damage. The developed gripping mechanism can be applied with different manipulation mechanisms for harvesting tomatoes.

Keywords: Robotic harvesting, Gripping mechanism, Electric gripper, Force sensing resistor, Fruit separating mechanism

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Effectiveness of Advisory Videos in Educating Tea Smallholders on Nursery Management, Foliar Fertilizer Application, and Labour Wage Issues in the Mid Country and Uva Region Sri Lanka

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The use of advisory videos is gaining prominence in agricultural extension services, particularly for reaching small-scale farmers with timely and targeted information. This study was conducted to test the effectiveness of video-based advisories in enhancing the knowledge of tea smallholders in Mid Country and Uva tea cultivating regions in Sri Lanka. focusing on three key areas; nursery management, foliar fertilizer application, and labour wage issues. A design-based research (DBR) approach was adopted. The research process comprised three stages; audience analysis, video content development, and effectiveness evaluation. Based on the audience analysis results, ten short video clips (4–6 minutes each) were developed using documentary and interview-style formats. A pre-test and post-test design was implemented with 30 volunteer participants to assess knowledge levels before and after viewing the videos. Data were analyzed using the paired sample t-test. The results indicated that there was a significant knowledge improvement after watching videos across the selected topics ($t = 5.19$, $p < 0.005$). Participant feedback revealed mixed results while more than 75% of the respondents appreciated the videos' clarity and relevance, others suggested producing videos to explain new techniques. Furthermore, video-based extension services can serve as a valuable supplement to traditional agricultural training. However, it is needed to focus on interactive content, regional customization, and integration with other extension activities for greater impact. This study concludes the advisory videos were effective in improving knowledge among tea small holders however, knowledge gain was not uniform, indicating that videos alone may not be enough. The study highlights the potential of digital media in agricultural extension and recommends further research on long-term knowledge retention, technology access, and farmer adoption rates.

Keywords: Advisory videos, Tea smallholders, Design-based research (DBR), Video-based learning, Digital media

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Effect of Green HRM Practices and Employee Green Behavior on Organizational Sustainable Performance: A Study in a Sri Lankan Bank

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Green Human Resource Management (GHRM) has emerged as a crucial driver for integrating sustainability into corporate strategies, by embedding environmentally friendly policies within HRM functions such as recruitment and selection, training, performance management, and employee rewards fostering environmentally friendly practices across organizations. This study aimed to identify the effect of employees' perception of green HRM practices and employee green behavior on organizational sustainable performance and employee engagement. Study was conducted at the head office of an established licensed private sector commercial bank in Sri Lanka. The study employed quantitative methods involving employees from three (3) executive grades, representing middle and junior management (n=124). Data were analyzed using inferential statistical analyses that included the t-test, ANOVA test, and multiple linear regression analysis. Findings of the study revealed that certain green HRM practices, viz; training and green involvement, had a positive effect ($p < 0.05$) on organizational sustainable performance. Organizationally planned, standard environment-friendly practices have a positive effect on the sustainable performance of the organization. Employee green behavior, when not properly aligned with the standard practices of an organization, can have a negatively affect. Discretionally, the environmentally friendly practices of individual employees can have a negative effect on the sustainable performance of the organization. Employee green behavior has a positive effect on employee engagement. Opportunities to practice environmentally friendly practices improve employee engagement within an organization.

Keywords: Green HRM, organizational sustainable performance, employee engagement

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Evacuate Now or Never: Framing Effects on Public Response to Early Warning Messages of Floodplain Residents in Sri Lanka

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As global warming intensifies, flooding remains a recurrent issue in Sri Lanka, particularly in Colombo, Kaluthara, Rathnapura, and Matara districts. During 1974 and 2022, floods affected more than 15.4 million Sri Lankans. Early warning messages issued by the Irrigation Department are disseminated through various media channels, despite their high credibility, evacuation processes remain slow, leading to significant loss of lives and property damage during flood events. Limited research has explored whether these messages effectively engage flood-affected communities or influence their behavioral responses. This study addresses this gap by examining how textual design and visual framing affect flood risk communication. We pose four research questions. RQ1: Does the visual framing of flood early warning messages positively affect (a) flood policy support, (b) flood preparedness, (c) information-seeking behaviors, and (d) pro-environmental behavioral intentions? RQ2: Does the textual design of flood early warning messages positively affect the above outcomes? RQ3: Is there an interaction effect between visual framing and textual design that enhances these outcomes? RQ4: Does fear mediate the relationships identified in RQ1 and RQ2? We used a 2 (visual frame: images vs. no images) $\times$ 2 (textual design: paragraphs vs. no paragraphs) between-subjects factorial experimental design with a control message. Data were collected via an online survey hosted on Google Forms. Hierarchical linear regression and SPSS Process Macro were employed for the analysis. Demographics, source credibility, proximity to the river, residential status were set as covariates. Findings revealed that visual framing significantly predicts policy support, with fear mediating this relationship (RQ1a: Effect size = 46.9%, RQ4: Direct effect size = 29.70%, Indirect effect size = 5.01%). Textual design and its interaction with visual framing do not significantly affect outcomes. Age, gender, and proximity to the river (500-1000m) predict flood preparedness, while proximity to the river and rural residential status predict information-seeking behaviors.

Keywords: Flood early warnings, Visual framing, Textual design, Policy support, Fear appeal, Flood risk communication

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Effectiveness of Community-Based Organizations as Entry Points for Rural Agricultural Development

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Community-Based Organizations (CBOs) have been recognized as channels for rural development mainly in agricultural communities. CBOs play a major role in Sri Lanka's rural agriculture. This research aimed at identifying the CBOs that serve as entry points for rural agricultural development and examining their effectiveness with reference to "Good governance principles". The research was conducted as a case-study in *Mamunugama* and *Ihalathimbiriyawa Grama Niladhari* Divisions with a sample of 47 respondents selected using purposive sampling, representing agricultural CBOs. The research involved data collection through consultation meetings (04) with development practitioners, focus group discussions (04), and a questionnaire survey (n=47). Data were analyzed mainly using thematic analysis, descriptive statistics and Spearman's correlation test. The results revealed several CBOs that act as entry points to development, including Farmer Organizations (FOs), Women's Societies and Water CBOs. They perform important roles in resource management, administrative management, knowledge transfer, communication, coordination and governance. Statistical analysis indicated the presence of significant positive correlations between CBO effectiveness and good governance principles. Perceived effectiveness of FO was moderately correlated with participation ($\rho=0.440, p=0.003$), transparency ($\rho=0.391, p=0.007$), responsiveness ($\rho=0.401, p=0.005$) and rule of law ($\rho=0.467, p=0.001$). Access to resources ($\rho=0.463, p=0.001$) significantly impacted CBO performance. The results further revealed that CBOs face several challenges including administrative difficulties, managing wildlife conflicts and implementation issues. This in-depth exploration generates empirical evidence on the potentials and limitations of CBOs as entry points for rural agricultural development.

Keywords: Community, Rural Development, Community-based Organization, Good governance

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Can Urban In-Migrants Revitalize Declining Rural Regions?: An Exploratory Study On Chiiki Okoshi Kyouryokutai Program In Saga Prefecture, Japan

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Japan's rural regions, particularly those in peripheral areas, continue to face significant demographic decline, economic stagnation, and social fragmentation. In response, the Japanese government has implemented a range of rural revitalization policies, most notably the *Chiiki Okoshi Kyōryokutai* (Local Revitalization Cooperator: LRC) program. This initiative encourages urban residents to relocate to rural areas and contribute to local development. The LRC program aims not only to counter depopulation but also to stimulate economic activity, facilitate cultural exchange, and promote the long-term sustainability of rural communities through the engagement of skilled urban in-migrants. However, empirical research evaluating the program's effectiveness and sustainability from a multi-stakeholder perspective remains limited. This study addresses this gap by examining the LRC initiative in Saga Prefecture through a qualitative research design. From a multi-stakeholder perspective, it explores the factors influencing the integration of LRC members into local communities, as part of broader efforts to revitalize the declining rural regions of Saga. Data were collected through open-ended and semi-structured interviews with 14 LRC members and 19 local residents. Additionally, an online survey of 128 members of the general public was conducted to assess broader societal perceptions of the program. Thematic coding was employed to identify and analyze key patterns and themes. The findings underscore the critical role of local residents' acceptance and willingness to engage, the motivations of LRC participants, and the presence of an enabling environment in ensuring the program's success. While centered on the Japanese context, the insights from this study offer valuable implications for the design and implementation of similar rural revitalization initiatives worldwide, particularly in regions experiencing socio-economic and cultural decline.

Keywords: *Chiiki Okoshi Kyouryokutai*, In-migrants, Multi-stakeholders, Rural revitalization

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Developing a Subjective Tool to Assess Social Capital in Rural Agrarian Communities: A Psychometric Approach

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Social capital is a crucial resource for collective action, particularly in rural agrarian communities where resources are often shared. It fosters collaboration and facilitates collective problem-solving. Measuring social capital within a given social group is crucial for informing policy decisions, as it enables development practitioners to both stimulate collective initiatives and assess their feasibility within the local context. Despite its significance, there remains a lack of subjective psychometric tools capable of effectively measuring social capital. In this study, a subjective psychometric tool was developed to assess social capital, capturing its key dimensions. A cross-sectional study was conducted with 205 respondents across seven Grama Niladhari divisions in the Knuckles Region of Matale District, Sri Lanka. Data were collected through face-to-face interviews. Exploratory Factor Analysis (EFA) revealed a four-factor structure with significant factor loadings. The latent dimensions identified—general trust, trust in livelihood transactions, shared identity, and networks/norms of reciprocity—reflect the broader construct of collective action. Confirmatory Factor Analysis (CFA) supported an acceptable model fit, and the tool demonstrated strong validity and reliability metrics. Structural Equation Modeling (SEM) further confirmed predictive validity, using group efficacy as the dependent variable. Additionally, the Intra-class Correlation Coefficient (ICC) indicated cognitive consensus among respondents. This tool offers a robust means for development practitioners and policymakers to understand and leverage social capital, enabling more effective strategies for promoting collective action and sustainable development.

Keywords: Social Capital, Collective Action, Psychometric Tool

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An Exploratory Study on the Impact of Producer-Led Farmers' Markets on Social Well-Being of Aging Farmers in Central Saga Prefecture, Japan

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Japan is undergoing a rapid demographic transition characterized by an aging population. This aging trend is exacerbated by a concomitant decline in the availability of labor, further straining the sector's capacity to meet the growing demands of food production. Addressing the social well-being of aging farmers is essential for maintaining their involvement in agricultural production, encouraging retention, and ensuring the long-term sustainability of the sector. This exploratory study investigates the role of producer-led farmers' markets in enhancing the social well-being of aging farmers in the Central Region of Saga Prefecture, Japan. Although existing literature emphasizes the economic advantages of Japan's farmers' market system, this study posits that these markets also enhance quality of life by prioritizing the needs and interests of producers. Data were collected through systematic observations, in-depth interviews, and a semi-structured questionnaire survey. Interviews were conducted with managers of five producer-led farmers' markets in the Central Region of Saga Prefecture, and 56 elderly farmers who supply produce to these markets were surveyed. The interviews examined various market operations and their underlying functions, which contribute to the enhancement of quality of life for aging farmers. Findings reveal that farmers' markets enhance social well-being by fostering community engagement, social support, reducing isolation, and facilitating social connections. These connections influence social acceptance, contribution, integration, actualization, and coherence among farmers. The findings can inform policies and programs to support aging farmers, promote sustainable agriculture, and revitalize rural communities by recognizing farmers' markets as critical social and psychological support networks that enable elderly farmers' continued participation in agriculture.

Keywords: Producer-led farmers' markets, Aging farmers, Social well-being

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The Impact of Crisis-Induced Migration on Livelihoods of Agricultural Communities: A Case Study from the Dry Zone of Sri Lanka

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Crisis-induced migration is a complex socio-economic phenomenon with significant consequences upon rural agricultural communities. This case study explored the lived experience of individuals affected by crisis-induced migration in *Gomarankadawala*, a minor tank-based village in Sri Lanka's dry zone. This study explored the impact of crisis-induced migration on livelihoods of agricultural communities, specifically, it explores the prevalence and patterns of out-migration, key driving factors and socio economic consequences of crisis-induced migration for migrants and non-migrants. Focusing on three *Grama Niladari* divisions, *Mailawewa*, *Pamburugaswewa* and *Kandamalawa*, the research was conducted with a sample of 41 households, selected using purposive sampling method. Key Informant Interviews (KIIs) and a survey (n=41) was carried out using structured guides for data collection. Data were analyzed using thematic analysis and descriptive statistics. The findings revealed three distinct types of migrants namely 1) Resettlers displaced due to development projects, 2) Seasonal migrants driven by agricultural labor demands tied to the *Yala* and *Maha* seasons, 3) Returned migrants driven by post-civil war. In this study, distinct disparities in livelihoods were observed in relation to the specific migration patterns of the community. This resulted in notable differences in the socio-economic conditions between migrant and non-migrant groups. The findings of the study contribute to a deeper understanding of migration patterns in an agrarian crisis context, offering insights for sustainable livelihood restoration in affected rural communities.

Keywords: Crisis-induced migration, Sustainable livelihoods, Rural agriculture, resettlement, Seasonal migration, Post-war return

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Comparison of Growth and Nutrient Assimilation in Hybrid Napier Cultivars in Mid Country, Wet Zone

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Hybrid Napier (*Pennisetum purpureum*) cultivars show better adaptation to tropical climates, offering a sustainable solution to forages shortage for feeding dairy cattle in Sri Lanka. This study investigated the growth and nutrient assimilation of the newly imported CO6, in comparison with two widely used Napier cultivars (CO5, Pakchong) in the mid country wet zone. Fodder cultivars were randomly assigned to 12m² size plots using a Randomized Complete Block Design at the Animal Farm of Veterinary Research Institute. Two-node stem cuttings were planted at 1 x 1 m spacing. Recommended fertilizer mixture for Napier (Urea-TSP-MOP at 200-150-100 kg/ha) was applied. Plant height, shoot density, leaves per shoot, standard leaf length and standard leaf width were recorded weekly. Forages were harvested at ten weeks. The leaf to stem ratio (LS), composition, fresh matter yield (FMY), dry matter yield (DMY), organic matter digestibility (OMD), and Metabolizable energy (ME) were determined. Significant differences were observed among the cultivars in terms of growth and nutrient assimilation. At harvest, CO6 recorded the tallest plants (225.89 cm; $p < 0.05$), while Pakchong had the longest leaves (102.45 cm; $p < 0.05$) and widest leaf blades (4.02 cm; $p < 0.05$). However, CO5 exhibited plants with the highest shoots density, leaves per shoot and LS ratio (33.34 shoots/m², 13.50 leaves/shoot and 0.83, respectively; $p < 0.05$). These superior growth characteristics contributed to CO5 achieving the highest FMY and DMY (30.42 MT/ha and 4.86 MT/ha, respectively; $p < 0.05$). In terms of nutritional quality, CO5 had the highest crude protein content (18.99 %; $p < 0.05$), while Pakchong recorded the highest OMD and ME content (64.13% and 9.37 MJ/kg, respectively; $p < 0.05$), compared to CO5 (61.12% and 8.86 MJ/kg, respectively) and CO6 (52.20% and 7.59 MJ/kg, respectively). In conclusion, the CO5 cultivar outperformed both CO6 and Pakchong cultivars under the conditions of mid country wet zone. Further research is recommended before CO6 is promoted for adoption by dairy farmers in this region.

Keywords: CO5, CO6, Crude protein, Digestibility, Metabolizable Energy

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Investigation of Length-Weight Relationship and Condition Factor of Table Fish Species in Some Reservoirs in Ampara District

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A study was conducted to determine the relationship between length and weight of major freshwater fish species and their condition factor in *Jayanthi Wewa*, *Namal Oya Wewa* and *Ampara Wewa* reservoirs. The fish species studied were *Labeo rohita*, *Catla catla*, *Cirrhinus mrigala*, *Hypophthalmichthys molitrix*, and *Oreochromis niloticus*. Total length and weight of the above species were recorded individually from random catches of the fishing nets from January 2025 to February 2025. The total sample size of the respective species were 160, 197, 285, 97, and 365, respectively. Fulton's condition factor was calculated as $\text{Weight} \times 100 / \text{Length}^3$. The dominant species in the catches of the first two reservoirs was *Cirrhinus mrigala* while *Oreochromis niloticus* dominated Ampara Wewa catches. Mean condition factor estimates across the reservoirs for the five species were 1.36, 1.85, 1.13, 1.18 and 2.40, respectively. Analysis of Variance procedure conducted species-wise showed no significant differences among the reservoirs with respect to length, weight and condition factor of the fish species except for *Oreochromis niloticus* ($P > 0.05$). *Jayanthi Wewa* recorded significantly higher ($P < 0.05$) mean length and weight values for *Oreochromis niloticus* (11.98 cm, 678.83 g, respectively) compared with those of *Namal Oya Wewa* (10.08 cm, 380.75 g, respectively) and *Ampara Wewa* (9.75 cm, 408.98 g, respectively). Nonlinear regression analysis was carried out to obtain 'a' and 'b' parameter estimates for the length-weight relationship ($\text{Weight} = a \times \text{Length}^b$) where values equal to, greater than or less than 3.0 for parameter *b* indicated isometric, positive allometric or negative allometric growth patterns, respectively. The results showed that overall estimate of *b* parameter estimate of *Catla catla* across reservoirs was 3.1 indicating a positive allometric growth while the respective overall mean values for *Labeo rohita*, *Cirrhinus mrigala*, *Hypophthalmichthys molitrix* and *Oreochromis niloticus* were 2.84, 2.73, 2.84 and 2.53, respectively exhibiting negative allometric growth patterns across the reservoirs.

Keywords: Condition factor, Freshwater fish, Isometric growth, Length, Weight

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Bioprospecting *Spirulina subsalsa* native to Sri Lanka: Assessment of Antioxidant, Antidiabetic, Anti-obesity and Anti-aging potentials

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This research investigated the antioxidant, antidiabetic, anti-obesity, and anti-aging potentials of *Spirulina subsalsa* native to Sri Lanka. Isolated *S. subsalsa* cultures were maintained as semi-mass cultures using one-fifth strength Zaurrok medium. Before harvesting, samples were observed microscopically to ensure that they were free of contamination. Upon confirmation, the biomass was harvested, dried and subsequently ground. The ground *S. subsalsa* was extracted with three solvents: water, methanol and ethanol. Antioxidant activities were assessed using Total Phenolic Content (TPC), Total Flavonoid Content (TFC), Ferric Reducing Antioxidant Power (FRAP), DPPH radical scavenging (DPPH), and Oxygen Radical Absorbance Capacity (ORAC). Antidiabetic and anti-obesity effects were evaluated through α -amylase and pancreatic lipase inhibitory activities, respectively. Antiaging was done using a DNA damage protection assay. The methanol extracts of *S. subsalsa* showed the highest ($P < 0.05$) TPC (43.35 ± 13.16 mg GAE g⁻¹ dry weight) and ORAC values (297.98 ± 2.45 μ mol TE g⁻¹ dry weight). Total flavonoid content (TFC) showed negative values across all extracts, with methanol extract recording the highest (-41.54 ± 1.00 mg catechin g⁻¹ DW), followed by ethanol (-42.19 ± 2.00) and water (-33.04 ± 10.07). The water extract featured the most powerful reducing potential because it obtained the highest FRAP value at 12.20 ± 0.60 mM FeSO₄ g⁻¹ DW, whereas methanol extract had 7.19 ± 3.58 and ethanol extract had 1.36 ± 0.67 . The methanol extracts also exhibited the highest ($P < 0.05$) α -amylase inhibitory activity ($IC_{50} = 0.049 \pm 0.00002$ mg mL⁻¹), indicating antidiabetic properties against α -amylase inflammation ($IC_{50} = 0.049 \pm 0.00002$ mg mL⁻¹). Water extracts showed the highest ($P < 0.05$) anti-obesity activity by blocking pancreatic lipase ($IC_{50} = 0.051 \pm 0.00005$ mg mL⁻¹). The ethanol extract exhibited higher anti-aging activity than the water extract. The present results revealed that the native Sri Lankan *S. subsalsa* holds great potential as a bioactive source which can lead to nutraceutical and pharmaceutical applications.

Keywords: *Spirulina subsalsa*, Extraction method, Antioxidant properties, Antidiabetic potential, Anti-obesity potential, Antiaging potential

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Incorporation of Soy Protein Isolates on the Quality Characteristics of Chicken Sausages; a Comparative Analysis between Pb-1 Soybean (*Glycine Max*) and Commercially Available Soy Protein Isolates

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Soy protein, a complete plant-based protein, is a crucial alternative to animal proteins for meeting protein needs sustainably, while supporting health and reducing environmental impact. Utilizing by-products like soybean meal minimizes waste which benefits to the environment, enhance economic viability by reducing cost. This study was aimed to develop chicken sausage by incorporating soy protein isolate (SPI) from locally grown soybean (*Glycine max*) variety PB-1 and evaluate its' properties against sausage produced from commercially available SPI. In this study, SPI were extracted from two samples as soy beans and soy bean meal by NaOH and the properties of two isolates; Water Holding Capacity (WHC), Fat absorption capacity, emulsification stability index (ESI) were evaluated with the commercially available SPI (control). Due to its economic and environmental advantages, SPI from soybean meal was selected for further application. An emulsion-type chicken sausage was formulated with three (3) levels of the developed SPI as 1 %, 2 % and 3 % compared to control sausage containing 1% of commercial SPI with three replicates. Physicochemical, and microbiological analyses were conducted over three-week storage period at -18°C. There is no significant difference in crude protein, ash, crude fat and water soluble protein content of all three SPI samples. WHC of SPI prepared from soybean meal was the highest ($P<0.05$) among three samples and ESI of SPI from soybean meal was significantly higher compared to other SPI. According to sensory evaluation, sausages incorporated with 3% SPI from soybean meal was selected as the best treatment with respect to overall acceptability. Crude protein and dry matter percentage of all the sausage samples were not significantly different. Thus, 3% SPI of locally grown soybean meal PB1 can be used to produce nutritious, consumer acceptable chicken sausage while reducing cost of production of sausage manufacturing.

Keywords: Soy Protein Isolates, Soy meal, Soybean, Sausage, Sensory

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Incidental Occurrence of Benzoic Acid in Raw Milk

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This study was conducted to investigate the incidental occurrence of benzoic acid and to identify the causes for its presence in cow milk. A mixed-method approach combined a systematic survey of 11 milk chilling centers with research involving 25 lactating cows grouped by somatic cell count (SCC) levels. Milk samples were analyzed for total plate count (TPC), coliform count, keeping quality (KQ), and alcohol stability, with storage conditions set at 4°C and 25°C to evaluate temperature effects. Survey data revealed a 75% incidence of benzoic acid positivity in raw milk ($p < 0.001$). Alcohol stability and keeping quality tests showed an inverse relationship with benzoic acid presence ($p < 0.001$). Specifically, benzoic acid positivity was 39% at 68% alcohol, decreasing to 19.5% at 72% and 17% at 77%. TPC and SCC levels were positively associated with benzoic acid formation ($p < 0.05$). In contrast, coliform counts did not exhibit a strong association ($p > 0.05$), indicating that total microbial activity plays a more significant role than specific bacterial groups. Temperature had a critical impact on benzoic acid formation, with delayed detection at 4°C compared to 25°C, resulting in an average delay of 50.1 hours ($p < 0.01$). Milk stored at 25°C exhibited higher microbial activity (TPC $> 10^5$ CFU/mL), correlating with increased benzoic acid formation. Overall, temperature control and hygiene protection alone play a critical role in the benzoic acid presence in Sri Lanka.

Keywords: Benzoic Acid, Raw milk, Somatic Cell Counts, Incidental-occurrence, Keeping Quality

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Spike-Topped Apple Snail (*Pomacea diffusa*) Meal as an Alternative to Fishmeal in Guppy (*Poecilia reticulata*) Diets

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The present study was conducted to evaluate the effect of dietary inclusion of Spiketopped apple snail (*Pomacea diffusa*) meal (SM) as an alternative to fishmeal on growth performance, pellet quality, colour enhancement, and stress tolerance in guppy (*Poecilia reticulata*). Four isonitrogenous and isoenergetic experimental diets were formulated: Fishmeal-based control diet (CD), and three diets replacing fishmeal with SM at 25% (25 SM), 50% (50 SM), and 75% (75 SM). A total of 360, 28-days-old golden chest guppy fry with mean initial weight $0.087 \pm 0.00g$ were randomly distributed and reared in 12 outdoor rearing tanks for 35 days under natural photoperiod (n=3). The growth performance and colour intensity of fish were evaluated. The stress tolerance was evaluated by calculating the survival rate of fish after exposing 10 guppies from each replicate to a salinity of 30 ppt for 2 hours. The pellet expansion of feeds containing SM was higher compared to CD. The dietary inclusion of SM did not affect the feed intake, specific growth rate, or feed conversion ratio of guppies. However, regression analysis showed that feed intake and specific growth rate reduced, whereas feed conversion ratio increased with increasing fishmeal replacement levels. The mean grey values of guppyfed 25 SM and 50 SM were significantly ($P < 0.05$) lower, illustrating higher caudal fin colour intensity. Moreover, fish fed with the experimental diets exhibited a comparable survival rate during the stress tolerance test. The present study showed that fishmeal could be replaced by SM up to 75% without compromising growth performance, pellet quality indexes, caudal fin colour intensity and stress tolerance. However, replacing 25% and 50% fishmeal offers the additional benefits with increased caudal fin colour intensity.

Keywords: Fishmeal, Golden apple snail, Guppy, Growth performance, Colour intensity

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Investigation of Seasonal Fluctuation of Catch and Effort Statistics and Catch Diversity in Jayanthi Wewa Reservoir, Ampara

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This study aimed to investigate the effects of seasonal fluctuations on number of fish and fish yield (kg) of different species in the daily catch and catch diversity in *Jayanthi Wewa* in Ampara district, and their relationship with the rainfall of the day prior to the catch. A set of 116,573 daily records collected by the National Aquaculture Development Authority (NAQDA) on number of fish and fish yield of different species from individual boats (catch/boat) during 2011-2024 period were extracted and subjected to statistical analysis. Shannon index was used to measure species diversity of the catch and Simpson's Dominance Index was employed to identify species dominance. Daily rainfall data of the *Jayanthi Wewa* area were collected from NASA POWER API site. Analysis of variance procedure was performed to determine the effect of calendar month on catch statistics and the indices and Duncan's New Multiple Range Test was used for comparison of means. Daily catches predominantly consisted of several exotic species namely *Oreochromis niloticus*, *Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*, *Cyprinus carpio*, and *Hypophthalmichthys molitrix*. Mean weight of individual species in the catch (kg/boat) were 6.42, 4.44, 5.71, 0.92, 0.01 and 0.24, respectively. Similarly, the mean number of fish present in the catch were 10.1, 2.61, 0.78, 0.40, 0.002, and 0.03, respectively. Calendar month had a significant influence on the catch statistics and well as the two indices ($P < 0.05$) with the highest catch statistics recording during October-December period for all species except for *Hypophthalmichthys molitrix*. Shannon index values from January to December were 0.39, 0.38, 0.41, 0.44, 0.43, 0.40, 0.38, 0.35, 0.33, 0.37, 0.42, 0.41, respectively. Overall mean of Simpson's index was 0.75. Local fish species such as *Heteropneustes fossilis* contributed only to 0.6% of the catch. Simple linear regression analysis showed that catch statistics increase significantly with rainfall ($P < 0.05$).

Keywords: Catch and effort, Inland fishery, Shannon index, Simpson index, Species diversity

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ADME-Tox Prediction, Molecular Docking, and Molecular Dynamics Simulation of Phytocompounds from *Sphagneticola trilobata* as Potential Anti-Alopecia Agents

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Androgenic alopecia (AGA), commonly referred to as male or female pattern hair loss, is a prevalent form of hair loss caused by increased sensitivity of hair follicles to androgens, particularly dihydrotestosterone (DHT). Traditionally, *Sphagneticola trilobata* has been used in herbal medicine for its anti-hair loss properties, attributed to phytocompounds in its leaves. This study aimed to evaluate the anti-alopecia potential of these phytocompounds through *in silico* analysis of their interactions with the androgen receptor (PDB ID: 4K7A), using molecular docking, ADME-Tox screening, and molecular dynamics simulations. Methanolic extracts of *S. trilobata* leaves were analyzed via GC-MS, identifying 126 phytocompounds. ADME-Tox screening narrowed these down to 57 candidates with favorable drug-like properties. Molecular docking using PyRx v.8.0 against the androgen receptor's ligand-binding domain identified 18 compounds with high binding affinities ($\Delta G < -6$ kcal/mol). Among them, 6-(Salicylideneamino)-1H-benzotriazole exhibited the strongest binding affinity (-8.5 kcal/mol), forming stable interactions with key AR residues (MET745, LEU707, PHE764, MET749, LEU704). Molecular dynamics simulations further confirmed the stability of this complex, with RMSD and RMSF values ranging from 2–3 Å. These findings suggest that 6-(Salicylideneamino)-1Hbenzotriazole is a promising androgen receptor antagonist and may serve as a potential therapeutic agent for the treatment of alopecia. Further experimental validation is required to confirm its efficacy and safety.

Keywords: Androgen receptor, Androgenic alopecia, *Sphagneticola trilobata*, Molecular docking, ADME-TOX

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Beta Casein A1/A2 Gene Variation in Selected Commercial and Native Cattle Herds in Sri Lanka

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A1 and A2 β -casein milk variants occurs due to the replacement of proline in A2 by histidine in A1 at the 67th amino acid during course of evolution (CCT to CAT). The variation Milk A1 β casein releases betacasomorphin-7 (BCM7), which is linked to several health issues, during gastro intestinal digestion. The health concerns associated with milk A1 β casein endures the need to select cattle with higher genotype frequency of A2. In general, milk from majority of exotic and crossbred cows contain A1 β -casein, while indigenous cow milk contains A2 β -casein. In this context, the present study was undertaken to screen cattle for genomic variants of milk A1 and A2 β casein at the exon 7 of CSN2 gene. Cattle from commercial (52 Jersey $\times$ Friesian crossbred) and native herds (20 Thamankaduwa white and 30 Kinniya white cattle) in Sri Lanka were included in the study along with seven semen doner bulls at the Central Artificial Insemination Center, Kundasale. DNA extracted from the blood samples of cattle were subjected to PCR and restricted digestion. Restricted fragment patterns visualized in agarose gel electrophoresis were used for the identification of genotype frequencies for A1 and A2 (A1-213 bp and A2-251bp). Jersey $\times$ Friesian cross bred cattle exhibited frequencies of 0.88 and 0.12, respectively for A1A2 and A2A2 genotypes. Local white cattle (Thamankaduwa and Kinniya) only exhibited A2A2 genotype. Three of the semen doner bulls (IDs: 996, 601, 9500) were homozygous (A2A2) while others were heterozygotes (A1A2) for β -casein locus. These findings will be helpful in guiding breeding programs to incorporate native cattle in commercial dairy production, while prioritizing the selection of A2A2 genotype in semen doner bulls to promote healthier milk and reduce potential health risks associated with A1 milk.

Keywords: β -casein variant, A1 and A2 genes, genotype, PCR-RFLP

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Antibiotic Resistance Profile and Prevalence of Resistance-Related Genes in *Escherichia coli* Isolated from Omphalitic Broiler Chicks

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The poultry sector plays a crucial role in antimicrobial resistance (AMR) due to its heavy antibiotic usage underscoring a significant one health challenge. Disease management may be more challenging if *Escherichia coli* (*E. coli*) poses AMR such as extended-spectrum beta-lactamase (ESBL), which could cause resistance to antibiotics like penicillin and third-generation cephalosporins. This study was aimed to isolate *E. coli* from broiler chicks with omphalitis, to understand the antibiotic resistance profiles and the prevalence of the resistance related *bla*_{CTX-M} and *bla*_{TEM} genes from the isolates. A total of 39 dead chicks were collected from 5 farms and post-mortem examination was performed. Yolk sac samples were collected and *E. coli* were isolated from the samples using recommended conventional methods and biochemical tests. The *E. coli* isolates were subjected to antimicrobial susceptibility testing (AST) for five different antimicrobials. The presence of the *bla*_{CTX-M} and *bla*_{TEM} genes was investigated using a Duplex PCR method. From the collected samples, 28/39 (71.7%) were identified with omphalitis and all those samples, tested positive for *E. coli* 28/28 (100%). Furthermore, 25/28 (89%) of the isolated *E. coli* were phenotypically resistant to amoxicillin and 20/25 (80%) of them harbored the *bla*_{TEM} and 1/25 (4%) the *bla*_{CTX-M} genes. 18/28 (64%) of isolates showed Multi Drug Resistance as 22/28 (78%) was resistant to tetracycline and 19/28 (68%) was resistant to sulpha-trimethoprim other than amoxicillin. This study discovered that *E. coli* from yolk sac infected broiler chicks are multi drug resistant and are possible reservoirs of β -lactamase producing *E. coli* that carries the *bla*_{TEM} gene, which possess one health risk. Thus, farmer/hatchery awareness campaigns and surveillance programs are recommended to mitigate the AMR spreading.

Keywords: Omphalitis, AMR, *E. coli*, Resistance genes, One Health challenge.

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A Case study: Assessment of Water Usage in a Freestall Dairy Cattle Management System

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Ambewela Farm is considered one of the leading dairy cattle farms in Sri Lanka, where temperate cows are intensively managed in freestall housing systems. The cows are divided into functional groups; fresh cows, super-producing (>40 L/d), high-producing ($40 > 25$ L/d), low-producing ($25 > 10$ L/d), tail-ending (<10 L/d), dry cows, and steaming-up cows. The cows were fed total mixed rations (TMR) and had free access to clean drinking water. Water use in the freestall system is primarily associated with TMR preparation (dietary water), drinking, barn cleaning, parlor operations and milk pre-cooling. The water footprint of milk is defined as the volume of water required to produce one liter of milk. This study investigated water usage for across the different cow groups and estimated their water footprints. The study was conducted using a complete randomized design, with the functional cow groups considered as treatments. Water usage was measured using 24 installed water meters. Significant differences ($p < 0.05$) were observed in water usage among cow groups. Total daily water use per cow for fresh, super producing, high producing, low producing, tail-ending, dry and steaming-up cows was 352.43 ± 73.83 , 247.93 ± 41.49 , 249.23 ± 46.75 , 232.36 ± 51.62 , 241.89 ± 57.27 , 104.15 ± 21.88 , and 67.41 ± 12.38 L/cow/d, respectively. The mean water usage for lactating cows alone was 265.73 ± 25.21 L/cow/d, while the average for all cow groups was 210.90 ± 19.17 L/cow/d. Water footprint of milk varied significantly ($p < 0.05$) among cow groups and showed a strong negative correlation with milk productivity of cows ($r = 0.83$, $p < 0.0001$). The estimated water footprint for fresh, super producing, high producing, low producing, tail-ending, dry and steamingup cow groups was 10.97 ± 2.36 , 5.88 ± 0.98 , 8.50 ± 1.60 , 10.97 ± 2.43 , and 13.86 ± 3.28 , respectively. The mean water footprint of milk for lactating cows was 9.42 ± 0.94 L of water per liter of milk. These findings provide valuable insight for optimizing water use in freestall dairy cattle farming systems in Sri Lanka.

Keywords: Cow groups, Total mixed ration, Water footprint

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***In silico* Analysis of *Cassia auriculata* Bioactive Compounds as Potential Inhibitors of Newcastle Disease Virus HN Protein**

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Newcastle disease virus (NDV) is a highly virulent avian pathogen causing severe hemorrhagic disease in poultry. The hemagglutinin-neuraminidase (HN) protein, critical for viral entry and pathogenesis, plays a pivotal role in NDV immune evasion and antiviral development. However, current NDV vaccines face several limitations, including side effects, a dependency on cold chains, high effective doses ($\geq 10^6$ EID₅₀), and the need for frequent boosters due to viral evolution, highlighting the demand for novel therapeutics. Here, we investigated *Cassia auriculata*, native to Sri Lanka, and its compounds as potential inhibitors of the NDV HN protein. In this study, gas chromatography-mass spectrometry (GC-MS) analysis identified 75 compounds, with 24 meeting drug-like criteria based on Lipinski's rule of five and toxicity profiling. Virtual screening (PyRx 8.0) prioritized 6 compounds with binding energies < -6 kcal/mol against HN. Consequently, binding pocket analysis (CB-Dock 2) and refined docking (UCSF Chimera) identified phenol 2-methyl-5-nitro-4-(phenylmethoxy)-methanesulfonate (ester) as the top candidate, showing strong binding affinity (-7.5 kcal/mol) and key interactions with active-site residues (ARG174, SER237, ARG498, ARG416, GLU401, TYR317, ALE466, and MET398). Molecular dynamics (MD) simulations confirmed complex stability, with root-mean-square deviation (RMSD) analysis revealing minimal fluctuations (0.6 Å). Complementary, root-mean-square fluctuation (RMSF) data indicated minimal structural deviations. Persistent hydrogen bonds, hydrophobic interactions, and unchanged secondary structure further validated binding stability. Taken together, these results demonstrate the potential of *C. auriculata*-derived phenol 2-methyl-5-nitro-4-(phenylmethoxy)-methanesulfonate (ester) as an HN inhibitor, supporting further investigation for NDV antiviral development.

Keywords: Newcastle Disease Virus (NDV), Hemagglutinin-neuraminidase (HN), *Cassia auriculata*, Molecular docking and dynamics

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Welfare Aspects of Semi-Intensive Small-Scale Dairy Farms: A Case Study at Kahatgasdigiliya Divisional Area in Sri Lanka

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The objective of the research was to assess welfare of dairy cattle on 40 selected small-scale semi-intensive farms with a total of 366 cattle in Kahatgasdigiliya, Sri Lanka. The study focused on housing, feeding, health, and productivity animals. Average herd size was 8.9 and the average milk production was 3.5 L/day. Majority of the farmers (51%) surveyed were of the age group of 50 to 60 years and 73% had their education up to ordinary level. In all farms, animals were allowed to graze part of the day with 40% of the farmers using their own grazing lands. Lack of proper lying, feeder and waterer space for animals 20%, 29%, 24% respectively, poor hygiene (18%) of farms. Hot iron branding for identification (32%), no method using for identification (5%). Presence of the skin lesions (3%) of animals and presence of clinical mastitis (7%) were found major issues affecting the welfare of the animals. Although lameness was not major problem where 90% of animal were having normal gait. Deprived floor quality and bedding management may be risk factor to hoof health and lying comfort. With respect to feeding, farms with longer grazing times had significantly ($P < 0.05$) higher body condition score, suggesting that longer or better-managed grazing periods may improve nutrition of cows managed under these conditions. It was also observed the reproductive parameters of cows were positively affected by provision supplementary feeding. However, with the increment of the herd size per farm a negative correlation was detected with respect to calving problems. (Spearman's correlation = -0.438 $P < 0.05$) which demonstrated scalability problems. Findings of this study underscore the necessity of interventions to address gaps to enhance welfare and productivity of dairy cows in semi-intensive small-scale dairy farms in Kahatgasdigiliya divisional area.

Keywords: Dairy cattle welfare, Semi-Intensive systems, Small- scale farming, Calving problems, Kahatgasdigiliya

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Development of a Whey Based Ready-To-Serve Beverage

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Whey is rich in protein, carbohydrate, vitamin B, and minerals. Even though whey is a highly utilized expensive dairy by product in developed countries, in Sri Lanka still it remained underutilized. The available techniques are not cost effective for Sri Lanka. Therefore the objective of this study was to develop a method to use this whey in natural form by converting into a ready to serve beverage. First whey was collected and chemical composition and microbiological quality was analysed. The chemical parameters such as, Moisture (92.89%), Total solid (7.11%), Fat (0.62%), and Ash (0.56%) were analysed. Then the whey was clarified to remove the remaining fat and pasteurized (85°C/25minutes). After cooling down to room temperature, Pineapple (*Ananas comosus*) juice was added that was prepared at different ratios (0%,5%,10%,15%) and sugar was fixed as 9%, stabilizer carboxymethyl cellulose (0.15%) , preservative; Sodium meta bisulphate (50 ppm) was added. Then the mixture was homogenized and filled into sterilized bottles. Then in bottle heating was done at 85°C 15minutes. Sensory evaluation was done using 35 untrained panellists with five point hedonic scale. The physicochemical and keeping quality parameters were analysed under refrigerated condition $7 \pm 1^{\circ}\text{C}$ for 4 weeks of storage period. The 15% pineapple, added mixture was scored highest median for taste and overall acceptability. The final product was subjected to physicochemical analysis. The pH titratable acidity, Total suspended solid and colour had a significant effect during storage period and among treatments ($p < 0.05$). According to the keeping quality parameters, coliform was not detected and there was an increase of acidity, TPC, yeast and mould count ($p < 0.05$) with the storage time period. The study demonstrated that whey can be effectively utilized in a ready-to-serve beverage, with the 15% pineapple juice formulation achieving the highest sensory acceptability and maintaining stability during refrigerated storage.

Keywords: Cheese whey, Pineapple Juice, beverage

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Morphological and Molecular Identification of Lobster Species Caught in Southern Province of Sri Lanka

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The spiny lobster (*Panulirus*) fishery plays a significant role in the economy of Sri Lanka, being one of the most expensive seafood commodities due to high market demand. However, comprehensive molecular identification of available species remains limited in Sri Lanka. Hence, this study focuses on the molecular identification of *Panulirus* species found along the Southern coast of Sri Lanka, where five species are known to occur (*Panulirus homarus*, *P. versicolor*, *P. longipies*, *P. Ornatus* and *P. penicillatus*). Samples were collected from a lobster collecting center in Tangalle. A total of five samples were analyzed, each of the five *Panulirus* species being represented by one sample. The samples were analyzed by DNA barcoding targeting the mitochondrial COI gene marker. The GenBank accession numbers obtained for the sequenced samples are PV362736, PV362740, PV362762 and PV449455 for *P. versicolor*, *P. penicillatus*, *P. homarus* and *P. longipes* respectively. The phylogenetic tree constructed by the maximum likelihood method using similar sequences from other regions, revealed the evolutionary relationships among spiny lobster species of the genus *Panulirus* of the three clades in the phylogenetic tree, the first clade grouped *P. homarus* samples from India and Sri Lanka, indicating close genetic relationships between these populations. Second clade included *P. versicolor* samples from Sri Lanka, Indonesia, Australia and Iran. The grouping of geographically dispersed populations highlights the widespread distribution of this species and its genetic connectivity across regions. Clade three comprised *P. penicillatus* samples from Sri Lanka, Spain, and the USA. The clustering of Sri Lankan samples with distant populations indicates significant genetic divergence within this species. This study contributes to global DNA barcoding initiatives with significant advancement in local molecular taxonomy by providing genetic data on ecologically and economically important spiny lobster species. This information is important for conservation programs, sustainable fisheries management, and future aquaculture initiatives in Sri Lanka.

Keywords: *Panulirus*, Spiny lobster, DNA barcoding, Sri Lanka, Fisheries management

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Effect of Reduced Nitrogen and Phosphorus Fertilization on Nutrient Assimilation at Vegetative Tasselling and Early Dent Stages in Fodder Maize

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Inadequate good quality forage contributes to low productivity in dairy cattle in Sri Lanka. Hybrid fodder maize (*Zea mays L.*) cultivars were introduced with an aim of producing high quality fodder and silage. Fertilizer recommendations for cultivation of hybrid fodder maize have not yet been established in local condition. This study evaluated the impact of reduced urea and Triple Super Phosphate (TSP) fertilization on nutrient assimilation of hybrid fodder maize and their silage quality. The experiment was conducted at Dima Agri Techno Park, Lenadora as a Randomized Complete Block Design (RCBD) with factorial arrangement. The experiment included recommended fertilizer rates of urea and TSP (425 and 100 kg/ha, respectively) and 90% of the recommended rate. Hybrid fodder maize (Veera) seeds were planted at 60x60 cm spacing. Two seeds were planted in each hole (55,778 plants/ha). Fodder crops were harvest at vegetative tasselling (VT) and at the early dent (R5) stages. At R5 stage, yield, and nutritive value of fodder and silage were estimated including and excluding the cobs. While the effect of reduction of 10% fertilizer was not significant ($p>0.05$), the stage of harvesting was significant ($p<0.05$) on yield and nutritive value of forage. At both recommended and reduced fertilization rates the crude protein (CP) was greater ($p<0.05$) at VT stage while the dry matter (DM) was greater ($p<0.05$) at R5 stage. Exclusion of cobs resulted in low ($p<0.05$) CP, organic matter digestibility (OMD) and metabolizable energy (ME) in forage. Although, the silage produced from cobs excluded fodder achieved favourable pH and lactic acid content the OMD and ME were significantly ($P<0.05$) less. These findings suggest the importance of harvesting hybrid fodder maize at the R5 stage and the inclusion of cobs in green-chop and silage for feeding cattle.

Keywords: Hybrid fodder maize, Harvesting stage, Silage, With cob

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Application of Microbial Transglutaminase as a Gelatin Substitute in Set-type Yoghurt: Assessing its Compatibility with Three Types of Starter Cultures

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Gelatin, a common stabilizer in yoghurt production, is associated with several drawbacks due to its animal origin. Despite extensive studies on microbial transglutaminase (mTGase) in dairy research, its potential as a substitute for gelatin remains underexplored. This study evaluated the effect of various mTGase levels (0.005%, 0.01%, 0.015%, 0.02%, 0.025%, 0.03%) compared with gelatin using three different starter cultures (YoFlex Express7 - YF, Premium 6 - PR, White Classic 101 - WC) on the textural, physico-chemical and sensory properties of cow milk setyoghurt after one day of production and storage at 4°C. Yoghurts produced with WC showed higher hardness and cohesiveness values ($p < 0.05$). Comparable hardness to gelatin-treated samples was observed at mTGase levels of 0.025% and 0.03%. An increase ($p < 0.05$) in adhesiveness (mJ) was observed in yoghurts treated with PR, with 0.02% mTGase yielding values comparable to gelatin. Springiness (mm) showed no difference ($p > 0.05$) across the starter culture types or gelatin and mTGase levels. Lower syneresis and higher water holding capacity (WHC) were observed in yoghurts treated with PR whereas, gelatin had the lowest syneresis and highest WHC ($p < 0.05$). Among the mTGase levels, 0.025% and 0.03% showed reduced syneresis. Titratable acidity (TA) was higher ($p < 0.05$) in WC, yet, no differences were observed between gelatin and mTGase levels. However, lactic acid bacteria population (log CFU/mL) showed no difference ($p > 0.05$) among starter cultures, or between gelatin and mTGase levels. Regardless of the starter culture type used, gelatin treated yoghurts received higher consumer acceptability compared to mTGase. In conclusion, the most suitable starter cultures to be used with mTGase were WC and PR. mTGase levels such as 0.02%, 0.025% and 0.03% showed a higher potential in improving desirable properties in set-yoghurt. Overall, mTGase enhanced the properties in set-yoghurt to a degree similar to that of gelatin, proving its potential as a gelatin substitute.

Keywords: Microbial transglutaminase, Gelatin, Substitute, Starter culture

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Paddy Husk Adulterated Rice Polish in Broiler Diets: Impact on Growth Performance and Nutrient Digestibility

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This study evaluated the impact of dietary inclusion of paddy husk-adulterated rice polish on growth performance, nutrient digestibility, and occurrence of intestinal lesions in broiler chicken. Five iso-energetic and iso-nitrogenous diets were formulated: a corn-soybased control diet containing unadulterated rice polish (CD) and four diets containing rice polish adulterated with paddy husk at 3% (3PH), 5% (5PH), 8% (8PH) and 10% (10PH). One hundred and twenty Cobb 500, one-day old chicks were randomly fed with one of the five experimental diets (n=4 and 6 birds per replicate). Growth performance, relative organ weights, ileal dry matter digestibility and occurrence of small intestine lesions of the birds were assessed. Body weight gain, feed intake, and feed conversion ratio, showed no significant differences across the dietary groups. Apparent ileal dry matter digestibility was also not significantly affected by the diets. Carcass yield and breast muscle yield remained unaffected, though gizzard and caecum weights were higher ($P < 0.05$) in birds fed 8PH, suggesting enhanced digestive function. Notably, birds fed 3PH reduced duodenal lesion odds ($OR = 0.020$, $P < 0.05$), indicating a protective effect on gut integrity, while higher levels (5PH, 8PH and 10PH) showed no significant impact on jejunal or ileal lesions ($P > 0.05$). These findings suggest that rice polish can be adulterated with paddy husk up to 10% without adversely affecting growth performance and nutrient digestibility.

Keywords: Broiler chicken, Paddy husk adulteration, Rice polish, Growth performance, Nutrient digestibility.

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Relationship of Somatic Cell Count (SCC) and Chemical Properties in Milk from a Group of Crossbred Cows

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Sri Lanka's domestic dairy production has seen considerable growth in recent years. Nevertheless, milk quality assurance, in relation to somatic cell count (SCC), remains inadequately addressed. This study examines the impact of SCC on the chemical properties of milk from a group of crossbred cows kept in an intensive management system. Udder samples from 24 cows, in mastitic conditions were collected over a five-day period and analyzed using Fourier Transform Infrared (FTIR) spectroscopy to determine their chemical parameters such as fat, solids-not-fat (SNF), total solids (TS), lactose, glucose, galactose, free fatty acids (FFA), titratable acidity (TA), total proteins (TP), caseins and urea. On the final sampling day, SCC were obtained for each cow, and the animals were categorized into four groups as high-clinical (2×10^6 – 10×10^6 cells/mL), medium-clinical (1×10^6 – 1.999×10^6 cells/mL), low-clinical (4.01×10^5 – 9.99×10^5 cells/mL), and sub-clinical (2×10^5 – 4×10^5 cells/mL). The results showed that SCC above 1×10^6 cells/mL (lower boundary of the medium clinical group), significantly impacted the levels of TS, TP, caseins, and galactose. Elevated SCC above 1×10^6 cells/mL led to a decrease in TS and galactose ($p < 0.05$). Lactose also showed a similar trend as galactose, though it was not significant ($p > 0.05$). FFA gradually decreased with rising SCC, although this effect was not statistically significant. TP and caseins increased above 1×10^6 cells/mL ($p < 0.05$). Fat, SNF, TA, glucose, and urea were not significantly correlated ($p > 0.05$). According to the current study, SCC above 1×10^6 cells/mL can significantly affect the TS, TP, caseins, and galactose in milk. This information can be used in the quality assurance and policy implementation of the Sri Lankan dairy sector.

Keywords: somatic cell count, mastitis, dairy cow, chemical properties, fourier transform infrared spectroscopy

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Development of a Low-Fat Drinking Yoghurt with Kithul Treacle, Fortified with Thebu (*Costus speciosus*) Targeting Type 2 Diabetic Patients

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The rising prevalence of type 2 diabetes and its associated healthcare costs, particularly in low and middle-income countries such as Sri Lanka, necessitate the development of innovative, cost-effective and healthier dietary options. This study aimed to develop a low-fat drinking yoghurt fortified with Thebu (*Costus speciosus*) and sweetened with Kithul treacle, targeting type 2 diabetic individuals. Sensory evaluation was conducted to determine the most preferred Thebu (*Costus speciosus*) dried leaves aqueous extract concentration (0.4%w/v, 0.6%w/v, and 0.8%w/v,) and the 0.6%w/v Thebu incorporated drinking yoghurt was selected as the best by panellist for colour, aroma, taste, sourness, mouth feeling and overall acceptability. Three treatments, which were T1 (Kithul treacle + 0.6% Thebu extract + yoghurt drink), T2 (plain yoghurt drink with table sugar) a control (Kithul treacle + yoghurt drink) evaluated for Physicochemical, proximate, and microbiological properties. Throughout the storage period, no differences in pH and Total solids were observed across the three treatments ($p > 0.05$). At the same time, the titratable acidity of the 0.6%w/v Thebu extract-added drinking yoghurt was lower compared to both the control and the plain yoghurt drink during storage at 4C°. The lightness of the yoghurt drinks remains stable across all groups over 14 days, with no significant differences ($p > 0.05$). The crude protein content of both the 0.6% Thebu fortified drinking yoghurt (5.55%) and the control (5.56%) was higher compared to the plain yoghurt (4.86%) while in both the fat was 2.6%. However, the Brix value of both the 0.6% Thebu extract-added drinking yoghurt and the control was lower than that of plain yoghurt drink. This suggests that a 0.6% Thebu incorporated drinking yoghurt with kithul treacle would be a healthier yoghurt for type 2 diabetic individuals. Yet, further studies are necessary for its hypoglycemic effect.

Keywords: Type 2 diabetes, Kithul treacle, Thebu (*Costus speciosus*), Drinking Yoghurt, Low Fat

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Comparative Analysis of Drying Methods on Antioxidant, Antidiabetic, Anti-obesity, Antimicrobial, and Anti-aging Activities in *Kappaphycus alvarezii*: An *in-vitro* Study

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This study evaluated the effects of three drying techniques: oven drying (50°C, 72 hours), microwave drying (800W, 20 minutes), and sun drying (30°C, 5 days) on the bioactive properties of *Kappaphycus alvarezii*, collected from Jaffna, Sri Lanka. Seaweeds were extracted using absolute methanol and assessed for total phenolic content (TPC), total flavonoid content (TFC), antioxidant capacity (Ferric reducing antioxidant power - FRAP and oxygen radical absorbance capacity - ORAC), α -amylase and pancreatic lipase inhibitory activities and anti-aging activity with DNA damage protection against H₂O₂ induced oxidative stress. Crude extraction with 70% ethanol was used for evaluating antimicrobial effects against *Escherichia coli*, *Staphylococcus aureus*, and *Candida albicans*. Oven-dried samples exhibited the highest TPC (5.05 ± 0.31 mg GAE/g DW), and α -amylase inhibition ($IC_{50} = 0.063 \pm 0.003$ mg/mL), pancreatic lipase inhibition ($IC_{50} = 0.29 \pm 0.009$ mg/mL), and anti-aging activities indicating superior retention of antioxidant, antidiabetic and anti-obesity properties. Microwave-dried samples demonstrated the strongest antimicrobial activity, with inhibition zones of 9.67 ± 0.58 mm for *E. coli*, 12.00 ± 1.00 mm for *S. aureus* and 8.68 ± 0.58 for *C. albicans* at 50 mg/mL, alongside the highest antioxidant capacity as indicated by FRAP value (0.29 ± 0.009 mM FeSO₄/g DW) and ORAC value (316.27 ± 9.08 μ mol TE/gDW). Sun-dried samples showed moderate TPC (3.51 ± 0.13 mg GAE/g DW) but the lowest antioxidant and enzyme inhibitory activities. In conclusion, oven drying emerged as the most effective method for preserving a broad spectrum of bioactive properties, likely due to controlled thermal conditions minimizing degradation. These findings underscore the importance of drying method selection in optimizing *K. alvarezii*'s functional potential for industrial applications.

Keywords: *Kappaphycus alvarezii*, Drying methods, Bioactive properties, Extractions, *in-vitro* study.

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Development of Drinking Yogurt Using Citrus Fiber as a Stabilizer and Determining Its Effect on Quality Parameters and Probiotic Viability

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A yoghurt was produced with incorporation of orange fiber and its effects was evaluated on physical characteristics, microbiological stability, and sensory quality of the final product. A total of four formulas were prepared with combinations of 0.2% gelatin with 0.1%, 0.2%, and 0.3% citrus fiber and 0.2% gelatin as a control. Physicochemical properties of lactic acid bacteria and yeast/molds were determined for the duration of a 15-day storage at 4°C, including pH, titratable acidity, syneresis, viscosity, and microbial viability levels. Based on median scores, the blend of 0.2% gelatin and 0.2% citrus fiber yielded the highest palatability sensory effects with a score of 8.67 flavor points and 6.83 mouthfeel points. A 0.3% content of citrus fiber decreased the visual acceptability of the yogurt samples as well as the undesirable effect on their smoothness and perception of sourness. Measurement of syneresis indicated a significant decrease (Day 16: 12.5% vs. control: 18.2%) i.e., improvement in the stability of treated yogurt. In the case of both the citrus fiber-containing formulae, the viscosity as well as the total solids content increased. Increasing numbers of two enriched bacterial cultures, *Lactobacillus bulgaricus* and *Streptococcus thermophilus*, were present in the treatment samples compared with the control samples (Day 15: 6.8 ± 0.2 log CFU/mL vs. control: 5.9 ± 0.3 log CFU/mL). Even though the unfortified yogurt still scored higher for preference, the addition of both 0.2% gelatin and 0.2% citrus fiber yielded the highest sensory values for texture and flavor. Besides enhancing the health-promoting properties and viscosity and maintaining palatability-sensitive characteristics, product stability as well increased as a result of fortification with 0.2% citrus fiber. Adding more fiber content than 0.3% will degrade the texture and flavor. A combination of 0.2% gelatin and 0.2% citrus fiber constituted the optimal stabilizer system that was used; this blend delivers a green and environmentally friendly stabilizing system for functional dairy foods.

Keywords: Drinking yogurt, Citrus fiber, Gelatin, Stabilizer, Probiotic viability

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Effect of Management Practices on Common Welfare Issues in Small and Medium-Scale Broiler Farms in Kurunegala District, Sri Lanka

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This study assessed the effect of management practices on the welfare of broiler chickens in small- and medium-scale farms in the Kurunegala District. A purposive sampling technique was used to select 30 small and medium-scale broiler farms based on management practices, housing type and flock size. The birds were between 21-25 days old at the time of assessment. Data were collected through farm visits and included farmer demographics, farm management practices, housing conditions, and on-farm observations. Key welfare indicators, including footpad dermatitis, hock burns, plumage cleanliness, lameness, and litter quality, were evaluated using standardized scoring systems. These indicators were chosen based on their relevance to broiler welfare and their ease of assessment in field conditions. Each welfare indicator was scored on a 3 to 5-point scale to determine the severity of the condition. The study revealed that most of the farmers (96%) belong to the 31-64 age group, aligning with previous findings that experience and financial stability may drive poultry farming. Education levels varied, with 57% and 20% completing O/L and A/L, with 3% attaining higher education. Sixty percent of the farmers had more than five years of experience with the rest having less than 4 years of experience. The presence of footpad dermatitis, hock burns, and lameness were 50%, 73%, and 35%, respectively. The occurrence of footpad dermatitis and hock burns were correlated ($P < 0.05$) with litter turning frequency, where higher frequencies resulted in fewer occurrences. The study underscored the need for improved management practices, better housing conditions, and farmer education to enhance broiler welfare. Recommendations include training farmers on proper litter management practices, provision of appropriate housing conditions, and regular welfare assessments. Addressing these issues will not only improve broiler welfare but also contribute to the long-term sustainability of broiler farming in Sri Lanka.

Keywords: Broiler welfare, Management practices, Litter quality, Kurunegala District

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Intercropping of Maize and Sorghum with Pole Beans in the Mid Country Intermediate Zone

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Lack of quality feed is a recurring problem for ruminant feeding in mid-country intermediate zone, Sri Lanka. This study investigated the effects of intercropping sorghum (*Sorghum bicolor*) and maize (*Zea mays*) with pole beans (*Phaseolus vulgaris*). The experiment was conducted at Dodangolla Experimental Station as a Randomized Complete Block Design in a factorial arrangement. Maize seeds were planted as established in monoculture (60 × 60 cm), intercropped with pole bean at recommended spacing (60 × 60 cm), and intercropped at wider spacing (60 × 75 cm). Similarly, sorghum seeds were planted as monoculture (45 × 15 cm), intercropped with pole bean at medium spacing (45 cm × 45 cm), and intercropped at wider spacing (45 × 60 cm). The height and leaf number of plants were recorded during 10 weeks growth period. At 10 weeks the experimental plots were harvested. The leaf to stem ratio (LS ratio), dry matter (DM), fresh matter yield (FMY) and dry matter yield (DMY) were determined. Maize monoculture showed steady growth and produced more leaves (15 vs. 10; $p < 0.05$) and higher leaf-to-stem ratios (0.17–0.29) compared to sorghum (0.10–0.20). Although sorghum had higher dry matter content (20.7–21%) and dry matter yield than maize, it was more sensitive to intercropping. FMY of sorghum under intercropping is lesser (31–35 MT ha⁻¹; $p < 0.05$) compared to its monoculture (60.83 MT ha⁻¹). A significant fodder–stand interaction ($p < 0.05$) confirmed this sensitivity. In contrast, maize maintained a stable FMY (29–34 MT ha⁻¹) and height (230–233 cm) across treatments ($p > 0.05$), demonstrating resilience. These findings emphasize intercropping stability of maize and yield advantage of sorghum under monoculture in the mid-country intermediate zone.

Keywords: Dry matter yield, Fresh matter yield, Leaf-to-stem ratio, Plant height, Intercropping

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Assessment of the Forage Value of Hybrid Fodder Sorghum Cultivars Intended for Importation

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Hybrid fodder sorghum cultivars (*Sorghum bicolor*) exhibit better adaptation to tropical climates, offering a sustainable solution to forage shortage for feeding cattle in Sri Lanka. Hybrid fodder sorghum seeds are not produced in Sri Lanka. This study investigated the growth and yield of two hybrid fodder sorghum cultivars (Fat Boy and Honey Pot) intended to import. Fodder sorghum were grown at Dima Agri Techno Park, Lenadora in the low country dry zone. The experiment was on Randomized Complete Block Design. Fat Boy and Honey Pot were grown at 30×15 cm spacing. Popular Sugargraze was grown as a control at 30×15 cm and 45×15 cm (recommended) spacing. Three replicates of each treatment were randomly assigned to 12 plots (14.4 m²). During the growth plant height, leaves number, stem diameter, shoots number and length and width of standard leaf were weekly recorded. Forages were harvested at eight weeks, and their dry matter content and leaf to stem ratio were determined. Subsequently, fresh matter yield and dry matter yield were estimated. During the growth Fat Boy recorded higher ($P<0.05$) plant height, leaves number and shoot number. Further, at harvest, the cultivar recorded the highest ($p<0.05$) plant height, leaves number, and shoots number (265.55 cm, 13.08, 1 shoots/plant, respectively). Fat Boy exhibited the highest ($p<0.05$) DM content (25.01%) followed by Honey Pot, Sugargraze at 45×15 cm and Sugargraze at 30×15 cm (14.4%, 13.41% and 14.26%, respectively). Although, Sugargraze growth at 30×15 cm spacing recorded the highest fresh matter yield (62.45 MT/ha), Fat Boy recorded the highest ($p<0.05$) dry matter yield (10.36 MT/ha). Sugargraze planted at high density (30×15 cm) had better yield compared to the cultivar planted at low density (45×15 cm). In conclusion, Fat Boy cultivar is superior to Honey Pot and Sugargraze cultivars in mid country wet zone of Sri Lanka.

Keywords: Dry matter content, Sorghum cultivars, Hybrid sorghum, Forage quality

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Development of Vegan Patty Using Soy Protein Isolates from Locally Grown Soybean (*Glycine Max*) Pb1 and Evaluation of Its' Quality Characteristics

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Consumption of plant-based protein products has increased due to religious norms, personal perspectives, health implications, animal welfare and environmental issues. The objective of this study was to formulate a patty analogue using soy protein isolates (SPI) obtained from locally grown soybean (*Glycine max*) PB1 variety and evaluate its physiochemical, nutritional, microbiological and sensory properties. The patty analogue was produced with combinations of chickpea flour (CF), mushrooms, onion, garlic, carrots, corn flour and breadcrumbs as the main ingredients. In this study, five (5) fatty analogues were prepared using extracted ISP and CF as combinations: 0% SPI: 100% CF (T1), 30%:70% (T2), 50%:50% (T3), 70%: 30% (T4), 100%: 0% (T5) and those treatments were analyzed with patty analogue produced from 100% commercial SPI (Control). According to sensory evaluation, the control sample was selected as the best treatment followed by T5 and T4. The selected two (2) vegan patty produced from the extracted SPI and control were subjected to physio-chemical and microbiological analysis during four (4) weeks of the storage period at -18°C. Proximate composition, cooking losses of the selected three (3) samples were analyzed. The control sample had higher ($p<0.05$) crude protein content (39.48 ± 0.28) and lower ($P<0.05$) crude fat content (13.46 ± 0.24) compared to other two treatments. Crude fiber, dry matter content and cooking losses of all the patty analogues were not different ($P>0.05$). Water Holding Capacity, pH, Total viable plate count, b* value were not different ($P>0.05$) during the storage period. The 100% commercial SPI: 0% CF formulation was the preferred formulation according to the sensory analysis and higher crude protein content. Thus, 20.8% of ISP of locally grown soybean variety PB1 can be used to replace commercial ISP in vegan patty production which was cost-effective, nutritious plant-based protein for all the consumers.

Keywords: Vegan patty, Soy protein isolate (SPI), Soybean PB1, Plant-based analogue

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The Impact of Breeder Flock Age and Egg Positioning On Hatchability, Fertility, and Chick Quality in Broiler Production

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Successful hatchery management is crucial to produce high quality chicks. Among several factors, egg handling and breeding stock characteristics play significant roles in achieving high quality chicks. This study focusses on the operational and biological aspects of hatchery operations to investigate how the breeder flock age (young (34 weeks-A), middle (44 weeks-B) and old (51 weeks-C)) and positioning of eggs (control (X) and upside down (Y)) influence on fertility, hatchability and chick quality in hatchery operation. A total of 2,916 eggs were used in the experiment using six treatment combinations, namely AX, AY, BX, BY, CX and CY under two-factor factorial design. The Pasgar scoring technique was used to assess the quality of chicks. The results showed that flock age C had 6%-7% ($p < 0.05$) reduction of fertility compared to flock age B. There was a strong ($p < 0.05$) correlation between breeder age and hatchability rates. The egg position Y reduced hatchability by 6%-10% ($p < 0.05$). The flock age B showed the highest hatchability rates (97% - 98%) in both X and Y egg positions, while the egg position X consistently produced high hatchability rates ($p < 0.05$) across all age groups. However, the interaction between breeder age and egg position was not significant ($p > 0.05$). The chick quality was influenced by both age of breeders and positioning of egg. These results demonstrate the significance of hatchery practices by taking breeder age into account and by ensuring the ideal egg placement for efficient hatchery operation and quality chick production.

Keywords: Breeder age, Fertility, Egg position, Chick quality, Hatchability

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Formulation and Quality Assessment of High-Protein Drinking Yoghurt

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This study aimed to develop high-protein drinking yoghurts fortified with varying concentrations of Milk Protein Isolate (MPI) and evaluate their quality attributes. Three formulations containing 5% (T1), 6% (T2), and 7% (T3) MPI were compared with a commercial drinking yoghurt as the control. Samples were stored at $4 \pm 1^\circ\text{C}$ for 28 days and assessed for physicochemical, microbiological, proximate, and sensory properties. MPI-fortified samples exhibited higher pH, increased titratable acidity, and lower total soluble solids compared to the control. Syneresis was also highest in T3. Microbiological analysis confirmed product safety throughout storage. Sensory evaluation revealed that T1 had the highest acceptability scores, while T3, despite its high protein content, was least preferred. Proximate analysis showed increased protein and total solids with rising MPI levels, while carbohydrate and energy values slightly decreased. All MPI formulations qualified for “high-protein” labeling. Among them, T1 (5% MPI) emerged as the optimal formulation, balancing enhanced protein content with favorable sensory and functional qualities.

Keywords: Milk Protein Isolate, Drinking yoghurt, High Protein, proximate analysis.

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Development of Fish Seasoning Powder from Sea Chicken Fish (*Canthidermis maculata*)

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Sea chicken fish (*Canthidermis maculata*) is an underutilized fish species in Sri Lanka. It has low economic value due to its high availability. However, its taste, texture and protein content are similar to chicken. This study aims to develop a nutritious fish-based seasoning powder from sea chicken fish and add economic value to this fish species. The processing ingredients include fish flour, onion flour, garlic flour, ginger powder, black pepper powder, fine salt and powdered sugar. Formulations were developed by incorporating sea chicken fish flour at concentrations of 20%, 30%, 40% and 50% with a control formulation containing no fish flour. Sensory evaluation, proximate and physical property analysis were conducted to select the best formulation. Significant differences ($P < 0.05$) were observed between the treatments and the control as well as the commercial product. The formulation containing 50% fish flour was selected based on consumer preference and nutritional content. This formulation comprised 50% sea chicken fish flour, 10% onion-garlic mix (7:5 ratio), 2% ginger powder, 2% black pepper powder, 30% fine salt, and 6% powdered sugar. Developed sea chicken seasoning powder containing 50% fish flour has a moisture of 1.53%, protein content of 49.06%, fat content of 3.44%, ash content of 34.52%, fibre content of 0.53% and carbohydrate content of 10.92%. It showed bulk density of 0.8g/cm^3 , tapped density of 0.928g/cm^3 and angle of repose of 24.73° . This seasoning powder complied with microbial standards for *Escherichia Coli* test, total plate count, yeast and mold growth. This research shows that sea chicken fish has a high potential to be developed into a fish seasoning powder.

Keywords: Seasoning powder, *Canthidermis maculata*, Fish flour, Physical property

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Acid soluble Collagen Extraction from Yellowfin Tuna (*Thunnus albacares*), Skipjack Tuna (*Katsuwonus pelamis*), Sea Chicken (*Canthidermis maculata*) Fish Skin

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Collagen is most abundant structural protein in animal's body and provides elasticity, strength to connective tissue. In this study, mainly focused on the collagen extraction from three different fish species namely, yellowfin tuna (*Thunnus albacares*), skipjack tuna (*Katsuwonus pelamis*) and sea chicken (*Canthidermis maculata*). These by-products of the fishing industry offer a cost-effective and sustainable option for collagen extraction. The steps of collagen extraction method are pretreatment, collagen extraction, precipitation and drying. Fish skin was pretreated with 0.1M NaOH for 24 hours and 0.75M acetic acid was added to pretreated skin and kept for 48 hours at 4°C for collagen extraction. After precipitation of collagen with 0.9M NaCl, collagen samples were freeze dried. pH, colour, solubility, proximate analysis was assed for its potential for commercial and industrial applications. The higher yield was obtained from the yellowfin tuna (7.57± 0.41%) followed by skipjack tuna (3.77± 0.25%). Under this condition, collagen was not extracted from sea chicken fish skin. The protein content of yellowfin tuna and skipjack tuna were 75.54±0.21% and 80.56 ±0.27% respectively. pH for yellowfin tuna and skipjack tuna ranged from 3.68 to 4.03, showed acetic nature. Collagen solubility of yellowfin tuna, skipjack tuna was 72.05± 0.15% and 78.12±0.39% respectively. There was too low-fat content (0.03±0.001%, 0.025±0.001%) and minimal ash content (0.563±0.01%, 0.520 ±0.01%) of extracted collagen from yellowfin tuna and skipjack tuna. This study showed, there was a potential for collagen extraction from yellowfin tuna and skipjack tuna skin due to its yield and quality.

Keywords: Collagen, *Thunnus albacares*, *Katsuwonus pelamis*, *Canthidermis maculata*, Acetic acid

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Assessing Hatchability, Fertility and Product Quality Parameters of Black (Kadakhnath) Chicken and Village Chicken

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Poultry industry plays a vital role in Sri Lanka's agriculture sector, with broiler and village chicken contributing significantly to meat and egg production. Black chicken (Kadakhnath) is a variant of indigenous chicken, and has a high potential to popularize in Sri Lanka owing to its medicinal value and unique appearance. However, the production and reproduction parameters of this chicken variant have not been evaluated under Sri Lankan conditions. This study aims to evaluate and compare the performance traits of Kadakhnath with village chicken. Egg and meat quality parameters, and fertility and hatchability of similarly managed Kadakhnath and village chicken flocks were assessed. Commercial broiler chicken meat was also included in comparison of muscle micro-structure. Statistical analyses showed that there were no significant differences ($p>0.05$) observed in egg external quality parameters, fertility and hatchability between village and Kadakhnath chicken. However, there were significant differences ($p<0.05$) in egg yolk color and yolk index between the two chicken types. Water holding capacity and cook loss did not show a significant difference ($p>0.05$) between village and Kadakhnath chicken. For water holding capacity numerically Village chicken had a high value and for cook loss Kadakhnath chicken had a high value. The texture analysis revealed a significantly ($p<0.05$) higher adhesiveness was observed in Village chicken than Kadakhnath. Hardness, resilience, cohesiveness, gumminess, and chewiness did not show a significant difference ($p>0.05$) in Kadakhnath and Village chicken. The breast muscle myofiber analysis revealed significantly ($p<0.05$) higher diameter was observed in Village chicken than Kadakhnath and Broiler chicken, but there was no significant difference observed in leg muscle myofiber ($p>0.05$) of those chicken types tested. Numerically Kadakhnath showed slightly high leg muscle myofiber diameter. These findings suggested that Kadakhnath chicken possesses distinct performance that could contribute to their commercial potential in Sri Lanka.

Keywords: Black chicken, Kadakhnath, Texture analysis, Muscle fiber

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Dietary Supplementation of Yeast Fractions (Safmannan®) on Growth Performance and Nutrient Digestibility in Broiler Chicken under High Stocking Density

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The increasing demand for poultry production requires sustainable strategies to counteract the negative effects of high stocking density on broiler productivity. This study investigated the impact of dietary supplementation of Safmannan®, a yeast-derived postbiotic, rich in mannan-oligosaccharides and β -glucans, on growth performance and nutrient digestibility in broiler chicken reared under standard stocking density (11.11 birds/m²) and high stocking density (15.92 birds/m²). A two-factor factorial design was employed using 112 one-day-old Cobb 500 broilers, which were randomly assigned to one of four treatments: T1, a control diet with standard stocking density; T2, a control diet with high stocking density; T3, a diet supplemented with 0.05% Safmannan® and standard stocking density; and T4, a diet supplemented with 0.05% Safmannan® and high stocking density. Growth performance and ileal nutrient digestibility of birds were assessed. Safmannan® supplementation increased ($p < 0.001$) final body weight, weight gain ($p < 0.001$) compared to birds fed diets without Safmannan®. While high stocking density reduced ($p < 0.001$) the growth performance, Safmannan® supplementation increased ($p < 0.05$) weight gain of birds. Dry matter digestibility showed a tendency to increase ($p = 0.06$) with Safmannan® supplementation. In conclusion, dietary Safmannan® supplementation enhances growth performance and nutrient digestibility in broiler chicken, even under high stocking density.

Keywords: Broiler chicken, stocking density, yeast postbiotics, growth performance, nutrient digestibility

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The Performance of GIFT Tilapia (*Oreochromis niloticus*) Fry in a Diet with Fishmeal Replaced by Black Soldier Fly Larvae (*Hermetia illucens*) Meal and Fish Silage

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Aquafeed has become significant determinants of aquaculture due to its high price and the issues of accessing locally produced quality fishmeal (FM). The black soldier fly larvae meal (BSFLM) is becoming a sustainable alternative to FM and can be produced locally and economically. However, the previous research confirms it is impossible to totally replace FM with BSFLM due to its poor nutrient conditions, such as amino acid and lipid profiles. Simultaneously, fish silage (FS) has been identified as a sustainable and economical aquafeed ingredient. Therefore, this experiment was performed with *O. niloticus* fry to check the possibility of substituting FM with a combination of BSFLM and FS in their diet without affecting body growth. Fish were allocated to 18 fish tanks, with 30 fish in each, for a fiftyseven-day experiment. The FM containing diet was replaced by five feed combinations of BSFLM and FS. The control diet (FM 100%) included FM. The other five treatments included 100% BSFLM (FS0), 95% BSFLM + 5% FS (FS5), 90% BSFLM + 10% FS (FS10), 85% BSFLM + 15% FS (FS15), and 80% BSFLM + 20% FS (FS20). This study confirmed that FM could be replaced by a BSFLM and FS combination in *O. niloticus* fry diet without affecting body growth. According to the Tukey test, there is no significant difference ($P < 0.05$) in initial and final body weights, weight gain, relative weight gain, and the specific growth rate in all treatments. Since the survival rate was high, the tested feed combinations were not a limiting factor for the survival of *O. niloticus* fry. Finally, the study revealed that BSFLM and FS can replace FM totally, while a ratio of 80:20 is most suitable. However, further studies are needed to determine the effects of these treatments on the liver and carcass conditions and overall health of fish fry.

Keywords: Fishmeal replacement, Novel feed ingredients, Sustainable aquafeed

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Analysis of Extracted Calcium from (*Hypostomus plecostomus*) Sucker Mouth Catfish Fish Bones and Its Fortification in Fish Crackers

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Invasive Sucker mouth cat fish/ tank cleaner (*Hypostomus plecostomus*) have become a threat to the Sri Lanka especially inland fisheries. Preparation of value-added products from underutilized invasive *Hypostomus plecostomus* is important for controlling their population. This study aimed to obtain calciumrich bone powder from the waste parts of the *Hypostomus plecostomus* fish and to produce fish crackers fortified with the extracted fish bone powder (FBP) to alleviate calcium deficiency-related disorders and provide a healthy protein source. *Hypostomus plecostomus* fish samples were collected from Victoria reservoir, Digana, Kandy. The experimental design was a two-factor factorial CRD. Factors were NaOH concentrations (1, 1.5, and 3%) and boiling time (30 and 60 minutes). FBP was prepared by boiling the waste part of the *Hypostomus plecostomus* fish with NaOH to remove the organic matter. Separated fish bones were neutralized before using it, and variables were measured such as calcium (Ca) yield, phosphorus (P) yield, digestibility, soluble organic matter, crude protein, average crude fat, and ash. Four types of fish crackers were made out of FBP and rice flour in different ratios of 0, 5, 10, and 30% of FBP. Crude protein, crude fat, and ash were measured in fish crackers as variables, and finally, sensory evaluation was done. Results revealed that the highest Ca yield was 0.375 (g/g) with 3% in 60 minutes treatment. The highest P yield was 0.34 g/g with 3% in 30 minutes boiling period ($P>0.05$). However, 70% of digestibility was reported as the highest digestibility with 3% and 30 minutes of boiling treatment ($P>0.05$). The most preferred fish cracker was 5% bone extracted powder fortified fish crackers. Digestibility is the most important factor, therefore most efficient treatment was 3% NaOH in 30 minutes. Efficient treatment to obtain the highest calcium yield was 3% in 60 minutes.

Keywords: *Hypostomus plecostomus*, Calcium, Fortification, Fish bone powder, Fish crackers)

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Sustainable Development of Fish Leather from Sailfish Skin (*Istiophorus platypterus*) And Skipjack Tuna Fish Skin (*Katsuwonus pelamis*)

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Leather is a durable flexible and non-putrescible material obtained from tanning of animal skins and hides. This versatile material finds applications in products such as footwear, clothing, accessories, furniture, and interior decor. Raw material is provided mostly by cattle, goats, buffalo, crocodile and fish. Since Sri Lanka has a powerful fishing industry, the opportunity exists to produce fish leather. Leather production helps to minimize fish waste. The skin of Sailfish and Skipjack tuna fish are largely removed during processing. The objective of the present study was to prepare leather from the skin of sailfish and skipjack tuna fish using vegetable tanning and chromium tanning methods. Leather production follows three stages; pre-tanning, tanning and finishing. The physical properties of the leather, such as tensile strength, thickness, elongation at break, density, and water absorption were evaluated using the International Union of Leather Technologists and Chemists Societies (IULTCS) official methods of analysis for leather. There were significant difference between the skins of the fish species ($P < 0.05$). There were no significant difference between the tanning processes. The highest tensile strength ($319.32 \pm 35.6 \text{ N/mm}^2$) was obtained from sailfish chromium-tanned leather. The highest thickness ($1.23 \pm 0.18 \text{ mm}$) was obtained from sailfish vegetable-tanned leather. The highest elongation at break ($6.6 \pm 0.8 \text{ cm}$) was obtained from skipjack tuna fish chromiumtanned leather. Skipjack tuna fish vegetable-tanned leather had lowest water absorption percentage ($14.1 \pm 4.59 \%$). Sailfish leather has better tensile strength and thickness while skipjack tuna fish leather has high elongation value. Thus they can be used to produce different products according to their physical parameters.

Keywords: Fish Leather, *Istiophorus platypterus*, *Katsuwonus pelamis*, Vegetable tanning, Chromium tanning

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***In silico* Pharmacological Analysis of *Tinospora cordifolia* Compounds Targeting African Swine Fever Virus B175L**

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African swine fever virus (ASFV) is a highly virulent DNA virus that suppresses the host's immune response to establish infection. One of its key immune evasion proteins, B175L, directly inhibits STING-mediated type I interferon (IFN-I) signaling, preventing antiviral defense activation. Thus, targeting B175L could be a promising strategy for antiviral drug development as effective ASFV inhibitors remain unidentified. In this study, we investigated the potential of the *Tinospora cordifolia* plant's bioactive compounds to disrupt B175L's function and restore immune signaling. Gas chromatography-mass spectrometry (GC-MS) analysis of *T. cordifolia* methanol extract identified 124 compounds, of which 52 met SwissADME and DataWarrior criteria for drug-likeness and safety. We generated a highly accurate 3D B175L model with strong confidence scores utilizing AlphaFold 3. We performed virtual screening using PyRx 8.0. and top 4 candidates with binding affinities exceeding -6 kcal/mol advanced to CB-Dock2 with higher binding affinities and Benzaldehyde, 5-bromo-2-hydroxy-, (5-trifluoromethyl-2-pyridyl) hydrazone exhibited the highest binding affinity. Further docking using UCSF Chimera (-8.2 kcal/mol) with binding pocket analysis of CB-Dock2 confirmed strong interactions at the B175L active site. Molecular dynamics (MD) simulations demonstrated the compound's stability, with root mean square deviation and fluctuation (RMSD, RMSF) indicating minimal conformational changes (<2 Å). The compound maintained stable hydrogen bonds and hydrophobic interactions, reinforcing structural robustness. Integrating the results of this study emphasizes *T. cordifolia* derived Benzaldehyde, 5-bromo-2-hydroxy-, (5-trifluoromethyl-2-pyridyl) hydrazone as a promising B175L inhibitor, advancing exploration towards effective antiviral solutions for ASFV.

Keywords: African Swine Fever Virus (ASFV), B175L, *Tinospora cordifolia*, AlphaFold 3, Molecular Dynamics (MD) Simulations

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Development and Characterization of Chicken Sausage Formulated Using Jackfruit (*Artocarpus heterophyllus*) Bulb flour: A Plant-Based Filler

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The rising demand for healthier and sustainable processed meat products has driven with the exploration of plant-based alternatives in sausage formulations. The main purpose of this study was to develop chicken sausages formulated with reduced isolated soy protein (ISP) and corn flour content, by replacing jackfruit (*Artocarpus heterophyllus*), "Kothmale" variety bulb flour (JFBF) as a natural filler and to evaluate the nutritional, physio-chemical, microbiological and sensory qualities of the formulated sausages. In this study, four (4) sausage treatments were prepared including control (0% JFBF), JFBF incorporated three (3) treatments as 0.5% (T1), 1.0 % (T2), and 1.5 % (T3), replacing ISP and corn flour in sausage formulations. Each treatment had three (3) replicates and all samples were evaluated during 21-days of the storage period at -18°C. Water holding capacity, pH, 2-thiobarbituric acid reactive substances (2-TBARS), color, cooking loss, Total Plate Count and Coliform test were measured once in 4 weeks of the storage period. Proximate composition and sensory evaluation for all sausages were conducted. According to the sensory analysis, T2 was selected as the best treatment with respect to the overall acceptability except of color and mouthfeel. There was no significant difference among all samples for the dry matter, crude protein, crude fiber and total ash contents. Crude fat content of T3 was ($P<0.05$) higher than that of T2 sausage. Control sausage sample had ($P<0.05$) higher pH value than other treatments. Water holding capacity, L^* , a^* , b^* value, and 2-TBARS were not ($P>0.05$) different between all treatments during the storage period. T1 sausage had ($P<0.05$) higher cooking losses than T3 sausage sample. Therefore, results showed that 1% JFBF can be used as a good filler in order to produce nutritious, healthy, microbiologically sound chicken sausage by replacing ISP and corn flour without hindering the sensory properties.

Keywords: Sausage, Jackfruit Bulb, Sensory, Soy protein isolate, Filler

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Examining the Influence of Sea Surface Temperature (SST) and Salinity on the Distribution and Abundance of Swordfish (*Xiphias gladius*) in the Southern Ocean region of Sri Lanka

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Swordfish (*Xiphias gladius*) is a key species in Sri Lankan fisheries, particularly in the southern coastal region known for its productive fishing grounds. Understanding the factors that influence swordfish abundance is essential for sustainable fisheries management. This study investigates the impact of Sea Surface Temperature (SST) and Sea Surface Salinity (SSS) on swordfish distribution and abundance using remotely sensed satellite data from 2020 to 2023. The study area spans latitudes 0°N to 6.5°N and longitudes 76°E to 85.6°E along Sri Lanka's southern coast. Environmental data (SST and SSS) were obtained from Copernicus Marine Services and processed to a 1/3° resolution. Swordfish catch data was sourced from the Department of Fisheries and Aquatic Resources (DFAR). The relationship between oceanographic factors and swordfish abundance was analyzed using Generalized Additive Models (GAM) and Empirical Cumulative Distribution Functions (ECDF). The analysis revealed that swordfish catch rates were highest when SST ranged from 28.74°C to 29.38°C, and SSS ranged from 34.17 PSU to 34.92 PSU. Both the GAM and ECDF models demonstrated the significant impact of SST and SSS on swordfish abundance. The GAM model, which accounts for non-linear relationships, explained more deviance and had a lower AIC compared to the ECDF model, indicating better predictive accuracy. Based on model performance, the Generalized Additive Model (GAM) is the most reliable for analyzing the abundance and distribution of swordfish in response to oceanographic factors. These findings underscore the importance of SST and SSS in sustainable fisheries management, offering a foundation for informed decision-making regarding swordfish fisheries.

Keywords: Fishing Grounds, Longline, Catch Data, Relationship, Oceanographic conditions

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Evaluation of Locally Produced Rice Distillers Dried Grains with Solubles as a Sustainable and Cost-Effective Feed Ingredient for Layer Chicken Diets

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A 10-week feeding trial was conducted on 340 Hy-Line White laying hens, aged 30 weeks to evaluate the feeding value of locally produced Rice Distiller's Dried Grains with Solubles (RDDGS) and imported Corn Distiller's Dried Grains with Solubles (CDDGS) without enzymatic supplementation. A 2 × 3 completely randomized factorial design was used, with six iso-caloric and iso-nitrogenous dietary treatments, each consisting of 60 birds. Birds were housed in floor cages (12 birds/replicate), with experimental diets incorporating three levels (50, 75, and 100 g/kg) of each DDGS type. Notably, RDDGS contained 14.45% ± 0.63 non-protein nitrogen. Results showed an increase (P<0.05) in egg weight and yolk index in RDDGS-fed hens (up to 100 g/kg inclusion) compared to CDDGS. However, shape index, shell thickness, egg mass, yolk color, feed conversion ratio, and Haugh unit remained unaffected. Dry matter digestibility was lower (P<0.05) in RDDGS diets (CDDGS, 0.77 and RDDGS, 0.68). Importantly, increasing RDDGS levels led to a reduction (P<0.05) in feed cost per kilogram of egg mass and per dozen eggs. RDDGS can be effectively included in layer diets at up to 100 g/kg, achieving optimal productivity while reducing feed costs by 3.8%. Incorporating distillery by-products in poultry feed aligns with circular economy principles, offering a cost-effective and sustainable alternative for layer chicken nutrition. Furthermore, this study provides valuable insights regarding how locally produced RDDGS can positively influence on a resilient and robust layer chicken industry while addressing higher cost of production per chicken egg in Sri Lanka.

Keywords: Distillery by-product, Rice DDGS, Alternative Feed Ingredients, Feed Cost Reduction, Egg Weight

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Potential and Effects of Using Aqueous Extracts of Tulsi (*Ocimum tenuiflorum* L.) as a Natural Preservative of Raw Cow Milk

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This study investigated the potential of the aqueous extracts from Tulsi (*Ocimum tenuiflorum* L.) as a natural preservative for raw cow milk under tropical ambient conditions (29.0 ± 1.0 °C), focusing on its effects on microbial growth, pH, and titratable acidity. Raw milk, being highly perishable, poses significant challenges for smallholder dairy farmers in Sri Lanka, where refrigeration is often may not be accessible. Tulsi, renowned for its antimicrobial and antioxidant properties, was evaluated at concentrations of 0.75 %, 1.00 %, and 1.25 % (v/v). Qualitative phytochemical analysis confirmed, presence of alkaloids, phenolics, and tannins in the extracts, which are known for their preservative effects. Results demonstrated, Tulsi extracts significantly ($P < 0.05$) inhibited microbial growth, with the 0.75 % and 1.00 % concentrations showing the highest efficacy, outperforming the control. The extracts also induced a slight but significant reduction in pH ($P < 0.05$) for treated samples compared to the control. Titratable acidity remained stable across all treatments. The Clot-on-Boiling (COB) test showed no spoilage within the 8-hour experimental period for all samples, suggesting Tulsi's potential to delay milk spoilage. The findings highlight Tulsi's viability as a cost-effective, natural preservative for raw milk in tropical settings, offering a sustainable alternative to synthetic additives. Optimal results were achieved at 0.75–1.00 % concentrations, balancing efficacy and practicality. This study supports the integration of Tulsi-based preservation into dairy practices to reduce post-harvest losses, enhance food security, and improve livelihoods for small-scale farmers in Sri Lanka. Further research is recommended to assess sensory impacts and long-term preservation efficacy.

Keywords: Tulsi, Raw cow milk, Microbial inhibition, Tropical conditions, Smallholder farmers

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***In silico* Druggability Assessment of *Coccinia grandis* Compounds Against Monkeypox Virus E8L**

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Monkeypox virus (MPXV) is responsible for over 120,000 global cases by early 2025 and lacks FDA-approved therapeutics despite available vaccines. The E8L envelope protein is a promising antiviral target due to its crucial role in a viral entry via 3 ganglioside-binding domains. In this study, we investigated the bioactive compounds of *Coccinia grandis* (L.) Voigt, a versatile and nutrient-rich climber widely distributed across tropical regions, is a potential inhibitor against MPXV E8L. Methanol extracts of the plant were analyzed using gas chromatography-mass spectrometry (GC-MS), leading to the identification of 120 phytocompounds, and only 42 compounds appeared as druggable, adhering to Lipinski's rules of five with no toxicity. A homology-modeled 3D structure of E8L was further validated using a Ramachandran plot with 92.4% residues in the favored region after refining, which served as the target for virtual screening and molecular docking (PyRx, AutoDock Vina). Nordextromethorphan (PubChem CID 620851) (Alkaloid) emerged as the top candidate, demonstrating a binding affinity of -7.0 kcal/mol to E8L, surpassing other screened compounds and key interactions with active-site residues (Asp18, Leu21, Phe56, Thr168, Tyr232). Molecular dynamics simulations (100 ns) revealed stable binding, with root mean square deviation (RMSD) and root mean square fluctuation (RMSF) analyses confirming complex stability (<2 Å). Interestingly, Nordextromethorphan binds with a key residue (Phe56) within E8L's ganglioside-binding domain, potentially disrupting viral-host membrane interactions. Altogether, our findings highlight Nordextromethorphan's Druggability against MPXV, warranting further experimental validation to advance therapeutic development.

Keywords: Monkeypox virus (MPXV), E8L, *Coccinia grandis*, Nordextromethorphan, Molecular docking and dynamics

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Sustainable Fish Glue Production from Sea Chicken (*Canthidermis maculata*) Fish

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Fish glue is considered a value-added adhesive derived from fish by-products, such as skin, scales, bones, and heads. Sea chicken fish (*Canthidermis maculata*) generates a considerable amount of skin waste that can be utilised as a source for glue production. This research study evaluated the efficiency of acid pre-treatment methods in extracting fish glue from the skin of sea chicken fish. Fish glue was produced by extracting gelatin from the frozen skin of sea chicken fish by alkaline pre-treatment followed by acid pretreatment. The effect of four different concentrations (0.05%, 0.10%, 0.15%, and 0.20%) of HCl on physicochemical properties was tested using a complete randomised design (CRD). The best open time (202.36 ± 6.32 min), better time to tack (0.77 ± 0.01 min), high bonding power (120.66 ± 1.14 PSI), and desirable colour (light brown) for sea chicken fish glue were obtained in 0.15% HCl treatment. The pH of the glue samples ranged from 3.27 to 3.48. The moisture content, crude protein, crude fat, and crude ash of the skin from sea chicken fish (*Canthidermis maculata*) were found to be $58.04 \pm 0.31\%$, $28.57 \pm 0.19\%$, $0.66 \pm 0.01\%$, and $12.92 \pm 0.05\%$ respectively. The effect of acid concentration was significant ($p < 0.05$) on open time, time to tack, bonding power, and colour. The results showed that sea chicken fish skin can be effectively utilised for fish glue extraction using mild alkali and acid pre-treatments.

Keywords: By-products, Fish glue, *Canthidermis maculata*, Time to tack, Open time

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Computational Analysis of *Breynia androgyna* Constituents for Druggability against Influenza A Virus Neuraminidase

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Avian influenza A virus (IAV) is an RNA virus that poses significant global health issues and economic challenges due to its zoonotic potential and recurrent outbreaks in humans and livestock. The high mutation rate of the virus often leads to drug resistance, necessitating novel antiviral drugs. The IAV neuraminidase (NA) enzyme is a key therapeutic target as its dual role in infection, evolutionary stability, and synergy with existing anti-avian drugs. This study investigates the antiviral potential of 1,4-dibenzoylpiperazine, a compound derived from *Breynia androgyna*, a medicinal herb native to Sri Lanka renowned for its antioxidant, antimicrobial, and antidiabetic properties. Gas chromatography-mass spectrometry (GC-MS) identified bioactive compounds in *B. androgyna*, while ADME and toxicity screenings proved the drug-likeness and safety of 1,4-dibenzoylpiperazine. Molecular docking targeted the IAV NA active site (PDB: 3TI6) using virtual screening and blind docking approach, with oseltamivir and zanamivir as positive controls. Specific docking was performed on 1,4-dibenzoylpiperazine using UCSF Chimera software for further validation. The compound interacted with 17 NA active-site residues, similar to reference drugs, and formed a strong hydrogen bond with ARG371, a key interaction shared with oseltamivir and zanamivir. Notably, 1,4-dibenzoylpiperazine also engaged with secondary sialic acid binding site residues (LYS432 and TRP403), suggesting an added advantage over conventional inhibitors. Its binding affinity ($-8.5 \text{ kcal mol}^{-1}$) exceeded zanamivir ($-7.2 \text{ kcal mol}^{-1}$) and surpassed oseltamivir ($-6.8 \text{ kcal mol}^{-1}$). Molecular dynamics (MD) simulations revealed stable binding, with root mean square deviation (RMSD) and root mean square fluctuation (RMSF) values below 2 Å. This study indicates that 1,4-dibenzoylpiperazine could effectively inhibit IAV NA, potentially blocking viral entry. Further *in vitro* and *in vivo* studies are needed to validate its therapeutic potential.

Keywords: Influenza A Virus, Neuraminidase, *Breynia androgyna*, 1,4-dibenzoyl piperazine, Molecular docking

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Development and Characterization of Active Bioplastic Film from Carrageenan, Chitosan, and Modified Starch: A Sustainable Alternative for Petroleum-Based Plastics Packaging

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The escalating environmental crisis caused by petroleum-based plastics, known for their persistence and contribution to pollution, underscores the urgent need for sustainable alternatives. This study aimed to develop and characterized an active bioplastic film using carrageenan (CG), chitosan (CS), and modified tapioca starch (MS), with the goal of creating a biodegradable and functional substitute for conventional petroleum-based packaging materials. The films were prepared through solution casting, incorporating glycerol as a plasticizer, with varying CS-MS ratios while maintaining a constant concentration of CG. A comprehensive evaluation was conducted to assess the physical, mechanical, thermal, and biological properties of the films. Results indicated that film thickness, color, opacity, moisture content, and water solubility varied with composition, influenced by the structural rigidity of CS and the solubility of MS. Water vapor permeability (WVP) varied across formulations, with optimal barrier properties observed at intermediate CS-MS ratios. Tensile strength was highest in CS-dominant films and decreased as MS content increased, while elongation at break showed the opposite trend, highlighting a tradeoff between strength and flexibility. Thermal stability analysis revealed a three-stage degradation pattern, with decomposition temperatures influenced by synergistic interactions among the polymers. Fourier Transform Infrared (FTIR) spectroscopy confirmed hydrogen bonding among CG, CS, and MS, contributing to structural integrity of the films. The films exhibited notable antibacterial activity, particularly against *Staphylococcus aureus*, attributed to CS's antimicrobial properties, with moderate effects against *Escherichia coli*. Biodegradability tests showed that highMS formulations degraded fully within a short period, while CS-rich films degraded more slowly, suggesting tunable degradation rates. These bioplastic films, derived from renewable polysaccharides, offer a sustainable and scalable alternative to petroleum-based plastics, effectively balancing functionality with environmental benefits. This research highlights the potential of these bioplastic films for applications in active food packaging, providing a promising solution to reduce plastic waste and support circular economy principles.

Keywords: Bioplastic, Carrageenan, Chitosan, Modified Starch, Sustainable Packaging

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Comparative Assessment of Cow, Goat, and Buffalo Milk Coagulum Properties Made Using Noni (*Morinda citrifolia* L.) Fruit Extract

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The dairy industry is increasingly challenged by the reliance on animal-derived rennet, which raises concerns among vegetarian consumers and those seeking ethically sourced products. Consequently, there is growing interest in plant-based milk coagulants as viable alternatives. This study investigates the coagulating potential of *Morinda citrifolia* L. (Noni) fruit extract as a vegetarian-friendly substitute for rennet. The extract's performance was evaluated in cow, goat, and buffalo milk, and compared to that of conventional rennet in terms of coagulation efficiency and curd quality. Noni extracts were prepared via two methods (extraction with distilled water and extraction using a buffer solution; phosphate buffer pH 7.0). Noni extracts were prepared at three concentrations: 1%, 2%, and 3%, while commercial rennet (0.005%) served as the control. Skimmed milk, which has 0% fat, was obtained from each species and analyzed for coagulum yield, syneresis (after 3 and 24 hours), titratable acidity, pH, textural properties (hardness, adhesiveness, cohesiveness, springiness), and proximate composition (crude protein: $6.36 \pm 0.12\%$). Rennet-induced samples exhibited superior ($P < 0.05$) coagulum properties compared to those induced by noni extracts. Among the noni treatments, buffer-extracted noni demonstrated the highest milk-clotting activity, with a 3% (w/v) concentration yielding the greatest coagulum mass. However, the yield remained lower than that obtained through rennet-induced coagulation. Coagula formed by noni extract showed increased syneresis and a softer texture, indicating weaker gel structure and water-holding capacity. SDS-PAGE analysis of the noni extract confirmed the presence of proteolytic enzymes within the 10-25 kDa molecular weight range, consistent with known milk-clotting proteases. Although noni extracts showed less efficiency than rennet, their ability to coagulate and their ethical advantages make them a potential good sustainable alternative.

Keywords: Dairy industry, Milk coagulation, Noni (*Morinda citrifolia* L.), Rennet alternative

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Estimation of Genetic Parameters and Breeding Values of Sires Based on Two State Dairy Farms

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Precise estimation of genetic parameters and breeding values (BV) is essential for identification of genetically superior animals for milk yield and other desirable traits. This study aimed to estimate heritability and breeding values of dairy sires on production and reproduction traits, such as daily milk yield (DMY), total milk yield (TMY), lactation length (LL), birth weight (BW), and number of lactations (NL) in crossbred cattle reared under semi-intensive management system in the Low Country Intermediate Zone (IL₃). The study utilized records from 199 crossbred cows across two state farms, namely *Siringapatha* and *Melsiripura*, where *Australian Friesian Sahiwal* (AFS), *Friesian*, and *Jersey* semen were used for breeding. Heritability was estimated by half sib analysis using herd (fixed) and sire (random) effects. The Analysis of Variance procedure carried out showed that *Melsiripura* herd had significantly greater performance ($P < 0.05$) on DMY, TMY, BW, and NL (8.06 L, 2362.7 L, 25.8 kg, and 4.2, respectively) compared with *Siringapatha* herd (6.14 L, 1712.4 L, 19.5 kg, and 3.2, respectively). In both herds, sire breed had no significant effect on DMY ($P > 0.05$), but offspring of *Friesian* sires had significantly greater ($P < 0.05$) performance in TMY and LL (2704.1 L, 332.6 days, respectively) compared with AFS sires (1991.5 L, 257.4 days, respectively). However, AFS sires had a significantly higher ($P < 0.05$) estimate for NL (5.38) compared with *Friesian* and *Jersey* sires (3.3 and 3.8, respectively). Heritability estimates for DMY, TMY, LL, BW, and NL were 0.42, 0.36, 0.50, 0.49, and 0.51, respectively. The highest BV estimates for DMY, TMY, LL and BW were recorded by a *Friesian* sire, followed by many *Jersey* sires. The AFS sires and the rest of the *Friesian* sires had considerably lower BVs. These results indicate the presence of genetic variability among the dairy sires and the importance of estimation of their breeding values.

Keywords: Breed comparison, Breeding value, Crossbred cattle, Dairy sires, Heritability.

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Isolation and Molecular Characterization of Methicillin- Resistant *Staphylococcus aureus* (MRSA) in Service Dogs in Sri Lanka

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Antibiotic resistance (AMR) is a serious one-health issue. MRSA have developed or acquired resistance to multiple drugs of β -lactam antibiotics primarily through the presence of the *mecA* gene. In this research, we examined the colonization statuses of MRSA in service dogs at police kennel division, Kandy, Sri Lanka. Altogether 56 nasal and ear swab samples from 28 dogs were collected and presumptive *Staphylococcus aureus* species were isolated using conventional laboratory techniques such as growth on selective medium: Mannitol Salt Agar, Gram stain, catalase, coagulase and beta-hemolysis tests. All the presumptive isolates were tested to see the presence of *nuc* gene: the gene to confirm *S. aureus* and *mecA* genes using singleplex PCR reactions. All the presumptive isolated were subjected to antimicrobial susceptibility testing (AST) including cefoxitin, the surrogate antimicrobial disk to detect phenotypic methicillin resistance. Out of 56 swab samples, only 5 samples (four nasal swabs and one ear swab) were tested positive for MRSA resulting in a 8.9% prevalence rate shown by a Wilson score interval when calculating the 95% confidence interval (0.028, 0.17) indicating nasal cavity as the primary colonization site. All five MRSA positive isolates were cefoxitin resistance indicating the presence of both genotypic and phenotypic methicillin resistance. The AST indicated antibiotic resistance to cefoxitin while no significant statistical relationship appeared between swab location and antimicrobial testing results ($p = 0.202$, $p > 0.05$). Presence of *mecA* gene demonstrated a direct correlation with swab site selection ($p = 0.007$, $p < 0.05$) which validated its ability to identify methicillin-resistant bacteria. Further research needs to incorporate animal care staff members along with kennel facilities to study AMR transmission dynamics between humans and animals to recommend interventions.

Keywords: MRSA, Methicillin- resistance, one-health, *mecA* gene, Service dogs

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Apparent Metabolizable Energy and Nitrogen-Corrected Apparent Metabolizable Energy of Two Common Sri Lankan Rice Varieties (At 362 And Bg 352) in Broiler Chicken

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The experiment was conducted to determine the apparent metabolizable energy (AME) and nitrogen-corrected AME (AME_n) of commonly cultivated Sri Lankan brown rice variety (At 362) and white rice variety (Bg 352) by using difference method. Sixty Cobb 500® male broiler chickens were allocated to three treatments using a completely randomized block design, and each treatment included five experimental cages per treatment and four birds per cage. Birds were fed with a commercial broiler diet until d 30 post-hatch. A maize-soybean diet was formulated as a basal diet while two experimental diets were formulated by replacing 300 g/kg of the basal diet (w/w) with the two rice varieties separately. Experimental diets were introduced on d 30 for adaptation to the diet. The total excreta collection was carried out from d 36 to d 39. The AME and AME_n of the At 362 variety were determined to be 3,473 and 3,275 kcal/kg, respectively, on dry matter (DM) basis. In comparison, the AME and AME_n values for the Bg 352 variety were 3,739 and 3,540 kcal/kg, respectively, on DM basis. AME and AME_n values were not different ($P>0.05$) between At 362 and Bg 352 rice varieties. As the results suggest these two rice varieties can be used as an energy source by considering the availability and cost in formulating poultry feed formulations.

Keywords: Apparent Metabolizable Energy, Nitrogen-corrected Apparent Metabolizable Energy, Brown Rice, White Rice, Broiler chicken

Acknowledgement: *The experiment was conducted in experimental station of Veterinary Research Institute, Gannoruwa, Sri Lanka*

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Evaluation of Production & Reproductive Performance of Crossbred Dairy Cattle in a Large-Scale Dairy Farm in IL-1a Agro Ecological Region of Sri Lanka

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Maximizing productive and reproductive efficiency in dairy cattle is the key to enhancing profitability of dairy enterprises. This study investigated the factors affecting the performance of crossbred dairy cattle under a semi-intensively managed large-scale government farm in (IL-1a region) of Sri Lanka. The data set included performance records of 258 cows across seven parities, comprising of crosses of Friesian, Jersey, Sahiwal, Australian Friesian Sahiwal (AFS), and Australian Milking Zebu (AMZ) breeds, with pure Friesian, Jersey, and AFS as sire breeds. Key traits evaluated were total lactation yield (TLY), lactation length (LL), average daily yield (DLY), age at first calving (AFC), calving interval (CI), number of lactation (NL) and calf birth weight (CBW). Data were analyzed using Analysis of Variance, incorporating sire breed, dam breed, parity, calving month, and calving year as fixed effects, with means compared via Duncan's Multiple Range Test. Farm-wide averages of TLY, LL, DLY, AFC, CI, NL and CBW were 2206.14 L, 263.2 days, 8.3 L, 36.7 months, 512.41 days, 3.7 and 25.96 kg. Sire breed significantly influenced DLY, TLY, and CBW ($P<0.05$) with Friesian sires (2514.6 L) outperforming others in TLY compared with Jersey (2126.90 L) and AFS (1887.77 L). Daughters of Friesian sires also recorded significantly higher ($P<0.05$) CBW (27.65 kg) than AFS (26.32 kg) and Jersey (24.43 kg). Dam breed significantly affected LL ($P<0.05$), with AMZ crosses showing significantly shorter LL (143 days) in their daughters compared with other crossbred dams ($P<0.05$). Parity of cow significantly affected TLY, LL, and CBW ($P<0.05$), while calving month significantly influenced DLY, TLY, CBW and LL ($P<0.05$). The fixed effects had no influence on CI, AFC and NL traits ($P<0.05$). These results show the superiority of certain genotypes and the potential for greater improvement through improved management conditions.

Keywords: Breed comparison, Crossbred cattle, Performance evaluation, IL-1 region

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Development of Beef Salami Using Fast Fermenting Cultures (Bactoform® F-SC-111)

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This study was conducted to develop beef salami using fast-fermenting cultures (Bactoform® F-SC-111: *Lactobacillus sakei* and *Staphylococcus carnosus*) under tropical climate conditions. Preliminary trials were conducted to determine the optimum fermentation time and 12 h was selected based on the pH of salami. Four treatments were evaluated: an acid-fermented (AF) salami with 1.0% (w/w) sodium ascorbate, and three culture-fermented salami ripened for 2 (CF-2D), 7 (CF-7D), and 14 days (CF-14D). Physico-chemical properties (pH, water holding capacity, WHC, color), microbial counts (total plate count, *Escherichia coli*, and yeast & mold), lipid oxidation with Thiobarbituric Acid Reactive Substances (TBARS) of salami were measured at 1, 7, and 14 days of storage. Sensory evaluation of salami was conducted 1 day after the preparation. Over the storage period, culture fermented salami had lower pH than acid fermented salami. Water holding capacity was higher ($P < 0.05$) in acid fermented salami and 2-days ripened culture-fermented salami compared to 7- and 14-days ripened salami. The TBARS values were lower ($P < 0.05$) in culture-fermented salami, particularly ripened for 7 and 14 days, compared to acid fermented salami throughout storage ($P < 0.05$), indicating reduced lipid oxidation in salami fermented for a longer period. Color parameters, including lightness (L^*) and redness (a^*) varied significantly ($P < 0.05$) across treatments during the storage. Microbial analysis showed that the salami ripened for 7 days was absent of *E. coli* and had lower ($P < 0.05$) yeast and mold counts (5.71 ± 0.14 log CFU/g) compared to acid fermented salami (7.07 ± 0.05 log CFU/g) on day 14 of storage. Culture-fermented salami ripened for 7 days obtained the highest scores for sensory quality attributes. In conclusion, a 12 hours fermentation with Bactoform® FSC-111 and 7 days ripening optimize beef salami production in tropical climates, ensuring microbial safety and product quality.

Keywords: Beef salami, Fast-fermenting cultures, Physico-chemical properties, Microbial safety, Sensory properties

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Synergistic Effect of α -Galactosidase Enzyme and Locally Produced Extruded-Expelled Soybean Meal on Layer Performance and Egg Quality

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Extruded-Expelled Defatted Soybean Meal (EEDSBM) in layer diets may be a preferable alternative to conventional Solvent-Extracted Defatted Soybean Meal (SEDSBM). Additionally, supplementing α -galactosidase enzyme as a feed additive with EEDSBM may be more cost-effective. Therefore, aim of this study was to evaluate the synergistic effect of the α -galactosidase enzyme and EEDSBM on layer performance and egg quality characteristics. A total of 120 Lohmann Brown-Classic 50-weeks-old laying hens were randomly assigned to four (4) dietary treatment combinations, each with six (6) replicates including five (5) birds in one replicate. The formulated layer feed was isonitrogenous (17 % CP) and isocaloric (2750 kcal/kg). The hens were fed four (4) formulated diets: diet with SEDSBM as a negative control (T1), diet containing SEDSBM with α galactosidase as a positive control (T2), diet containing EEDSBM (T3) and diet containing EEDSBM with α -galactosidase (T4) during four (4) weeks including one (1) week of the adaptation period. Egg production and Feed consumption ratio (FCR) was measured weekly as well as, internal and external egg quality characteristics were measured weekly during three (3) weeks of the period. There was no significant difference in any of the production parameters measured: feed intake, FCR and mean egg weight, except of egg production. The highest ($P < 0.05$) egg production ($95.5\% \pm 1.30$) was observed in layers fed with T3 compared to the other treatments. There were no significant differences in any of the egg quality parameters: egg shell strength, air cell depth, Haugh index, yolk index, yolk color, shell thickness and shape index during three (3) weeks of the period. These outcomes encourage the use of EEDSBM with the α galactosidase enzyme as a cost-effective layer feed additive to replace conventional SEDSBM.

Keywords: Layers, Soybean, Extruded-Expelled Soybean, α -galactosidase, Egg Quality

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Development and Characterization of Biodegradable Packaging Film from Corn Waste-Derived Hemicellulose as a Sustainable Alternative to Synthetic Plastics

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With the growing environmental concerns over with petrochemical-based packaging films, finding sustainable alternative is more crucial. Herein, the performance of corn (*Zea mays*) waste-derived hemicellulose-based biodegradable films was investigated to address the environmental challenges posted by agricultural residues. Hemicellulose was extracted from corn waste using an alkaline-ethanol extraction method. The extracted hemicellulose was blended with the polyvinyl alcohol (PVA), glycerol and citric acid (CA) to determine the optimal polymer composition for biodegradable film formation. Modified hemicellulose-based biodegradable films were fabricated through homogenization, sonication and via a solvent casting technique, yielding films with thickness ranging from 0.21 ± 0.02 to 0.35 ± 0.31 mm. Five hemicellulose to PVA weight ratios (T1-1:0, T2-3:1, T3-1:1, T4-1:3 and T5-0:1) were investigated while maintaining the total polymer weight of 6g. The prepared films were characterized for mechanical properties, including tensile test, elongation at break and Young's modulus, as well as chemical, thermal and structural properties using Fourier Transform Infrared Spectroscopy (FTIR), thermogravimetric analysis (TGA), and scanning electron microscopy (SEM) respectively. Additional characterization was performed to assess film solubility, biodegradability and colour properties. In terms of mechanical performance, the highest peak stress was observed in the films incorporated with 75% corn cob-derived hemicellulose. Films prepared from corn husk-derived hemicellulose (CH100, CH75, CH50) exhibited significantly higher elongation at break, solubility (%) (ranging from 58.33 ± 4.72 to 76.33 ± 5.85) and biodegradability (%) (ranging from 54.47 ± 20.92 to 95.70 ± 7.43) compared to the films derived from corn cob hemicellulose (CC100, CC75, CC50). FTIR spectroscopy confirms that the chemical structure of hemicellulose, glycerol, polyvinyl alcohol and cross-linking interaction facilitated by citric acid. TGA curves reveal an increased carbonaceous residue in modified films, indicating enhanced thermal stability compared to the pure hemicellulose-based films. Corn husk derived hemicellulose-incorporated films showed a greater potential to further development.

Keywords: Biodegradability, Sustainable alternative, Corn waste hemicellulose, Solubility

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Molecular Docking-Based Drug Screening for Subclinical Endometritis in Cattle Targeting HTRA -1

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Subclinical endometritis significantly impairs the fertility of dairy cows, leading to economic losses. A proteomic analysis of extracellular vesicles (EVs) in the uterine fluid of cows with subclinical endometritis revealed significant enrichment of High-temperature requirement protein A1 (HTRA-1) in EVs. As a putative etiological factor, HTRA-1 has emerged as a potential drug target, prompting the application of molecular docking to identify possible drug candidates. Thus, a comprehensive molecular docking study was performed to identify possible inhibitors against HTRA-1. The docking site focused on the protease domain of HTRA-1. Selected ligands included proteolysis-inhibiting molecules, anti-inflammatory plant-based compounds, and FDA-approved drugs used for immune-related and female reproductive diseases. The pharmacophore-based virtual screening was done with the ZINC library to find potential lead-like molecules. The stability of the interactions was determined using molecular dynamics simulations. The binding affinity of -8.8, -7.6, -4.8, and -4.8 kcal/mol were exhibited by *Methotrexate*, *Sulfasalazine*, *Metformin*, and *Boro gluconate*, respectively. The lead-like compounds were within the range of -5 to -7kcal/mol energy and exhibited significant binding interactions with active site residues. *Azadirachtin* and *Curcuma longa* natural compounds also exhibited reasonably high binding affinity as natural compounds. The results conclude that the Food and Drug Administration (FDA) approved drugs have high binding affinity with HTRA-1, indicating the potential drug repurposing. The boron-containing proteolytic inhibitors can be further processed to increase the binding affinity and to block the active site of the protease domain of HTRA-1. This may regulate the hyperactivity of HTRA-1 which is responsible for the dysregulation of the immune system. These implications can be used in comparative interspecies medication with further validation through *in vitro* and *in vivo* trials.

Keywords: Subclinical endometritis, Extracellular vesicles, HTRA-1, Molecular docking, Drug candidates

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Quantifying the Carbon Footprint of Intensive Dairy Farming in Upcountry Sri Lanka: A Data-Driven Approach

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The dairy sector is receiving increasing attention in global carbon foot printing particularly due to greenhouse gas (GHG) emissions. However, country-specific carbon footprint (CF) assessments for dairy sector in Sri Lanka are limited and the country relies on default estimates rather than real-time data. Thus, this pilot study was designed to quantify the CF of large-scale intensive dairy farming in upcountry of Sri Lanka using a real time data-driven approach. The Intergovernmental Panel on Climate Change (IPCC) Tier-2 methodology was adopted to estimate emission factors, with fat- and protein-corrected milk (FPCM) as the functional unit. Data on feed composition, manure management, milk production, and energy use were collected from an intensively managed large-scale dairy farm in upcountry of Sri Lanka. A user-friendly Excel tool was developed based on IPCC guidelines to streamline emission calculations and enhance accessibility for stakeholders. Simultaneously, enteric methane emissions were quantified from various cow categories (heifers, early lactating, peak lactating, and dry cows) and manure pits, using a custom-built, Arduino-based low-cost methane sensor. The real-time measurements collected were compared against estimated emission patterns using IPCC Tier-2 calculation. The study found that the overall CF of the farm was 3.36 kg CO₂e per kg FPCM per year, which is considerably lower than the FAO's default estimate of 4.80 kg CO₂e for the relevant dairy systems. These findings demonstrate a significant disparity between quantified data and default values, highlighting a substantial gap in emission factors. The integration of real-time, industry-specific data and easy to use tools like the Excel model highlights the potential for generating robust emission levels which help in devising effective mitigation strategies, contributing to sustainable management of dairy farming.

Keywords: Carbon footprint, Greenhouse gases, Intensive dairy farming, Enteric methane, Arduino-based sensors

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Calculation of Growing Degree Days for BG 300 Paddy Variety in Two Agro Ecological Regions and Development of a SMS-Based Crop Management System

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Traditional calendar-based crop management in Sri Lankan rice cultivation often leads to inefficiencies due to weather variability, resulting in suboptimal yields and resource use. This study evaluates the potential of Growing Degree Days (GDD)-based management as a more adaptive approach. GDD, a heat accumulation metric calculated as $[(T_{\max} + T_{\min}) / 2] - T_{\text{base}}$. Field experiments of the research were conducted in the Intermediate Zone (Hanguranketha) and Dry Zone (Mahailluppallama) using transplanting and broadcasting methods. Temperature data collected via Arduino-based sensors correlated strongly with NASA climate datasets ($r = 0.9916$, $p < 0.0001$). GDD calculations for key growth stages revealed significant differences in heat accumulation between planting methods ($p < 0.05$), emphasizing the need for method-specific management. To operationalize this approach, a web-based application was developed using Python (Flask) and JavaScript, integrating real-time temperature data from the NASA Power API and soil moisture data from Open-Meteo API. Farmers receive SMS alerts before critical growth stages, facilitating timely interventions in fertilization and irrigation. This system enhances yield potential, reduces input costs, and mitigates environmental impact by aligning management decisions with actual crop development. Future enhancements may incorporate machine learning for yield prediction and multi-language support to improve accessibility. This research demonstrates that GDD-based crop management, supported by an SMS notification system, provides a scientifically robust and adaptable alternative to calendar-based methods, promoting sustainable rice production in Sri Lanka under changing climatic conditions.

Keywords: Growing Degree Days (GDD), Rice cultivation, Temperature variability
Resource efficiency, Web application

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Evaluating the Effect of Customized Fertilizer Blends on Growth and Nutrient Uptake in *Dianthus Caryophyllus*

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Floriculture industry of Sri Lanka, a promising avenue for economic growth and export diversification, faces persistent challenges in optimizing productivity and cost-efficiency. Conventional fertilizer practices, reliant on generic pre-mixed formulations, often result in nutrient imbalances, inflated production costs, and suboptimal crop performance, limiting the industry's global competitiveness. This study addresses these gaps by evaluating customized fertilizer blends for greenhouse-grown carnations (*Dianthus caryophyllus* var. 'Aila'), a high-value crop with growing demand in international markets. Eleven fertilizer treatments across five categories of blends—varied N-P-K ratios, low-cost alternatives, high-potassium, calcium/magnesium-enriched, and nutrient-rich formulations—were tested in a Completely Randomized Design (CRD). These fertilizer blends were tested against the current standard fertilizer blend practiced at the company, which served as the baseline for comparison. Key growth parameters (shoot number/length, dry weight, leaf pairs, nodes, internode length) and nutrient content (N, P, K, chlorophyll) were analyzed. Results demonstrated that the nutrient-rich blend T9 (20-10-20-5-3) and nitrogen-boosted T10 (20-5-15-2-1) significantly outperformed others in shoot length, dry weight, and leaf development. The balanced NPK blend T2 (15-15-15) enhanced phosphorus uptake, while T3 (15-5-15) maximized leaf nitrogen content. Partial budget analysis identified T10 as the most cost-effective, combining high growth performance with favorable returns. By tailoring nutrient formulations to Sri Lanka's unique growing conditions—particularly in coco peat media—this research identifies cost-effective strategies to enhance growth, nutrient uptake, and economic returns. Such innovations are critical for empowering local growers to adopt sustainable, precision-based practices, positioning Sri Lanka as a competitive player in the global floriculture trade while reducing environmental impacts of over-fertilization.

Keywords: *Dianthus caryophyllus*, Customized fertilization, N-P-K ratios, Nutrient uptake, Greenhouse production, Economic feasibility

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Can We Increase the Availability of Maize in Sri Lanka through In-country Production?

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Maize (*Zea mays*) is the second important field-crop in Sri Lanka, with *Maha* season contributing to 90% of annual production. As the country imports about 50% of its requirement, the potential to increase local maize production was assessed to reduce reliance on imports. A structured questionnaire was used to survey maize-farmers in Anuradhapura and Monaragala districts, which account for 65% of country's maize production. Key Informant Interviews (KIIs) engaged state and private sector experts in the maize value chain. Secondary data were accessed through government sources. Farmers were willing to continue maize cultivation due to higher profits ($p < 0.05$). Animal-pest attacks, shortage of high-quality planting material of high-yielding varieties, high input costs, poor land management, high insect pest/disease incidences, and inadequate drying facilities are the main constraints ($p < 0.05$). Based on growth of industries using maize, dried maize-seed requirement in Sri Lanka for poultry feed would increase from 600,000 Mt (2025) to 650,000 Mt (2027), cereal-based high-nutritive food from 20,000 Mt (2025) to 40,000 Mt (2027), and ethanol production from 15,000 Mt (2025) to 35,000 Mt (2027). Immature-cob and silage requirements are met from 8% and 2% of maize-cultivated extent, respectively. Accordingly, the annual dried maize-seed requirement would increase from 635,000 Mt (2025) to 681,000 Mt (2027) as per government estimates, which is lower than private-sector estimates: 675,000 Mt (2025) and 830,000 Mt (2027). With about 100,000 ha cultivated annually, dried maize-seed production would reach 310,000 Mt in 2025 (3.1 Mt/ha). As 25,000 ha is to be newly-cultivated since late-2025, dried maize-seed production would reach 635,000 Mt in 2027 (5 Mt/ha), still failing to meet national requirements. According to private-sector estimates, Sri Lanka should increase national productivity of maize to 6.65 Mt/ha to meet domestic requirements. Urgent attention to address critical challenges faced by maize value-chain actors would help achieving these targets.

Keywords: Self-sufficient, Imports, Productivity, Survey, Key informant interviews

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Impact of Sustainable Preharvest Practices on the Quality and Shelf Life of Tomato (*Solanum lycopersicum*); A case Study in Matale District

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Tomato (*Solanum lycopersicum*) is a crucial crop in Sri Lanka, playing a key role in domestic food markets. However, postharvest losses can reduce farmers' income and food availability. This study aims to investigate sustainable preharvest practices that can affect the quality and shelf life of tomatoes grown in the Matale District of Sri Lanka. A stratified random sampling method was used to select 40 farmers from the Naula and Dambulla Agrarian Service divisions. Data collection included a farmer questionnaire covering preharvest practices such as nursery management practices, field establishment practices, nutrient management practices, irrigation management practices and field maintenance practices and laboratory analysis of fruit quality parameters such as chroma, firmness, total soluble solids (TSS), titratable acidity (TA), juice pH, fruit disorders, physiological weight loss and shelf life. The results show that several preharvest factors have a significant impact on tomato quality. The farming method, bed type, and variety all strongly influenced fruit firmness and TSS, while the use of organic and foliar fertilizers notably affected fruit disorders. In contrast, factors like hue angle, pH, shelf life, and physiological weight loss showed no significant differences across the preharvest treatments, which might be due to uncontrolled variables or limitations in sample size. These findings highlight the importance of sustainable preharvest management in enhancing fruit quality. This study provides insights into how different cultivation practices can influence the characteristics of tomato fruit. The differences observed in quality parameters emphasize the necessity for optimized preharvest strategies to enhance tomato marketability and minimize postharvest losses.

Keywords: Pre harvest practices, Quality, Chroma, Firmness, Disorders

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Morphological Characterization of *Ex-situ* Conserved Sweet Potato (*Ipomoea batatas* (L.) Lam) Accessions in Sri Lanka

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Sweet potato (*Ipomoea batatas* (L.) Lam) is dicotyledonous plant which belongs to Convolvulaceae family and its capable of producing nutritious tuberous roots eaten worldwide. China is the main sweet potato producing country, and the Asian continent has the largest share of world production. It is very popular tuber crop grow and consume in Sri Lanka. Plant Genetic Resource Centre (PGRC), Gannoruwa, Peradeniya conserved 121 accessions of Sweet Potato in Sri Lanka. This experiment was conducted field no. 01 at PGRC to characterize 23 *ex-situ* conserved, uncharacterized accessions. Gannoruwa Sudu, Wariyapola Red and HORDI Malee were used as recommended varieties. Randomized Complete Block Design was the experimental design. In this experiment, 29 qualitative traits and 7 quantitative traits were used. According to the results obtained from analysis of covariance and mean comparison, there was significant difference among sweet potato accessions in characters such as internode length, internode diameter, flower width and plant type. But there was not significant difference among sweet potato accessions in characters such as mature leaf size, petiole length and flower length. According to the results obtained from Principle Component Analysis, first seven principle components explained 74.7% character variation among accessions. The dendrogram was obtained from Cluster Analysis and 5 main clusters were observed at the distance 11.83. There weren't duplicates among accessions. First cluster contained only five accessions such as PGRCSP 16, PGRCSP 79, Gannoruwa Sudu, HORDI Malee and PGRCSP 97. Second cluster contained accessions such as Wariyapola Red, PGRCSP 110, PGRCSP 96, PGRCSP 122, PGRCSP 119, PGRCSP 113 and PGRCSP 116. Third cluster contained 7 accessions and fourth cluster contained 6 accession. Cluster 5 was prominent cluster because it included only one accession which was the PGRCSP 115. These results are very much important for systemic germplasm conservation and utilization of prominent traits for crop varietal improvement programs.

Keywords: Genetic diversity, Morphological characterization, Cluster analysis, Sweet potato, Accession.

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Evaluation of Nutrient Management Packages for Yield Improvement in Commercial Cultivation of *Solanum virginianum* L. (Katuwelbatu)

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Solanum virginianum L. (Katuwelbatu) is a valuable medicinal plant widely used in Ayurvedic medicine. However, commercial cultivation of this plant faces challenges due to suboptimal growth conditions, including improper nutrient management. This study evaluated the effectiveness of different nutrient management packages in enhancing the growth and yield performance of commercial Katuwelbatu cultivation. The experiment was conducted in a farmer's field in the Anamaduwa area using a randomized complete block design. Five different nutrient management packages were tested: (i) current commercial farmer practice as the control, (ii) biocarbon-based alternative fertilizer mixture, (iii) inorganic fertilizer recommendation containing urea, triple super phosphate, and muriate of potash, (iv) poultry manure, and (v) no fertilizer application to represent the actual practice of some farmers. The impact of these nutrient management packages on plant dry matter production, nitrogen (N), phosphorus (P), and potassium (K) uptake, as well as their use efficiencies, were investigated. The highest total plant dry matter production was recorded under nutrient management packages (i), (ii), and (iv), with no significant difference among these three treatments. The biocarbon-based fertilizer mixture significantly ($P<0.05$) enhanced root growth compared to all other nutrient management packages. Furthermore, plant nutrient (N, P, and K) uptake was significantly ($P<0.05$) higher under the biocarbon-based fertilizer mixture than those of other nutrient management packages. Additionally, plants showed a significant ($P<0.05$) increase in nutrient use efficiency when total nutrient uptake was lowest under no-fertilizer application. The biocarbon-based fertilizer package proved to be the most effective in increasing yield and nutrient uptake in Katuwelbatu. These findings highlight the importance of selecting appropriate nutrient management packages for commercial Katuwelbatu cultivation. Future research focusing on integrated nutrient management and its impact on chemical quality parameters of Katuwelbatu could provide insights for developing sustainable fertilization strategies for commercial Katuwelbatu cultivation.

Keywords: Katuwelbatu cultivation, Nutrient management, Nutrient uptake, Yield improvement

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Application of Root Tissue Culture Technique for Conservation of Endangered Species, "*Rhynchosylis retusa* (L) Blume"

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This study aimed to establish an efficient root tissue culture protocol for *Rhynchosylis retusa* (L.) Blume, an endangered orchid species with significant ecological and medicinal value. Traditional propagation methods face challenges including low germination rates (~2-3%) and lengthy maturation periods, necessitating alternative approaches for conservation. Two experiments were conducted to investigate the effects of medium composition, ascorbic acid pre-treatment, plant growth regulators (PGRs), and light conditions on the establishment of root cultures. In Experiment 1, Chi-square analysis revealed that full-strength MS medium significantly outperformed half-strength MS medium ($P < 0.05$), achieving 100% survival and complete elimination of browning compared to 18.2% survival and 81.8% browning in the half-strength MS. Ascorbic acid pre-treatment alone did not significantly improve survival or reduce browning when used with half-strength MS medium ($0.05 < P$). In Experiment 2, logistic regression analysis demonstrated significant effects of both PGRs ($P < 0.05$) and light conditions ($P < 0.05$), with a significant interaction between these factors ($P < 0.05$). The 1 mg/L BAP+ 0.1 mg/L IBA combination performed consistently well regardless of light conditions, while 2,4-D efficacy was light-dependent, showing excellent results under dark conditions (100% survival) but poor performance under light (20% survival, 80% browning). Dark incubation significantly improved survival rates and completely eliminated browning across all treatments. Two optimal protocols were identified: (1) Ascorbic acid pre-treatment and culturing on full MS medium supplemented with 1 mg/L BAP+ 0.1 mg/L IBA, under both light and dark conditions; and (2) Ascorbic acid pre-treatment and culturing on full MS medium supplemented with 2 mg/L 2,4-D under dark conditions. These findings provide valuable protocols for the establishment of *R. retusa* root cultures, offering practical solutions to common challenges in orchid tissue culture and contributing to conservation efforts for this endangered species. The established protocols may serve as a foundation for further research and have potential applications in the conservation of other orchid species facing similar challenges.

Keywords: *Rhynchosylis retusa*, Orchid conservation, Root tissue culture, Light condition, Survival rate

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Identifying the Effectiveness of *Ferticoated* Urea for Improving Growth and Yield of Okra

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Rapid loss and poor utilization efficiency of conventional urea fertilizers after application has become a major problem in commercial crop cultivations and therefore, coated fertilizers have been developed as a remedial measure for this. A greenhouse study was conducted for identifying the effectiveness of *ferticoated* urea for improving growth and yield of Okra (*Abelmoschus esculantus* (L.) Moench), at Agricultural Biotechnology Center, Faculty of Agriculture, University of Peradeniya from January-April 2025. The experiment was conducted as a Completely Randomized Design, with 5 treatments and 13 replicates per treatment. The treatments were; T1 (100% N supplied as per the Department of Agriculture (DOA) recommendation using un-coated urea, control), T2 (100%), T3 (80%), T4 (60%) and T5 (50%) of DOA recommended N levels supplied by using *ferticoated* urea. Therefore T3-T5 were supplied with lower N levels whereas all the treatments were supplied with recommended P and K levels as per the DOA recommendation. The total N content in the growing media at the end of the experiment showed the highest value of 0.924 mg/g in T4. There was no significant difference ($p>0.05$) between treatments in SPAD values at 9 weeks after planting (WAP). Highest values were recorded for shoot length by T5 (102.33 ± 8.5 cm), root length by T4 (57.83 ± 14.63 cm) and root dry weight by T1 (4.8 ± 1.57 g) at 10WAP. There were no significant differences between treatments in leaf area, leaf dry weight and shoot dry weight at 10WAP. The total pod yield and pod length were not significantly different between treatments. Accordingly, the current study revealed that *ferticoated* urea application even at reduced percentages can provide similar results as of un-coated urea application at the 100% (recommended) rate in terms of okra plants' growth and yield suggesting *ferticoated* urea as a good source of N for okra farmers.

Keywords: Controlled-release fertilizer, Humates, Slow releasing fertilizers, Vegetables

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Effects of Free-Living *Azotobacter* spp. on the Growth and Development of Maize (*Zea mays* L.)

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This study evaluated the effectiveness of *Azotobacter chroococcum* inoculum as an alternative to the urea recommended by the Department of Agriculture (DOA), Sri Lanka, for the growth and development of maize (*Zea mays* L.). A greenhouse experiment was conducted at the WM2b agro-ecological region, Sri Lanka using a Completely Randomized Design (CRD) with 13 replicates. Reduced urea levels with *Azotobacter chroococcum* supplements were tested for their efficacy in the experiment. Accordingly, the treatments were; 100% N supply by urea (T1), 100% N by urea + *Azotobacter* (T2), 75% N by urea + *Azotobacter* (T3), 50% N by urea + *Azotobacter* (T4), *Azotobacter* alone (T5), no urea + no *Azotobacter* (T6), and a compost inoculant that included *Azotobacter* and other microorganisms (T7). Phosphorus and potassium were applied to all the treatments at DOA-recommended levels. Mass-multiplied *Azotobacter chroococcum* containing 10⁸ CFU/mL was applied at the rate of 5 mL per plant. Weekly growth measurements and destructive sampling at 4 weeks after planting (WAP) and at tasseling, assessing dry matter, shoot and root N-content, leaf area, and root length were conducted. *Azotobacter* viability in growing media was confirmed through microbial culturing at 4WAP. With repeated measurements the data were analyzed by fitting linear mixed models. The results showed that T5 significantly ($P < 0.05$) improved growth parameters compared to T6 while performing similarly to T1 and T7 in SPAD values, plant N-content, leaf area, and root length. Total nitrogen in the media at tasseling was highest in T2, while the amounts in T5 was similar as to T1 ($P > 0.05$). Treatments combining *Azotobacter* with urea (T2, T3, and T4) outperformed T6 ($P < 0.05$) but showed variable performances relative to T1 and T5. Results suggest *Azotobacter chroococcum* as a viable alternative to synthetic urea during vegetative growth of maize, as a sustainable and low-cost living N source under the grower-bag conditions.

Keywords: Biofertilizer, Microbial inoculum, Nitrogen fixation, Sustainable agriculture.

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Optimizing Seed Priming Strategies to Enhance Salinity Resilience in Rice (*Oryza sativa* L.)

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Salinity stress severely impacts rice (*Oryza sativa* L.) growth, especially during the vulnerable seedling stage. This study explored the efficacy of seed priming agents to improve salinity tolerance in the salinity susceptible rice variety Bg300. A pot experiment was conducted in glasshouse conditions as a completely randomized design. Rice crop was grown in those pots for two weeks from the time of transplanting. Priming agents tested included; calcium chloride (CaCl₂), magnesium chloride (MgCl₂), gibberellic acid, mannitol, sodium nitroprusside (SNP), and zinc sulfate (ZnSO₄), with concentrations of 10, 1, 0.025, 30, 0.031, and 2.5 g/L, respectively, with distilled water as the control. Results showed that, under very-low salinity conditions (1 dS/m), ZnSO₄ promoted dry matter accumulation by 73.033% while mannitol, SNP, and ZnSO₄ enhanced K⁺ concentration by 229.74%, 170.42%, and, 288.99%, respectively compared to the control, which was crucial for maintaining ionic homeostasis. Under low salinity stress (2 dS/m), CaCl₂ and mannitol reduced Na⁺ uptake by 61% and 65%, respectively compared to the control, alleviating the harmful effects of sodium toxicity. The findings highlight that selecting appropriate priming agents based on salinity levels is crucial. These priming agents, especially CaCl₂ and mannitol, are suitable for application in saline-prone environments (1-2 dS/m salinity levels). Ability of CaCl₂ and mannitol to enhance biomass production, regulate ion transport, and maintain water status suggests that seed priming is a cost-effective and reliable strategy to improve rice cultivation under varying salinity conditions. Future research should focus on evaluating the long-term field performance and stress adaptation of primed seeds.

Keywords: Priming agent, Rice, Seed priming, Stress, Tolerance

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Evaluation of the Quality and Maturity of Municipal Solid Waste (MSW) based Compost Using Radish (*Raphanus sativus*) as the Indicator Crop

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Municipal solid waste (MSW) composting is an effective approach for improving soil fertility and promoting sustainable agriculture. However, compost maturity plays a crucial role in determining its quality and suitability for plant growth. This study evaluated the quality and maturity of MSW based compost using radish (*Raphanus sativus*) as an indicator crop. The experiment was conducted at the University Experimental Station, Dodangolla, Kundasale, following a Completely Randomized Design (CRD). The treatments included 6 weeks old MSW compost, 4 weeks old MSW compost, 2 weeks old MSW compost and fully matured MSW compost as the control. Vegetable waste, cooked rice, and leaf litter was mixed at a ratio 1:3:1 to simulate Municipal Solid Waste. C:N ratios of all compost piles were adjusted to 30:1 by adding sawdust using a standard formula. Key physicochemical parameters temperature, pH, electrical conductivity, available ammonium, available nitrate, total phosphorus, potassium, and dry matter reduction were checked throughout the composting process. Growth of Radish under different compost mixtures were evaluated by measuring parameters, including final plant height, final leaf area index, final fresh root weight, and final number of leaves. Results showed that radish grown in six weeks old MSW compost and fully matured compost (control) had significantly better growth when compared plant grown in immature compost (Two weeks and four week old MSW compost). However, radish grown in six weeks old MSW compost exhibited higher variation in growth across replicates compared to the control. A minimum composting period of six weeks was found to be essential for nutrient stabilization, reducing ammonium toxicity, and improving nitrogen and phosphorus availability. The six-week-old compost retained an active microbial population, enhancing nitrogen mineralization and nutrient release. Extending the compost curing period further will improve nutrient uniformity and reduced ammonium fluctuations. The study emphasizes the importance of proper C:N ratio adjustments to optimize composting efficiency. Incorporating microbial populations and biochar can further improve the quality of compost including phosphorus and potassium retention. In conclusion, mature MSW compost adjusted for C:N ratio could significantly enhance plant growth, improves soil fertility, and contributes to sustainable waste management.

Keywords: MSW compost, C: N ratio of compost, Radish

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Preparation of Organic-Based Grow Bag for Urban Homegardens by Experimenting with Banana Peppers (*Capsicum annuum*)

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Urban homegardening is an emerging solution for enhancing food security in cities. Grow bags provide the best solution for cultivating crops in confined urban spaces. The study aims to develop a low-cost, ready-to-use, organic-based grow bag for banana pepper cultivation (*Capsicum annuum*). Banana pepper variety Hungarian Yellow Wax was used as the indicator crop in the experiment. Locally available organic soilless media such as coir dust, compost, and green manure mixture (Gliricidia, Mexican sunflower and Neem mixed at 2:1:1 ratio on weight basis) were incorporated in different ratios to evaluate their suitability for crop growth. The study was laid out using a completely randomized design. The study had five treatments: T1 – 100% coir dust, T2 – 35% coir dust + 60% compost + 5% green manure mixture, T3 – 30% coir dust + 60% compost + 10% green manure mixture, T4 – 25% coir dust + 60% compost + 15% green manure mixture, T5 – 20% coir dust + 60% compost + 20% green manure mixture. The most suitable organic-based grow bag was selected based on crop performance, nutrient content and cost effectiveness. The crops grown in T4 performed significantly better ($p < 0.05$) when compared to other treatment grow bags. In contrast, crops grown in T1 performed significantly low performance ($p < 0.05$). The analysis of media pH, EC, CEC, and nutrient availability revealed that the T4 grow had a suitable media composition for crop growth. It showed high nutrient availability throughout the research period without fertilizer application. Further, T4 is also among the low-cost media options for growing Banana pepper.

Keywords: Grow bag, Urban homegardening, Coir dust, Compost, Green manure.

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Influence of Selected Cladding Materials on the Greenhouse Microclimate, and Resultant Crop Growth

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Greenhouse cultivation utilizes environmental control principles to enhance crop performance, mitigating the limitations found in open-field agriculture. In tropical regions like Sri Lanka, where temperature, Relative Humidity (RH), and light intensity fluctuate seasonally, precise greenhouse management is crucial for optimizing plant growth and yield. This study evaluated the effects of two greenhouse cladding combinations; Woven polythene + Black shade net and Clear polythene + Thermal net on the internal microclimate and growth parameters of chili (*Capsicum annuum* L.) cultivated in the Mid-country Intermediate zone (IM) of Sri Lanka. The experiment followed a Completely Randomized Design (CRD). Plant height, canopy width, stem circumference, number of leaves per plant, pod weight, pod length, number of seed per pod and thousand seed weight were analysed using ANOVA. Results revealed significant differences in vegetative growth due to cladding materials. Chilli plants under woven polythene + black shade net exhibited significantly greater plant height ($p < 0.05$) and canopy width ($p < 0.05$) than those under clear polythene + thermal net. In contrast, the number of leaves ($p < 0.05$) and stem circumference ($p < 0.05$) were significantly higher under clear polythene + thermal net. For reproductive traits, the number of pods ($p < 0.05$), pod length ($p < 0.05$), and five-pod weight ($p < 0.05$) differed significantly, while number of seeds per pod ($p > 0.05$), and 1000-seed weight ($p > 0.05$) showed no significant variation. Observational data suggested differences in temperature, RH, and light intensity between treatments, though these parameters were not statistically analysed. Findings indicate that cladding materials significantly affect vegetative growth, whereas their impact on reproductive traits is limited under IM of Sri Lanka. Further research is needed for developing cost-effective greenhouse designs that optimize both vegetative and reproductive growth while considering local climatic factors.

Keywords: Cladding material, Woven polythene, Thermal net, Black shade net

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Effectiveness of Chitosan Coating to Preserve the Postharvest Quality and Prolong the Shelf Life of Guava Fruit (*Psidium guajava* L.)

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Guava exhibits fast ripening after harvesting due to accelerated ethylene production, respiration, and transpiration. This leads to a shortened effective storage period by decreasing postharvest quality and creating difficulties in long-distance transportation. In this study, chitosan coating was used to evaluate its effect on the postharvest quality and shelf life of guava. As treatments guava fruits were provided with 0, 2, 5, 10, and 20 g·L⁻¹ chitosan coatings, and stored in corrugated cardboard boxes, at 28°C and 85-90% RH. The quality attributes evaluated were physiological weight loss, firmness, peel colour, decay percentage, soluble solids content (SSC), titratable acidity (TA), ripening index (RI), and vitamin C content. Results showed that guava treated with 10 and 20 g·L⁻¹ chitosan significantly reduced weight loss, firmness reduction, and peel colour changes ($P < 0.05$). In addition, 10 and 20 g·L⁻¹ chitosan coatings showed the lowest increase in SSC and RI ($P < 0.05$). Furthermore, those two treatments contributed to the lowest reduction in TA and vitamin C in guava fruits ($P < 0.05$). Correlation analysis revealed that an increase in weight loss was linked with a decrease in firmness, TA, and vitamin C. Moreover, an increase in L*, a*, b*, a*/b*, and colour index contributed to a reduction in firmness, TA, and vitamin C content. When RI and SSC were positively correlated the correlation between RI and TA was negative. Considering all these changes 10 and 20 g·L⁻¹ chitosan coatings can be used in delaying ripening, preserving quality attributes, and extending the shelf life of guava fruits.

Keywords: Chitosan, Decay, Ripening index, Storage, Vitamin C

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Exploring the Potential of Seed Nutri-Priming to Improve Early Vegetative Growth of Maize under Nutrient-Limited Conditions

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Early seedling growth is an important determinant of uniform crop stand and yield in soils of low nutrient availability. Seed nutri-priming, the process of soaking seeds in nutrient solutions before planting, helps boosting early seedling growth and vigor by supplying vital nutrients and activating metabolic processes. This study investigated the potential of seed nutri-priming to improve early vegetative growth, nutrient uptake and nutrient use efficiency of maize (*Zea mays* L.) under nutrient-limited conditions. A pot experiment was conducted in a complete randomized design in a greenhouse with three priming treatments, (i) no priming as the control, (ii) hydro-priming, and (iii) nutri-priming with 0.5 g/L Albert solution for 12 hours which was selected based on a preliminary experiment. Two fertilization regimes, (i) fertilizer application to the recommendation of Department of Agriculture, Sri Lanka and (ii) no fertilizer application were used as the second factor. The impact of priming and fertilization regimes on early plant growth, uptake of nitrogen (N), phosphorus (P) and potassium (K), and their use efficiencies were investigated. Nutri-priming of maize seeds with Albert solution did not significantly enhance early vegetative growth, nutrient uptake and nutrient use efficiency of maize. However, fertilizer application significantly ($P < 0.05$) promoted shoot growth and overall plant performance including nutrient uptake. Under nutrient-limited conditions, plants exhibited 75% greater root to shoot ratio compared to that in nutrient-supplied condition. Similarly, plants remarkably ($P < 0.05$) increased use efficiency of acquired nutrients when total nutrient uptake was reduced under nutrient-limited conditions. These findings suggest that the tested nutri-priming method is not effective in improving early maize growth under nutrient-limited conditions. Further research is warranted to optimize priming strategies and nutrient management for better maize establishment in nutrient-limited lands.

Keywords: Maize, Nutri-priming, Nutrient uptake, Root development, Seed enhancement

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Application of Compost Enriched Grow Media for Grow-Bag Culture of Tomato

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Greenhouse horticulture provides a steady environment for year-round production of vegetable crops. Pot or grow bag culture is the most widely used growing system because of enhanced root growth and higher yields. The grow media used in aggregate-type hydroponics are inert. As a result, grow medium is constantly fed with fully soluble chemical fertilizer such as Albert's solution. The use of chemical fertilizer raises concerns on the food safety and eco-friendly issues all over the world. Besides, with constantly increasing prices, continuous use of chemical fertilizer also poses significant issues for the economy of crop production. Considering these concerns, this research was carried out to assess the possible replacement of chemical fertilizers in aggregate-type hydroponics systems with "enriched compost" in greenhouse vegetable cultivation, using tomato as the test crop. Considering the higher N, P and K composition, so called "super compost", tested for organic farming in Sri Lanka, was used for this purpose. The outcome of earlier experiments on testing solid and liquid based organic fertilizers for protected culture vegetable crop cultivation were utilized for composting the alternative media-fertilizer treatments. The experiment was conducted at the University Experimental Farm at Dodangolla Sri Lanka (IM03). The standard amount of Albert's solution (T1) for growing tomatoes was compared with three types of super compost with or without supplementary Gliricidia extract. Plant growth measurements, yield components and substrate parameters were assessed under semi-intensive greenhouse conditions. Basic enriched compost (T2) produced tomato fruits that are comparable in number and size with Albert's fertilizer (T1). With the foliar application supplementary Gliricidia extract, the reproductive growth and yield could be further increased (T4). Overall results show that for grow bag culture of tomato cultivation, enriched compost can be used effectively as a substitute for Albert's fertilizer enhancing its environmental and economic sustainability.

Keywords: Compost-enriched, Greenhouse, Hydroponics

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Identifying the Potential of Zn and Fe Agronomic Biofortification for Selected Microgreen Species

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Micronutrient deficiency, which is known as hidden hunger, is a persistent global issue that affects billions of people worldwide. Insufficient or suboptimal dietary intake of iron (Fe) and zinc (Zn) remains a pressing issue that often disproportionately affects vulnerable populations such as young children, women, and elderly people. These micronutrient deficiencies contribute to impaired cognitive development, weakened immunity, and increased susceptibility to disease, necessitating urgent intervention. As the world continues to evolve, scalable and sustainable solutions are required to address it. Agronomic biofortification has emerged as a viable strategy to enhance the nutritional quality of crops by increasing the accumulation of essential micronutrients in edible plant tissues. Microgreens are young, edible seedlings and are highly nutritious. Their rich antioxidant profile supports cellular health, while their rapid growth and biofortification potential make them a sustainable solution for addressing micronutrient deficiencies. Therefore, this study aimed to evaluate the potential of Zn and Fe agronomic biofortification for selected microgreen species using sand as the growing medium. They are Cabbage (*Brassica oleracea* var. *Capitata*), Beet (*Beta vulgaris* subsp. *vulgaris*), Mustard (*Brassica juncea* L.) and Finger millet (*Eleusine coracana* (L.) Gaertn). The experiment was conducted at the Department of Crop Science, Faculty of Agriculture, University of Peradeniya, following a completely Randomized Design (CRD) with four treatments and four replicates. Treatments included a control, a 10 ppm ZnSO₄ solution, a 10 ppm FeSO₄ solution, and a mixture of ZnSO₄ and FeSO₄ 5 ppm each. Results indicated no significant differences ($p>0.05$) in seedlings' fresh weight, dry weight, chlorophyll content, anthocyanin content, and ascorbic acid content. Zn and/or Fe accumulation in all four crops also did not show any significant difference between treatments. In conclusion, 10 ppm ZnSO₄ and FeSO₄ are not effective in Zn and Fe biofortification of microgreens and thus require further investigation with other chemical concentrations and other crop species.

Keywords: Fe biofortification, Hidden hunger, Microgreens, Nutritional security, Zn biofortification

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Calibration and Validation of APSIM Model for Horse Gram (*Macrotyloma uniflorum*) and Enhancing Green Manure Yield through a Modeling Approach

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Horse gram (*Macrotyloma uniflorum*) is a resilient legume with the potential for green manure production in Sri Lanka. However, research-based recommendations for optimal sowing times and planting densities remain unavailable. This study aimed to calibrate and validate the APSIM crop model for simulating horse gram growth and optimizing agronomic practices. Field experiments were conducted at the Mahailuppallama sub-campus of the Faculty of Agriculture, University of Peradeniya, during the *Maha* season of 2024-2025, using the horse gram variety ANKG Brown. Model calibration was performed with experimental data from field observations, while observations from previous studies were used for validation. Horse gram was sown in 4 plots (4.05 x 5 m) at a predetermined seeding rate of 25 kg/ha, and plant growth parameters, phenological stages, and initial soil nutrient contents were recorded. Long-term (30 years) weather data were obtained from the Field Crop Research and Development Institute at Mahailuppallama. Model calibration involved adjusting key growth and phenological parameters, including emergence, 50% flowering, and 50% pod formation. Model validation was conducted by comparing simulated and observed data using a 1:1 graph and statistical indices such as Root Mean Square Error (RMSE), Relative Root Mean Square Error (RRMSE), and Model Efficiency (ME). The model demonstrated reliable performance, with RMSE and ME values for dry matter yield at 7.7 g/m² and 0.97, respectively. Scenario analysis identified the optimal sowing window for higher biomass accumulation as being from July fifth to 26th for the *Maha* season and from January 18th to 25th for the *Yala* season. Additionally, a planting density of 160 plants/m² was determined to be optimal, corresponding to a sowing rate of 31.25 kg/ha. These findings provide valuable insights for enhancing horse gram cultivation as a sustainable green manure crop in Sri Lanka.

Keywords: Horse gram, APSIM, Crop modeling, Calibration, Validation, Scenario analysis

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Identifying the Effects of Hydro-Priming and Nutri-Priming on Watermelon and Okra Seeds

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Quality seeds are a critical factor for agricultural production, offering farmers the potential for an ideal plant stand that maximizes the crop yield. In terms of seed quality, seed priming considered as an efficient and promising approach that can increase the germination, growth and productivity of crops which can be practiced for seeds in different stages after harvesting. While priming is often used for poor quality seeds, its effects on good quality seeds need to be identified. Therefore, the current study was conducted to identify the hydro- and nutri-priming effects on good quality okra (*Abelmoschus esculentus* L. (Moench)) and watermelon (*Citrullus lanatus* (Thunb.) Matsum. & Nakai) seeds with the objective of recommending the same practices for farmers and seed producers. The experiment was conducted at Central Seed Testing Laboratory, Department of Agriculture, Gannoruwa following International Seed Testing Association (ISTA) standards. The experiment was arranged in a Completely Randomized Design (CRD) with seven treatments and four replicates which consisted 100 seeds per replicate. Treatments included a control/non-primed (T1), hydro-primed, dried (T2) and non-dried (T3), 10 ml/L nutri-primed, dried (T4) and non-dried (T5) and 5 ml/L nutri-primed, dried (T6) and non-dried (T7). The 'Breaker' solution which is available in the Indian market was used as the nutri-priming agent. Results indicated no significance differences ($p < 0.05$) in germination percentage and speed of germination (days) in primed seeds over non-primed in both crops. Primed okra seeds did not significantly differ ($p < 0.05$) from non-primed seeds in terms of seedling parameters, indicating the tested priming techniques are unnecessary for improving good quality okra seeds. In contrast, primed watermelon seeds showed significant improvements ($p < 0.05$) in seedling fresh weight (g) and root length (cm). Therefore, tested priming methods have not been able to further improve the germination and quality of okra and watermelon seeds.

Keywords: Germination, Seedling parameters, Seed priming, Seed quality

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The Potential of Using Azolla as a Bioremediation Agent to Alleviate Soil Salinity Stress and Enhance the Morphological and Physiological Characteristics of the Rice Plants

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Soil salinity is one of the major constraints for agriculture, especially for rice cultivation, as both productivity and cultivated extent have been reduced with soil salinity development. As a result, sustainable strategies need to be developed to overcome the impact of soil salinity stress on rice cultivation. This study was conducted to investigate the potential of azolla application in mitigating soil salinity stress in rice grown in pots within a plant house. The experiment had three levels of salinity (0.5, 3, and 5 dS/m), two rice varieties (saline susceptible and tolerant), and azolla as a treatment (growing crop with and without azolla), maintained in the standing water layer. Plant morphological and physiological characteristics were evaluated 45 days after planting. When azolla was introduced, the level of soil salinity decreased while the concentration of Na⁺ in azolla increased ($P < 0.05$). The effect of azolla for mitigating soil salinity could be observed through the responses of the plant. Reduction of shoot dry weight, root dry weight, and total root length due to soil salinity was inhibited ($P < 0.05$) by the applied azolla. The concentration of Na⁺ in the green leaves of rice plants across saline treatments was similar ($P > 0.05$). However, Na⁺ concentration in the senescence leaves increased as soil salinity increased ($P < 0.05$), due to the re-translocation of excess Na⁺ ions to senescing leaves. Consequently, chlorophyll content, photosynthetic rate, and stomatal conductivity of green leaves were similar among salinity treatments ($P > 0.05$). Azolla elevated the soil organic matter content by 64.27% without being impacted by soil salinity. Therefore, azolla can be introduced as a sustainable management strategy to overcome the soil salinity stress in rice plants.

Keywords: Azolla, Salinity, Organic matter, Ion translocation

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Exploring the Potential of Seed Nutri-Priming on Yield and Nutritional Quality of Radish and Mung Bean Microgreens

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Growing public health concerns demand innovative solutions for food sources. Microgreens are gaining popularity as functional and nutritious foods because of their improved nutritional profile and rich bioactive compounds. Among the alternative techniques for agronomic biofortification, seed nutri-priming is a simple, easy-to-use technique that involves soaking seeds in a solution containing macro- and/or micronutrients before sowing. The study aimed to investigate the potential of seed nutri-priming on biomass yield and the nutritional quality of radish (*Raphanus sativus*) and mung bean (*Vigna radiata*) microgreens for nutritional biofortification. The experiment was conducted in a completely randomized design with three priming treatments, nutri-priming, hydro-priming, and no-priming as the control. Based on a preliminary experiment, seeds were soaked for 12 hours in Albert's solution of 8g/L for nutri-priming. Radish and mung bean were cultivated in a compost medium. Biomass yield, accumulation of nitrogen (N), phosphorus (P) and potassium (K), and proximate composition (crude protein, crude fiber, and ash content) were analyzed. Results indicated that nutri-priming significantly improved seed germination and seedling vigor index in both species, with an increase in fresh weight in radish indicating improved microgreen yield of radish in response to seed nutri-priming. Furthermore, nutri-priming significantly ($P<0.05$) enhanced the assimilation of N and K in mung bean microgreens, compared to both unprimed and hydro-primed treatments. There was no considerable improvement in proximate composition in both species in response to nutri-priming. The results of the present study demonstrate that seed nutri-priming is effective in boosting biomass yield in radish. Furthermore, seed nutri-priming was able to improve N and K assimilation in mung bean microgreens with no notable nutritional biofortification in radish.

Keywords: Microgreens, Mung bean, Nutritional Biofortification, Nutri-priming, Radish

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Using Machine Learning Techniques and UAV-Based Multispectral Data for In-Season Prediction of Sugarcane (*Saccharum officinarum* L.) Biomass

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Sugarcane (*Saccharum officinarum* L.) is an important cash crop in Sri Lanka, supporting the national economy and rural livelihood. In-season biomass prediction provides valuable guidance for correcting suboptimal growth and for planning harvesting and processing. However, accurately predicting sugarcane biomass during in-season growth stages remains challenging, as traditional estimation methods such as manual cutting and visual assessment often lack precision and reliability. This study introduces an innovative approach using Unmanned Aerial Vehicle (UAV)-based multispectral imagery and machine learning models to forecast in-season sugarcane biomass. The study was conducted at the Lanka Sugar Company in Pelwatte, Sri Lanka, with the SL 96128 variety and multispectral images were captured by dji Mavic 3 drone vehicle. Multispectral imagery was processed into RGB orthomosaic maps using PIX4D fields software, and five vegetation indices (VIs); Normalized Difference Vegetation Index (NDVI), Normalized Difference Red Edge Index (NDRE), Green-Red Normalized Difference Vegetation Index (GRNDVI), Wide Dynamic Range Vegetation Index (WDRVI), Canopy Chlorophyll Content Index (CCCI) were derived from ArcGIS Pro software. The highly correlated VI with biomass was selected via Pearson's correlation test. Three machine learning models Linear Regression (LR), Random Forest (RF), and Support Vector Regression (SVR) were trained and validated for biomass prediction for two important growth stages. The SVR model excelled for the biomass prediction using selected VI (NDVI) at the late tillering stage ($R^2:0.98$; RRMSE:1.98%) and at the mid-grand growth stage ($R^2:0.9$; RRMSE:3%). This integration of UAV technology and machine learning enhances precision agriculture, enabling farmers to optimize management decisions and resource use. This methodology offers a scalable, data-driven solution to improve sugarcane yield predictions, potentially reducing Sri Lanka's reliance on sugar imports and boosting agricultural productivity.

Keywords: Sugarcane, UAV multispectral imagery, Machine learning, Precision agriculture, SVR

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Rapid Detection of Potato Late Blight Disease Using a Mobile Phone RGB Image-Based Machine Learning Approach and Developing a User-Friendly Mobile Application

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Potato late blight (PLB), caused by *Phytophthora infestans*, poses a significant threat to global potato production, resulting in annual losses exceeding \$6.7 billion. Traditional detection methods are often unreliable and time-consuming. This study explores a machine learning (ML) approach using mobile phone RGB images for the early detection of PLB, integrated into a user-friendly mobile application. A dataset of 800 field images (healthy, not severe, severe and cannot control stages) was collected under standardized conditions using a Samsung Galaxy Note 10. A Convolutional Neural Network (CNN) model, developed in Python and TensorFlow. Data augmentation (rotation, flipping, scaling) enhanced the model's robustness. A field trial was also conducted to evaluate fungicide efficacy across five severity stages (T1–T5) using a Randomized Complete Block Design (RCBD). Results indicated a significant yield difference ($p < 0.05$) between fungicide application at delayed intervention (T5: 4822.9 kg/ha) compared to pre-onset application (T2: 12211.8 kg/ha). The analysis of variance revealed significant differences in disease severity among treatments across all weeks ($p < 0.0001$, except for Week 0). Tukey's HSD test showed that T2 consistently exhibited the lowest disease severity from Week 4 onwards, while T1 and T5 generally exhibited the highest. The effectiveness of treatments T3 and T4 varied. Cost-benefit ratios favored early intervention (T2: 1.43) over untreated plots (T1: 0.71). The model achieved 57% accuracy, 0.68 precision, 0.57 recall, and 0.52 f1- score. The developed mobile app guides farmers in image capture and provides real- time predictions, offering a practical solution for timely disease management in resource-limited settings.

Keywords: Potato late blight, Machine learning, Mobile application, Disease detection, Fungicide application

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Effects of Silicon Enrichment on Growth and Physiology of Rice (*Oryza sativa* L.) under Alternative Wetting and Drying Practices

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Rice (*Oryza sativa* L.) is a globally indispensable staple crop, sustaining over half of the world's population. In Sri Lanka, rice cultivation is critical for food security, yet its productivity faces escalating threats from climate variability. While not classified as an essential nutrient, silicon (Si) has been demonstrated to enhance drought stress resilience and promote plant growth. This study examined the influence of soil Si supplementation on rice growth and physiology under alternative wetting and drying (AWD) conditions that induced 35 days after transplanting (DAT). A glasshouse pot experiment was conducted using the BG250 rice variety cultivated in Low Humic Gley soil. A two-factor factorial, completely randomized design (CRD) was employed, comprising four treatment combinations as Si application (3 g of silicic acid /kg soil) + AWD, Si+ Continuous flooding (CF), Si not-applied+ AWD, and Si not-applied+ CF each with 10 replications. First harvesting was performed 35 DAT, with data collected on stomatal density, specific leaf area (SLA), root dry weight, root length, root average diameter, shoot dry weight, and plant height. Photosynthetic rate and stomatal conductance were measured at 70 DAT. Si fertilization significantly increased shoot dry weight and plant height suggesting optimized biomass allocation toward aerial tissues, likely due to enhanced cell wall rigidity and improved nutrient assimilation. Furthermore, a significant difference in stomatal conductance with photosynthetic rate in Si-amended treatments under both moisture levels suggests stomatal density has not been contributing to the enhancement of photosynthetic rate under Si application. These findings underscore the potential of Si to modulate growth dynamics, dry matter partitioning, and physiological improvement in rice even under AWD. However, the absence of significant root morphological or SLA responses necessitates further field-based investigations to validate Si's long-term efficacy under realistic agronomic conditions. Future research should explore nutrient interactions and Si's role in augmenting grain yield and quality to optimize sustainable rice production strategies.

Keywords: Dry matter accumulation, Rice, Specific leaf area, Stomatal conductance

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Evaluation of the Effect of Using Natural Substances as Seed Primers for Enhancing the Discarded Bitter Gourd Seed Germination and Seedlings Quality

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This study investigated the effects of natural seed priming agents on discarded bitter gourd (*Momordica charantia*) seed germination and seedling quality. Treatments were arranged using Completely Randomized Design (CRD). Treatments were compared using Duncan's multiple range test. Seeds were primed with Coconut water, Beejamurtha, 10% Tithonia shoot extract, and Coconut vinegar, with a non-primed as farmer practices. Six parameters of Germination percentage, shoot height, root length, fresh weight, dry weight, and Seedling Vigor Index were measured. Results indicated that differences among treatments means were significant ($p < 0.05$) for all parameters. Coconut water significantly enhanced final germination percentage ($36\% \pm 7.48$), root length ($8.28 \text{ cm} \pm 0.38$) and seedling vigor index (5.13 ± 0.13). Beejamurtha promoted the greatest shoot height ($9.54 \text{ cm} \pm 0.41$), fresh weight ($4.49 \text{ g} \pm 0.11$), and dry weight ($2.49 \text{ g} \pm 0.21$). 10% Tithonia shoot extract showed intermediate effects, while Coconut vinegar, although superior to the non-primed, generally resulted in lower performance. This study indicates that natural seed primers, particularly Coconut water and Beejamurtha, can effectively improve bitter gourd seed germination and seedling quality. Coconut water is recommended for enhancing germination and root development, while Beejamurtha is ideal for maximizing shoot growth and overall biomass production.

Keywords: Seed priming, Germination, Seedling Vigor Index, Beejamurtha, Tithonia shoot extract.

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Effect of Moisture Stress and Foliar Application of Calcium on Growth, Yield and Fruit Quality of Fresh and Pickled Gherkins.

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The Gherkins (*Cucumis sativus* sub spp. Anguria) are valued based on crunchiness, which is considered a quality parameter determining their marketability and consumer acceptance. A major challenge faced by the export-oriented pickled gherkin production is fruit softening at storage, particularly the fruits from the *Yala* season, harvest in the dry zone of Sri Lanka. Calcium (Ca) is crucial for fruit quality by strengthening cell walls and improving firmness. Calcium uptake and translocation in plants occur through the transpiration stream, making soil moisture availability a critical factor. This study was carried out as a replicated pot experiment to investigate the effects of soil moisture stress and supplementary Ca on the softening of pickled gherkin. The moisture content of the top soil filled pots were maintained at 30-40% or 70-80% of field capacity while foliar application of calcium ($\text{Ca}(\text{NO}_3)_2$) was applied at flowering stage onwards at two concentrations (25g/16L, and 35g/16L) in five days interval, keeping no-calcium as control. Crops grown under moisture stress was significantly lower ($P<0.05$) in plant height, stem diameter and yield, highlighting, requirement of proper irrigation for plant growth and development. Ca foliar application was minimally effective on the fruit yield under well-watered conditions but played a beneficial role under water stress conditions. Leaf calcium content was higher under well-watered conditions but fruit calcium content was higher ($P<0.05$) under water stress, indicating the importance of Ca supplementation for fruit formation under soil moisture limitations. It can be concluded that soil moisture content significantly affects calcium uptake by plants. Since calcium is crucial for gherkin fruit firmness, variations in soil moisture levels and resultant limitations in Ca supply to growing fruits is one of the underlying causes of softening, pickled gherkins. Further studies on fruit firmness during pickling, grown under different soil moisture regimes with and without Ca supplementation will confirm the above inference.

Keywords: Firmness, Foliar calcium application, Crunchiness gherkin, Pickle gherkin, water stress

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Non-Target Effects of Herbicides: Impact on Plant Growth Promoting Bacteria *Bacillus* Spp and *Pseudomonas Fluorescens* in Upland Soils of Sri Lanka

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This study determined the non-target impacts of herbicides on plant growth-promoting bacteria (PGPB), namely, *Bacillus* spp and *Pseudomonas fluorescens*. The microorganisms were isolated from rhizosphere soil and microscopic identification was done. *Pseudomonas fluorescens* was observed under UV trans-illuminator to observe fluorescent characteristics. Four herbicides commonly used in uplands, namely, Glyphosate (360 g/l SL; 1700 ml/ha), Pendimethalin (300 g/l EC: 3,500 ml/ha), Topramezone (336 g/l SC; 100 ml/ha), Nicosulfuron (40 g/l OD; 1250 ml/ha) were assessed at half, recommended, and double dose under laboratory conditions. Distilled water was used as the control. The bacterial growth was measured at 24 h intervals for 3 days. Glyphosate and Nicosulfuron suppressed the growth of *Bacillus* spp. at increasing dosages compared to the control ($p < 0.05$), while showing a non-significant impact ($p > 0.05$) on the growth of *P. fluorescens*. Pendimethalin showed similar impact on *Bacillus* spp. to that of the distilled water control ($p > 0.05$), while the half-dose of the herbicide showed a significant increase in the growth of *P. fluorescens*. Topramezone enhanced the growth of *Bacillus* spp at all dosages tested ($p < 0.05$), and promoted the growth of *P. fluorescens* at half and recommended dosages ($p < 0.05$), while double-dose producing similar results to that of the control ($p > 0.05$). The four selected herbicides had varied impacts on the two PGPB. Increasing the dose of these herbicides may cause a negative impact for soil microbial population. However, different bacteria may respond differently to herbicide treatments in the soil environment. Understanding these non-target effects is crucial for developing sustainable agricultural practices that minimize the adverse impacts of herbicides on beneficial soil microorganisms while increasing their weed control efficacy.

Keywords: Herbicides, *Bacillus* spp, *Pseudomonas fluorescens*, PGPB, Weed control

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Evaluation of Agronomic Performance, APSIM Validation and Climate Resilience of Maize-Groundnut Intercropping under Organic Cultivation

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This research investigated the agronomic performance, APSIM model validation, and climate resilience of maize (*Zea mays* L.)-groundnut (*Arachis hypogaea*) intercropping under organic cultivation. The study evaluated the organic system's performance, validated the APSIM model, and compared the productivity and climate resilience with the conventional method. A field experiment was conducted at the University Research farm-Mahailluppallama, Faculty of Agriculture, University of Peradeniya and the experimental procedure included detailed data collection on soil parameters (Organic C, Total N, K, P, pH and EC), weather and growth data (plant height, aboveground dry biomass, leaf area index (LAI) and number of leaves). Key findings showed that the cropping system significantly influenced crop growth. Groundnut performed well in the organic intercropping system, while Maize exhibited lower dry weight, likely due to competition for nitrogen from groundnut, especially in the early growth stages. Previous study on the conventional system had reported a Land Equivalent Ratio (LER) of 1.74, indicating higher resource efficiency, whereas the organic system's LER was 1.014, suggesting optimization potential. The APSIM model's simulation accuracy was evaluated, and the Relative Root Mean Square Error (RRMSE) was 12.43% for above ground biomass and 11.35% for Leaf Area Index (LAI), indicating a reasonable agreement between simulated and observed values. Climate sensitivity analysis (RCP 8.5 scenarios for 2030, 2050 and 2100) revealed that while the organic system may have some yield reduction under future climate conditions, its resilience is better than the conventional system. In conclusion, organic maize-groundnut intercropping shows potential for sustainable agriculture and climate adaptation. Further research is needed to optimize organic practices and understand long-term impacts.

Keywords: APSIM, Land Equivalent Ratio (LER), Climate resilience

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Influence of soil moisture levels and cytokinin application on the formation of hard seeds in mung bean (*Vigna radiata* L.) variety ‘Harsha’

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Mung bean (*Vigna radiata* L.) is a vital legume crop that is widely grown for its nutritional value as well as for its ability to fix atmospheric nitrogen in order to enrich the soil. However, hardseededness in mung bean seeds causes abnormal germination and uneven seedling emergence. Hard seeds are problematic for both growers and consumers. The specific reasons for the formation of hardseeds is unknown, however it is believed that some environmental factors such as moisture stress could impact the process. The focus of this study was to analyze the response of hard seed percentage of mung bean variety ‘Harsha’ to different soil moisture levels and the application of cytokinin (kinetin) in controlled glasshouse conditions. The experiment was performed as a completely randomized design (CRD) with two-factor factorial arrangement, having two levels of moisture (80% field capacity and 40% field capacity) and two levels of cytokinin (0 and 150 mg/L kinetin) with ten replicates for each treatment. Kinetin was foliar sprayed for five times in weekly interval after flowering. The main measurement was the percentage of hard seeds, with secondary measurements including seed weight, leaf area, rate of photosynthesis, and stomatal conductance. Application of cytokinin had no significant impact on stomatal conductance, photosynthetic rate, total pods per pot, number of pods with and without seeds per pot, number of flowers per pot, number of good and deformed seeds per pot and 100 seed weight ($P>0.05$). However, those variables varied with soil moisture levels ($P<0.05$), with higher soil moisture resulting in increased values. Cytokinin application led to a lower percentage of hard seeds compared to cytokinin unapplied treatment and this response was more prominent under water limited condition than under high soil moisture condition.

Keywords: Cytokinin, Hard seeds, Mung bean, Soil moisture

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Applicability of Azolla as a Nitrogen Supplement for Hydroponic Tomato (*Solanum Lycopersicum*) Cultivation in Protected Culture

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High cost of inorganic fertilizer and high level of point source pollution in nitrate are two key constraints in hydroponic vegetable cultivation. Since Azolla can fix atmospheric nitrogen, it can be used as an eco-friendly alternative nitrogen source. According to the preliminary experiment, Azolla species used in the study contained 3.7% nitrogen. Therefore, this research was conducted with the aim of examining the applicability of Azolla as a nitrogen supplement in hydroponic tomato (*Solanum lycopersicum*) cultivation in protected culture. The research was conducted under greenhouse conditions at the Agricultural Biotechnology Centre, Faculty of Agriculture, University of Peradeniya (WM2b) in a completely randomized design with 6 treatments and 15 replicates. Azolla dosages were arranged to replace 30% (T1), 40% (T2), 50% (T3), 60% (T4), and 70% (T5) of the nitrogen requirement of tomato by Azolla and together with a control treatment (Albert's solution recommendation–T6). The fertilizer treatments were given, starting from the first week after transplanting (WAT) up to 10th WAT. Azolla replacement by 60% (T4) was not significantly different to 30% replacement (T1), in terms of plant height (124.13 ± 3.02 cm), stem thickness (9.35 ± 0.28 mm), fresh weight (210.8 ± 6.4 g), leaf nitrogen content (28.4 ± 1.5 mg N/g), time taken for flowering (46 days after transplanting), number of fruits per plant at early harvesting (6), and fruit yield (164.1 ± 21.0 g per plant). Meanwhile T5 was significantly ($P < 0.05$) lower with respect to all the above parameters. Nevertheless, the treatment effects on fruit quality were not significant. Overall results revealed that Azolla can successfully replace 60% of the nitrogen requirement of hydroponic tomatoes grown in coco-peat medium based hydroponics culture under tropical greenhouse conditions.

Keywords: Soilless culture, Albert's fertilizer, Plant growth, Combined application, Greenhouse

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Precision Nitrogen Management in Rice Using Unmanned Aerial Vehicle Images

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The over-application of nitrogen fertilizers in rice cultivation leads to significant environmental consequences, including water pollution and greenhouse gas emissions. This study investigates the use of Unmanned Aerial Vehicles (UAVs) for precision nitrogen management in rice (*Oryza sativa* L.) by utilizing UAV-based multispectral imagery to assess nitrogen status at different stages of rice growth. The overarching goal was to optimize nitrogen fertilizer application, reducing environmental impact and improving nitrogen use efficiency (NUE). The study objectives included determining the correlation between vegetation indices and nitrogen content in rice leaves, identifying nitrogen-deficient areas in rice fields, and developing a predictive model for leaf nitrogen status based on vegetation indices. The research was conducted at the Field Crops Research and Development Institute, *Mahailuppallama*, using a randomized complete block design with five treatments and three replicates. Multispectral images were acquired at tillering, panicle initiation, and flowering stages using a DJI M200 series UAV. Vegetation indices such as the Normalized Green Red Difference Index (NGRDI), Green Leaf Index (GLI), and Excess Green Index (ExG) were calculated to monitor and detect nitrogen deficiencies. The results revealed weak correlations between the calculated vegetation indices and leaf nitrogen content, primarily due to the absence of critical spectral bands (near-infrared and red-edge). These limitations hindered the accuracy of nitrogen predictions. The findings highlight the necessity for future research to incorporate additional spectral bands to enhance nitrogen prediction capabilities. This study demonstrates that UAV-based precision nitrogen management, when coupled with advanced spectral analysis, can substantially reduce nitrogen fertilizer usage and its associated environmental impacts in rice production.

Keywords: Precision agriculture, Nitrogen Use Efficiency (NUE), UAV, Vegetation Indices, Remote sensing

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Development of A Micropropagation Protocol for 'Lotus Delight' Aglaonema

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Lotus Delight Aglaonema belongs to family Araceae is an indoor plant, ideally grown under Sri Lankan climatic condition and has a very high export demand for its vibrant foliage and adaptability to indoor conditions. This study focused on developing an efficient micropropagation protocol for 'Lotus Delight' Aglaonema by optimizing sterilization techniques and finding the most suitable growth media. Leaf and shoot parts were collected from plants grown in the Department of Crop Science pre-treated with 1% Ridoxyl Metalaxyl fungicide. The first experiment was conducted to optimize the sterilization methods. The treatment of 70% Ethanol for 30s followed by 10% NaOCl with tween 20 for 15 minutes, 10% NaOCl without Tween-20 for 15 minutes and 0.1% HgCl₂ for 5 minutes showed the lowest contamination (4%) and higher success (96%) among all sterilization treatments. The second and third experiments were conducted to optimize the growth media concentration for leaf callus formation and shoot proliferation. Leaf explants were cultured on ½ MS medium supplemented with 6 growth regulator concentration while nodes were cultured on full MS medium with 4 different plant growth regulator combinations. Each treatment was replicated 20 times. Leaf explants were sterilized using the best treatment found the experiment 1 while nodes were dipped in 1% Ridoxyl Metalaxyl fungicide for half an hour before following the optimized sterilization procedure with minor changes to Ethanol treated period (1minute) and HgCl₂ treated period (8minutes). Aglaonema leaves placed on half Murashige and Skoog medium supplemented with 2 Benzyl Amino Purine (BAP) and 0.1 2,4-D proved the highest survival rate for callus formation in leaf compared to other six treatments. Aglaonema shoots placed on full strength MS medium supplemented with 2BAP proved the most responsive medium for Aglaonema shoot proliferation compared to other four treatments.

Keywords: Lotus delight aglaonema, Araceae, Sterilization, Plant growth regulators.

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Calibration and Validation of the APSIM Model for Sugarcane (*Saccharum officinarum* L.): Nitrogen Fertilizer Optimization and Climate Change Adaptation for Yield Improvement

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Sugarcane (*Saccharum officinarum* L.) is a vital cash crop for both sugar and bioenergy production worldwide. Sri Lankan sugarcane faces difficulties with climatic variability and sub-optimal nitrogen fertilizer application. The study focused on the objective of calibrating and validating the APSIM (Agricultural Production Systems Simulator) sugar model to simulate sugarcane growth for variety SL96-128 at Lanka Sugar Company, Pelwatte, Sri Lanka. Scenario analysis was conducted to optimize nitrogen fertilizer management using 17 years of historical weather data, and to evaluate climate change adaptation strategies under future climate scenarios, including the 2030 USDA projection and the 2050 and 2100 Representative Concentration Pathway (RCP 8.5) scenarios. The data were used as experimental data of the current field for calibrating, while experimental data from previous years were used for validating the model. Past weather data were collected from the Weather Station, Pelwatte and plant growth data, phenological data and soil Nitrogen content were measured in a field experiment. APSIM was calibrated with adjustments to leaf dimensions, crop height, and thermal time development phases. Model calibration and validation were done by comparing model output with observed data in a 1:1 graph and using statistical indices: Root Mean Square Error (RMSE), Relative Root Mean Square Error (RRMSE), and Model Efficiency (ME). Aboveground Biomass, Leaf Area index (LAI) and Plant height were predicted by the model with a strong correlation with observed data. The results described that the RRMSE and ME for Aboveground Biomass were 14.68% and 0.95, respectively. In LAI, RRMSE was 14.53% and ME was 0.91. RRMSE and ME of Plant Height were 13.25% and 0.79, respectively. Scenario analysis showed that biomass production remains relatively stable under future climate conditions, as the negative effects of elevated temperatures are offset by increased rainfall. The optimal nitrogen treatment was determined to be no basal dressing, with 50 kg/ha applied in the first top dressing and 100 kg/ha in the second top dressing as urea fertilizer which is 100 kg/ha lower than the current application.

Keywords: Sugarcane, APSIM, Calibration, Validation, Scenario analysis

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Determining the Optimal Incubation Period for Maximum Production of Secondary Metabolites in *Gyrinops walla* Shoot Cultures Elicited with 1 μ M Methyl Jasmonate.

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Gyrinops walla is an endangered Sri Lankan tree species valued for producing agarwood, a fragrant resin used in perfume industry. Over harvesting and slow natural regeneration threaten wild populations, requiring sustainable production methods. This study investigated the optimal incubation period for maximizing secondary metabolite production in *G. walla* shoot cultures elicited with 1 μ M Methyl Jasmonate (MeJA). Shoot cultures were established using Murashige and Skoog medium supplemented with 1 mg/L of BAP, 0.1 mg/L of IBA, 100mg/ L Myoinositol, 30 g/L of sucrose and 2.0 g/L Phytigel and 1 μ M MeJA. In-vitro shoot was cultured in each culture tubes for 10 weeks. 30 culture tubes per each week were harvested at weekly intervals until 10 weeks. Growth was monitored weekly for ten weeks, measuring fresh and dry weights to assess biomass accumulation. Samples were extracted with ethyl acetate. Secondary metabolites were analyzed using Thin Layer Chromatography (TLC). The results showed that the number of secondary metabolite was not significantly different across incubation periods ($P>0.05$), indicating that metabolite diversity remained constant. However, band thickness on the TLC plate, representing metabolite accumulation, exhibited a significant increase over time ($P<0.05$). The highest accumulation was observed between the sixth and seventh weeks, suggesting this as the optimal period for maximum secondary metabolite production. There are no significance between these two weeks and natural agarwood ($P>0.05$). Results showed that cell doubling times were 2.48 weeks (fresh weight) and 3.49 weeks (dry weight), indicating rapid initial growth. Furthermore, a correlation was established between shoot growth and metabolite synthesis, confirming that metabolic activity is growth-dependent. Control samples (no MeJA) showed minimal metabolite production, confirming MeJA's role as an effective elicitor. This study contributes to the sustainable utilization of *G. walla*, ensuring its conservation while meeting industrial demands for agarwood-products.

Keywords: Agarwood, Elicitor; *Gyrinops walla*, Methyl Jasmonate

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Comparative Analysis of Yield and Nutritional Quality of Microgreens from Different Species

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Microgreens are a type of functional food rich in essential nutrients and offer various health benefits when used as dietary supplements. Their popularity has surged due to their higher concentration of health-promoting compounds compared to their mature counterparts. In this study, microgreens from four different species including mung bean (*Vigna radiata*), radish (*Raphanus sativus*), finger millet (*Eleusine coracana*), and spinach (*Spinacia oleracea*) were examined for their yield and nutritional quality using a completely randomized design with compost as the growth medium. Biomass yield, nutrient (nitrogen, phosphorus, and potassium) accumulation, and proximate composition (crude protein, crude fiber, and ash content) were analyzed. Results revealed significant interspecies differences in the yield and nutritional quality parameters of the four microgreens. Radish microgreens exhibited the highest ($P<0.05$) fresh biomass yield, while mung bean showed superior dry matter accumulation, nitrogen, and protein content compared to the other microgreens, indicating its potential as a protein-rich dietary supplement. Finger millet recorded significantly greater ($P<0.05$) crude fiber and ash content than those of other microgreen species, suggesting its suitability for dietary fiber and mineral enrichment. Spinach tended to retain more moisture than other species. The study underscores the importance of species selection to optimize the nutritional output of microgreens, particularly focusing on yield and nutrient accumulation dynamics. The findings further provide valuable insights into the nutritional potential of microgreens from four different species, advocating for their inclusion in diets as functional foods to enhance human health.

Keywords: Comparative analysis, Microgreens, Nutritional profiles, Biomass yield

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Evaluating the Effect of Biochar to Rectify Saline Soil Conditions by Using Tomato (*Solanum lycopersicum*) as an Indicator Crop

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Salinity is a key abiotic stress limiting global crop production, second only to drought. More than 10% of world's cropland is already facing problems due to salinity and nearly 20% of irrigated land is affected by salt accumulation. According to the USDA salinity laboratory statement, saline soil's EC is ≥ 4 dS/m. This study aimed to evaluate the potential of biochar in mitigating saline soil condition by using Tomato (*Solanum lycopersicum*) as an indicator crop. The experiment was conducted at the University Experimental Station at Dodangolla as a greenhouse pot experiment. The experimental design was a two-factor factorial complete randomized design with four replicates. Two factors were biochar and salinity. Levels of biochar were 0%, 2%, 4%, & 6% and levels of salinity were 0.02153 dS/m- tap irrigation and 4 dS/m- saline irrigation. At the beginning and end of the experiment available N, P, K, pH, EC, and CEC of media were measured. Plant growth parameters measured were plant height, stem girth, number of fully expanded compound leaves, number of flowers, number of fruits, number of days taken for first flowering, shoot fresh weight, root fresh weight, plant fresh weight, and root shoot ratio by fresh weight. According to the results the effects of salinity, biochar and their interaction varied across the measured parameters. Salt stress negatively impacted most of the plant growth parameters. Effect of biochar on plant and media parameters were positive. Under non-saline irrigation, 6% and 4% of (w/w) biochar levels enhanced the plant growth. Biochar under salinity irrigation showed positive impact on plant growth parameters when compared to other treatments. Application of biochar improved soil parameters as well. Therefore, biochar has the potential to mitigate salt stress. Hence, incorporation of biochar is recommended for salt-affected soil to safeguard crop production.

Keywords: Saline soils, Biochar, Tomato,

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The Evaluation of Optimum Strawberry Variety for Organic Cultivation in Sri Lanka

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This research focused on assessing the optimum strawberry variety for organic cultivation in Sri Lanka. Given the rising health and environmental issues associated with strawberry cultivation under conventional farming, the study aimed to find a locally accessible strawberry variety that can flourish under organic practices while providing acceptable yields and fruit quality. The study was conducted as a pot experiment in a greenhouse operating at the Ramya Horticulture Farm in Ambewela. Ambewela is located in the Up Country Wet Zone of Sri Lanka. The study was carried out employing a Complete Randomized Design (CRD) featuring three commercial strawberry varieties: Festival, Chandler, and Sweet Charlie. Plants were cultivated in grow bags with an organic medium made of sterilized coir dust. Organic remedies used for growing strawberry comprised vermicompost, Gliricidia and banana peel extract, neem oil, eggshell powder, and elemental sulfur. Growth and yield parameters including fruit weight, fruit count, chlorophyll level, total soluble solids (TSS), fruit hardness, and days to flowering were measured during the experimental period. Results showed a notable interaction between variety and organic treatment in relation to the fruit weight and chlorophyll levels. Variety Festival demonstrated the most significant enhancement in fruit weight under organic conditions, whereas Sweet Charlie exhibited the highest TSS (Brix value). Nevertheless, organic methods typically postponed flowering and led to reduced firmness. In spite of these difficulties, the Festival variety showed greater adaptability to organic conditions, achieving a beneficial equilibrium between yield and fruit quality, exhibiting the highest average fruit weight (43.86g) and satisfactory firmness (494.0g). The research determines that variety Festival is the optimal and most economically viable strawberry variety for organic strawberry cultivation in the Up-Country areas in Sri Lanka. The results offer important perspectives to aid the shift towards eco-friendly and health-focused farming method for growing Strawberry. The findings of the current research will fill some knowledge gaps related cultivation of Strawberry under organic system in the Up Country, Sri Lanka.

Keywords: Organic farming, Strawberry varieties, Variety festival.

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Relationship between the Growth Parameters of Rice Varieties with Vegetation Indices Estimated Using UAV-Images

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This study explored the relationship between growth parameters of rice (*Oryza sativa* L.) and vegetation indices derived from UAV imagery. The integration of drone technology offers a promising solution for precise and timely data collection, aiding in yield prediction and better agricultural decision-making. The study was conducted using three rice varieties, namely, Bg251, Bg300, and Bg360 grown in the paddy fields of the Field Crops Research and Development Institute (FCRDI), Mahailuppallama, Sri Lanka. The UAV images were collected using DJI M200 drone flown at 80% forward and 70% side overlaps, at four growth stages (2, 4, 6 and 8 weeks after sowing) of the crop. Various vegetation indices (VIs) were calculated using Pix4Dfields software. Though several studies done globally have used RGB images using UAVs to effectively identify growth stages, the present study revealed no significant relationship ($p > 0.05$) between the extracted VIs and the measured growth parameters (e.g., plant height, leaf area, SPAD reading, number of tillers, number of leaves, plant biomass). Although these relationships were not statistically significant ($p > 0.05$), they suggest a moderate correlation that warrants further investigation. The findings underscore the importance of using multispectral cameras equipped with NIR and Red Edge bands for more accurate detection of rice growth stages and yield prediction. This study highlights the need for future research to refine vegetation indices and improve early yield prediction methods in rice cultivation.

Keywords: Rice, UAV imagery, Vegetation indices, Growth parameters

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***Diospyros melanoxylon* Roxb. As A Future-Ready Crop: A Case Study**

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This study was conducted as a case study in the *Bibile* area of the Monaragala District, Sri Lanka, to assess the domestication potential of *Diospyros melanoxylon* Roxb. , a wild species of significant economic importance. The leaves of this species are widely used as wrappers in the *beedi* (traditional cigarette) industry and serve as a key livelihood source for the local community. An ethnobotanical survey was carried out to document traditional knowledge related to the species. A species distribution prediction map was developed using niche modeling techniques to identify ecologically favorable areas for future commercial cultivation. The study also evaluated vegetative propagation methods, including stem cuttings treated with varying concentrations and durations of IBA application, as well as air layering using hardwood and semi-hardwood branches. Physical parameters of the leaves were analyzed to compare the quality of Sri Lankan and Indian specimens. Findings from the ethnobotanical survey highlighted a well-established value chain in the *Bibile* area, despite the species remaining underutilized. The distribution model identified much of the *Uva* Province as suitable for future cultivation. Successful propagation through stem cuttings was confirmed by callus formation. A normality test revealed that, apart from leaf thickness and burning time, most measurement data did not follow a normal distribution. Comparisons showed that Indian leaves had significantly higher mean and median values ($p > 0.05$) across all physical parameters, indicating superior quality. This study provides critical baseline information to support the potential domestication and commercialization of *D. melanoxylon*, with the aim of improving local livelihoods through sustainable resource use.

Keywords: Ecological niche modeling, Ethnobotanical survey, Domestication, Beedi industry, *Diospyros melanoxylon* Roxb.

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Root Behavior and Growth Patterns of *Cinnamomum verum* J.Presl (Ceylon Cinnamon) across Different Age Ranges.

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This study aimed to investigate the root structure and growth patterns of *Cinnamomum verum* syn. *zeylanicum* (Ceylon cinnamon), an indigenous tree in Sri Lanka, which dominates 90% of the global true cinnamon market. Cinnamon is planted with 5-7 seedlings in a single poly-bag, in a planting hole of 1ftx1ftx1ft size, and allowed to form a strong base with each harvesting. Despite its economic importance, there is little scientific information on its root system dynamics. Therefore, the objectives of the study were to evaluate root and base dynamics with age of the cinnamon plant, and to assess how multiple seedlings in a nursery bag develop their root systems over time. The study was conducted at the Cinnamon Research Institute, Thihagoda, and a farmer field in Debaragoda, Karadeniya, both with red yellow podzolic soil. Treatments included age ranges: 6 months, 1 year, 3–7 years, 8–12 years, 18–22 years, 28–32 years, and above 40 years, with three replicates per treatment. Manual excavation was performed to measure the number of vertically and horizontally oriented roots, soil bulk density, root diameter, and root zone depth, while observing signs of root fusion, decay, and regeneration. Pearson's correlation test revealed no significant relationship between bulk density and the number of vertically oriented tap roots ($r = -0.113$, $P = 0.856$). Non-linear regression analysis showed a significant decline in vertically oriented tap roots with age ($P < 0.05$), transitioning to horizontally oriented thick, lateral roots, likely to be a biological process influenced by harvesting cycles rather than environmental factors. Root systems of 5–7 seedlings per polybag developed independently without merging into a single, dominant tap root, even in older plants where partial fusion was observed. These findings suggest that cinnamon can be sustainably cultivated using multiple seedlings per polybag, providing a foundation for future research on its root dynamics.

Keywords: *Cinnamomum verum*, Root fusion, Vertically oriented tap roots, Bulk density, Sustainable cultivation

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Assessing Differences in Leaf Functional Traits across Plant Species Grouped by Leaf Lifespan, Leaf Lifestyle, Leaf Form, Life Form and Origin in the Lower Montane Forest Remnants in Hantana

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Plant functional traits reflect species' ecological strategies, influencing resource allocation, growth dynamics, and ecosystem functioning. This research assessed differences in leaf functional traits across plant species categorized by leaf lifespan (annual vs perennial), leaf lifestyle (evergreen vs non-evergreen), leaf form (simple vs compound), life form (tree, shrub, creeper, and herb), and origin (native, endemic, and invasive) in the Lower Montane Forest Remnants of Hantana, Sri Lanka. A total of 94 plant species were sampled for the study. Key leaf traits including leaf length, leaf width, leaf thickness, petiole length, leaf shape index (LSI), specific leaf area (SLA), leaf mass per area (LMA), leaf dry mass content (LDMC), foliar total nitrogen (N) and foliar total phosphorus (P) content, leaf oven dry weight, and leaf saturated fresh mass were measured. Statistical analysis revealed significant differences ($p < 0.05$) across life forms, life spans, leaf lifestyles, and plant origins. Herbs had the highest phosphorus content (399.8 ± 120.9 ppm), while trees had the highest LDMC (348.2 ± 91.3 mg g⁻¹), supporting resource conservation. Annuals and non-evergreens showed higher phosphorus content (421.8 ± 43.5 ppm), reflecting fast growth. Invasive species had thicker leaves (0.48 ± 0.46 mm), enhancing competitiveness. Correlation analysis highlighted key functional relationships, with leaf size traits strongly linked to leaf biomass. Moderate correlations reveal structural adaptations, while negative correlations, such as LMA vs. SLA, indicate trade-offs. High SLA favors fast growth, while high LDMC enhances stress tolerance, aiding ecosystem conservation. These research findings can be used for understanding plant strategies, ecosystem productivity and carbon cycling, enhancing ecosystem resilience, conservation and management. Additionally, these results can serve as a foundation for evidence-based policy development to support sustainable ecosystem management.

Keywords: Plant functional traits, lower montane forest, ecological strategies, resource allocation.

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Comparative Analysis of Physical Parameters and Carcinogenic Potential of Different Arecanut (*Areca catechu* L.) Types Grown in Different Climatic Zones of Sri Lanka

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Arecanut (*Areca catechu* L.) is central to betel quid chewing, a deeply-rooted cultural practice in South Asian countries, including Sri Lanka. Despite its socio-cultural significance, arecanut contains carcinogenic compounds like arecoline, posing health risks. Given that this practice cannot be entirely eliminated, identifying arecanut types with lower carcinogenic potential may be associated with reducing health risks. This study investigates the physical parameters and carcinogenic potential of different arecanut types grown in climatic zones across Sri Lanka, to identify the varieties with lesser carcinogenicity. Three arecanut types—'*Rata Puwak*', '*Hamban Puwak*', and '*Local Puwak*'—at the same maturity stage and cultivated in distinct climatic regions (wet, intermediate, and dry zones) of Sri Lanka were examined. Physical parameters (size, weight, volume, moisture content, and density) and chemical parameters (Antioxidant and Arecoline content) were evaluated. The findings revealed that '*Rata Puwak*' had the largest nut size and the lowest antioxidant properties, unlike '*Local Puwak*' which had the smallest size and the highest antioxidant properties. Arecoline content exhibited variation across climatic zones, with the highest levels observed in the intermediate zone. When comparing the arecanut types, '*Hamban puwak*' demonstrated a comparatively higher arecoline content than the other types. Physical parameters also showed variations across types but not across climatic zones. Environmental factors, particularly temperature, rainfall, elevation, and humidity, shaped both chemical composition and physical characteristics, with nuts from the dry zone showing lower arecoline concentrations than those from the wet zone. Analysis showed that the betel quid prepared to contain arecanut (A) and betel leaf (BL); A+BL+ Lime (CaCO₃); and A+BL+CaCO₃+ tobacco, exhibited antioxidant properties reduced with the addition of CaCO₃ and tobacco, and reporting the lowest antioxidant properties A+BL+CaCO₃+Tobacco. Therefore, physical and chemical properties of arecanuts are variable, and strategic selection of arecanut type, and appropriate processing methods can alter its health risks.

Keywords: Arecanut, Carcinogenicity, Climatic zones, Betel quid

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Developing a Species Recovery Plan for *Eugenia haeckeliana* Trimen: A Critically Endangered, Point Endemic Plant Species in Sri Lanka

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Eugenia haeckeliana Trimen, an endemic species to Sri Lanka, was recently rediscovered after 142 years since its last record and is currently confined to a single, small population located on private land in Weligama, making it endangered. Given its limited distribution and population size, developing a conservation and recovery plan is a priority. However, the absence of baseline ecological and biological information presents a significant challenge. This study aimed to generate essential data to support the formulation of a recovery plan for *E. haeckeliana*. Sixteen 10 × 10 m experimental plots were established to assess the vegetation structure and ecological characteristics of the habitat. Population structure and composition were studied, and phenological observations were recorded over 3 months. Stem cuttings and air layering were performed to evaluate the species' potential for vegetative propagation. Ecological niche modeling was employed to identify other suitable habitats. A molecular analysis was conducted. A total of 60 individuals, ranging in diameter from 1 - 6 cm, were identified and grouped into four spatial clusters. A detailed morphological description of the species was compiled to aid future taxonomic research. *Mimusops elengi* was found as a frequently associated species, suggesting potential ecological relationships relevant for conservation planning. Soil analysis showed no statistically significant differences ($p < 0.05$) in total nitrogen, available phosphorus, organic carbon, pH, and electrical conductivity between plots with and without *E. haeckeliana*. Ecological modeling has identified 19 km² of land where the species may occur. While root formation was not observed, signs of callus formation and sprouting were evident, indicating the potential for vegetative propagation. The DNA extraction and PCR amplification successfully produced monomorphic bands, confirming the feasibility of molecular studies. The outcomes of this research provide critical baseline data necessary for the development of a scientifically informed recovery and conservation strategy for *E. haeckeliana*.

Keywords: Conservation, Endemic, Endangered, *Eugenia haeckeliana*, Recovery plan

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Design and Development of a Tea Shoot Gripping Mechanism for Drone-Based Tea Selective Harvesting

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Sri Lankan tea has a superior quality, achieved through traditional hand-picking and selective harvesting. However, severe shortages and escalating costs of labor, and inefficiencies in manual harvesting pose significant challenges for selective tea harvesting and thus, maintaining the quality. None of the presently available tea plucking machines in Sri Lanka are selective, and therefore, a dire need exists to introduce a selective, cost-effective plucking machine at the earliest, to ensure the sustainability of the Sri Lankan tea industry. This study was conducted to introduce a tea shoot gripping mechanism for plucking harvestable tea shoots. The gripper was designed in AutoCAD and 3-D printed. The gripping mechanism consists of an MG995 servo motor. The gripper delivered optimal performance, generating a gripping force of 10 N to cut and hold the shoot when the motor axis was positioned 4 cm from tea shoots. The Gripper blade cutting angles were tested at 90° and 45° degrees to identify the optimum cutting parameters, and the 90°-degree angle was identified to be the best. A Python-based image processing algorithm was also developed to identify harvestable tea shoots. TRI 2043 and TRI 3072 harvestable tea shoot images were collected for training the algorithm. Field trials were conducted to evaluate the system's ability to harvest tea shoots with minimal damage. Based on the results, the gripping mechanism was capable of cutting and holding the tea shoot within 2 seconds. Real-time image analysis faced challenges due to background foliage and several other factors. The developed gripping mechanism can be linked with a vision system for autonomous drone-based tea plucking systems in the future.

Keywords: Drone-based harvesting, MG995 servo motor, Ceylon Tea, Tea shoot identification, Gripping mechanism

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Assessment of Fruit Quality Characteristics in Newly Developed Hybrids Resistant to *Aceria* Mite

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Coconut (*Cocos nucifera*) is a key agricultural commodity in Sri Lanka, but production is severely impacted by a wide variety of pests, including infestations of the coconut mite (*Aceria guerreronis*). To address this, the Coconut Research Institute (CRI) of Sri Lanka has developed mite-resistant hybrids by incorporating morphological traits such as reduced perianth space and yellow-to-orange fruit coloration, which are linked to lower infestation rates. However, the yellow-to-orange coloration of the hybrids has led to misconceptions among the growers that they are similar to the aurantica variety, which is generally perceived to have inferior kernel and milk quality. Thus, this study evaluated the kernel and milk quality of five new mite-resistant hybrids; Tall × Brazilian Green Dwarf (T×BGD), Gon Thembili Tall × Brazilian Green Dwarf (GT×BGD), Sri Lanka Yellow Dwarf × San Ramon Tall (DY×SR), San Ramon Tall × Brazilian Green Dwarf (SR×BGD), and Sri Lanka Yellow Dwarf × Gon Thembili Tall (YD×GT) compared to established cultivars (CRIC 65, Kapruwana, and TSR). Fruit quality parameters, including fresh nut weight, de-husked nut weight, kernel weight, milk yield, and milk fat content, were assessed. Statistical analysis performed using ANOVA procedure and mean separation done using Tukey's HSD test revealed significant differences among varieties. The SR×BGD hybrid outperformed others, exhibiting significantly higher ($P < 0.05$) fresh nut weight (2148 ± 89 g), husk weight (1317 ± 91 g), kernel weight (392 ± 22 g), and milk yield (305 ± 10 ml per 500 g kernel) while maintaining mite resistance. Although T×BGD showed comparatively lower performance, all hybrids demonstrated kernel quality comparable to or exceeding the traditional high-yielding variety CRIC65. Importantly, these findings reject the misconception linking yellow-to-orange fruit coloration with inferior kernel quality. The integration of mite resistance with superior kernel and milk quality in these hybrids highlights their potential to enhance sustainable coconut production in Sri Lanka.

Keywords: Coconut hybrids, *Aceria guerreronis*, Mite-resistance, Fruit quality, Kernel attributes.

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Evaluation of the Effects of Wavelength and Intensity of LED Lights Powered by Photovoltaics on Yield and Quality of Tea, with Special Emphasis on the Anthocyanin Content

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Agrophotovoltaics (APV) systems combine agriculture and solar energy production on the same land, offering a sustainable solution for both energy and food production with minimal environmental impact. In the competitive global market for specialty teas, Sri Lanka has cultivars suitable for purple tea production but needs to enhance their anthocyanin content. This study investigated how wavelength and intensity of photovoltaic-powered LED lights affect tea yield and quality, particularly focusing on anthocyanin content. An APV system was developed using mature tea (cultivar TRI 2043), with PV panels powering LED lights that provided blue and red light to tea plants, with sun-lit plants as the control. Light spectrum and intensity, chlorophyll fluorescence, and content of anthocyanins, polyphenols, and chlorophyll in bud, 1st, 2nd, and 3rd leaves was measured. Tea yield and shoot density were also measured. Light spectrum measurements showed that control plants received 317-886 nm wavelengths, while APV systems provided peaks at 420-460nm (blue) and 600-700nm (red). Blue light significantly decreased ($p<0.05$) anthocyanin content in bud, 1st and 2nd leaves compared to control, while red light showed no significant difference ($p<0.05$). Blue light significantly increased ($p<0.05$) polyphenol content in bud and 2nd leaf, and increased chlorophyll a in bud and 1st leaf compare to control. Total chlorophyll was significantly higher ($p<0.05$) in blue light treatment in buds only. Chlorophyll b content showed no significant differences ($p<0.05$) in both treatments compared to control. Neither treatment significantly affected ($p<0.05$) tea yield or shoot density. Chlorophyll fluorescence measurements showed that the performance index is significantly higher ($p<0.05$) in blue and red-light treatments compare to control. In conclusion, blue light decreased anthocyanin content while increasing chlorophyll and polyphenol levels in tea leaves. Both blue and red light enhanced photosynthetic components, though neither treatment significantly affected tea yield or shoot growth.

Keywords: Purple tea, Photovoltaic system, Chlorophyll fluorescence, Wave length, Anthocyanins

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Optimizing the Integration of Motorized Harvesting in Tea Cultivation: A Study on Cultivar TRI 4049 under Low-Grown Conditions in Sri Lanka

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Tea (*Camellia sinensis* L.) sustains nearly one million livelihoods in Sri Lanka, but labour shortages extend plucking intervals, reducing yield and quality. Mechanical harvesting presents a viable alternative to mitigate these challenges. Thus, this study evaluated the manual and motorized harvesting systems in minimizing yield losses, determining the optimal transition point from manual to mechanical harvesting, and assessing the impact of mechanization on leaf quality parameters. A field experiment was conducted using a Randomized Complete Block Design (RCBD) with five harvesting treatments: manual plucking at 7-day (H7 - control), 10-day (H10), and 14-day (H14) intervals, and mechanical harvesting using a Kawasaki NV60H petrol-driven harvester at 14-day (M14) and 18-day (M18) intervals. Results indicated that H7 and H10 treatments yielded significantly higher ($P < 0.05$) and comparable yield relative to M14 and M18, whereas H14 and M14 exhibited no significant yield difference. The highest yield reduction (76%) occurred under M18, while H10 showed the lowest reduction (18%) compared to H7. Although H14 showed the highest average shoot weight, comparable to H10, it yielded less than H7. Mechanical harvesting significantly reduced the average shoot weight, contributing to lower yields. Leaf quality analysis revealed that H14 with the highest coarse leaf content ($P < 0.05$), followed by H10 and H7, while mechanical harvesting exhibited increased coarse leaf content with longer plucking intervals. H7 produced no coarse leaves, highlighting the resultant superior quality of standard manual harvesting. Both extended plucking intervals and mechanical harvesting reduced tea yield and compromised its quality with increased fibrous content. These findings suggest that mechanized harvesting can be optimally introduced when manual plucking intervals exceed 10 days to minimize yield losses while maintaining acceptable leaf quality. However, standard manual harvesting (7-day intervals) maximizes yield and quality under low-country Sri Lankan conditions.

Keywords: *Camellia sinensis*, Mechanical plucking, Shoot composition, Yield loss, Leaf quality, TRI 4049

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Evaluation of the effect of organic liquid fertilizer as growth supplement on growth and yield improvement of tea (*Camellia sinensis*)

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The present research examined the impacts of three organic fertilizers, Bio tonic, Fish tonic, and Cow Dung Slurry on growth and yield of *Camellia sinensis* using a pot and a field experiment. The study was conducted at Urumeewala, Bulathkohupitiya in the Low Country Wet Zone of Sri Lanka. Pot and field experiment were laid out using a Completely Randomized Design (CRD) and a Randomized Complete Block Design (RCBD), respectively, with four treatments. Three treatments consisted of both organic and inorganic fertilizers and fourth one is the control and it had only inorganic fertilizers. Plant height, no. of leaves and no. of buds were recorded in the pot experiment. Green leaf yields were measured in the field experiment. Fertilizer application done with two week interval then field and pot measurements taken. Findings of the field experiment indicated significant differences in green leaf yields ($P < 0.05$). Bio tonic + inorganic gave the highest yield (595.62 ± 33.81 g), followed by Fish tonic + inorganic (436.14 ± 37.76 g), Cow Dung Slurry + inorganic (417.23 ± 34.18 g), and control (318.01 ± 37.20 g). Regression analysis indicated a superior yield under Biotonic when compared to other treatments ($\hat{y} = 365.26 + 2.56x$). In the pot experiment, Fish tonic + inorganic recorded the highest increase in height (5.18 ± 0.88 cm), whereas Bio tonic + inorganic recorded maximum number of buds (3.22 ± 0.93). Balanced nutrient profile and bioactive compounds in Biotonic may have contributed to high yield, whereas Fish tonic encouraged vegetative growth. Cow Dung Slurry showed positive results. All organic-inorganic treatments outperformed the control. In conclusion, bio tonic can be identified as the most effective out of the tested organic liquid fertilizer.

Keywords: *Camellia sinensis*, Organic liquid fertilizers, Bio tonic.

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Assessing the Shoot Replacement Cycle of Selected Tea Accessions under Mid Country Conditions

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The shoot replacement cycle (SRC) is a critical determinant of productivity and quality in tea (*Camellia sinensis* [L.] O. Kuntze). This study evaluated the SRC of selected tea accessions under mid-country climatic conditions at the Tea Research Institute, Mid Country Station at Hanthana, Sri Lanka. A Randomized Complete Block Design (RCBD) was employed with two blocks, eight treatments per block, and five replicates per treatment. Key parameters assessed included population density of active (two-leaf-and-a-bud and one-leaf-and-a-bud) and banji (dormant) shoots, active-to-banji shoot ratio, and fresh and dry shoot biomass. Significant inter-accession variation was observed in shoot growth dynamics. Accession 139 demonstrated the highest overall shoot growth rate, while accession 15 exhibited significantly greater ($P < 0.05$) population of two-leaf-and-a-bud shoots density compared to all other accessions, along with higher one-leaf-and-a-bud shoot density relative to accessions 139 and TRI 2025. Further, Accession 15 produced a significantly higher mean total fresh shoot weight than Accessions 12/11, 88, 139, TRI 2025, and TRI 4042. In contrast, accession 133 maintained the highest two-leaf banji shoot population, while accession 88 showed the highest active-to-banji shoot ratio. Dry biomass analysis revealed that banji shoot dry weight was significantly greater ($P < 0.05$) in accessions 62, 133, and TRI 2025 than in accessions 15, 139, and TRI 4042. Notably, accessions 139 and TRI 2025 exhibited a shorter SRC duration (54.3 ± 0.7 days) compared to accessions 15, 62, and 88. Therefore, accession 15 and accession 139 can be considered suitable for the mid-county conditions. These results demonstrate substantial genetic variability in SRC characteristics among tea accessions, with direct implications for plucking cycle optimization and yield enhancement. Targeted selection of accessions with superior SRC traits, particularly rapid shoot replacement and high active shoot ratios, could significantly improve harvest efficiency in mid-country tea production systems.

Keywords: *Camellia sinensis*, Shoot replacement cycle, Mid-country conditions, Tea accessions, Sri Lanka

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Innovating Tea Beverages: Development and Characterization of a Spice-Infused Carbonated Instant Drink with Comprehensive Sensory and Compositional Analysis

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The increasing consumer demand for innovative and health-oriented beverages has driven research into novel formulations that combine traditional ingredients with modern processing techniques. This study focuses on the development and characterization of a spice-infused, tea-based carbonated beverage, offering a unique fusion of traditional tea flavors and aromatic spices with the effect of carbonation. The beverage formulation involved the selection of suitable tea extracts and spices, followed by optimization of their proportions to achieve desirable sensory and physicochemical properties. The carbonation process was carefully controlled to enhance the palatability and shelf stability of the final product. A comprehensive analysis was conducted to evaluate the chemical composition, sensory attributes, and functional properties of the beverage. The physicochemical parameters, including pH, density, total soluble solids and antioxidant activity, were assessed to ensure product quality and nutritional benefits. Sensory evaluation, provided insights into consumer acceptance based on attributes such as aroma, taste, color, aftertaste and overall acceptability. Furthermore, stability studies were performed to examine the impact of storage conditions on the product's integrity over time. Results indicated that the formulated beverage successfully retained the beneficial properties of tea and spices while offering a refreshing and novel drinking experience. The infusion of selected spices contributed to enhanced and improved flavor complexity. The carbonation effect was found to positively influence the sensory experience, making the drink a potential candidate for commercial production in the functional beverage sector. This research highlights the feasibility of integrating tea and spices into a carbonated instant beverage, addressing both health-conscious consumer preferences and market trends.

Keywords: Tea-based beverage, Spice infusion, Carbonation, Instant drink, Functional beverage

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Food Compatible Extraction of Antioxidants from Selected Food Commodities

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There is a discrepancy between the antioxidant levels analyzed in the laboratories and the actual antioxidant availability in foods, since the conventional extraction methods of antioxidants depend on the use of organic solvents. This study explored the use of food-compatible solvents for the extraction of bioactive compounds from selected food commodities; cinnamon, pomegranate, and tea. During the study, seven different solvents were developed using common food ingredients such as citric acid, acetic acid, glucose, sucrose and glycerol. They were evaluated for their extraction efficiency for the antioxidants from selected food commodities against conventional solvents; methanol, ethanol and water. Ultrasound-assisted extraction (UAE) was performed, and extracts were analyzed for Total Phenolic Content (TPC), DPPH radical scavenging activity, and Total Antioxidant Capacity (TAC). The highest phenolic content and antioxidant activity was observed in pomegranate extracts, while the lowest phenolic content and antioxidant activity was observed in tea for all extracts. Notably, the solvent extracts composed of sucrose and glucose exhibited the highest total phenolic and antioxidant activity for all three food commodities compared to conventional solvents. These results demonstrate that, this novel solvent system can effectively extract antioxidant compounds from cinnamon, pomegranate, tea and these solvents have a potential to replace conventional solvents in extracting antioxidants from food materials.

Keywords: Antioxidants, Food compatible solvents, Ultrasound-assisted extraction (UAE)

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Formulation of Gelatin-free and Added Sugar-free Stirred Yogurt Pouches for Toddlers using Transglutaminase Enzyme

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This study aimed to develop a healthy, toddler-specific stirred yogurt without added sugars or gelatin, using food-grade transglutaminase (TGase) enzyme as a stabilizer. The yogurt was packaged in squeezable pouches for convenience. Since toddlers over six months require complementary feeding alongside breast milk for growth and development, concerns exist regarding the early introduction of added sugars and the use of gelatin due to its animal origin. Additionally, the Sri Lankan market lacks yogurt products specifically formulated for toddlers. A multi-phase study design was implemented, including preliminary trials, yogurt formulation, and experimental analysis. Four different TGase concentrations (T1: 0.005%, T2: 0.01%, T3: 0.02%, T4: 0.03%) were compared against a gelatin-based control sample. The yogurt formulations were evaluated for physicochemical properties (pH, viscosity, syneresis, titratable acidity, color), microbial safety, proximate composition, energy value, and sensory attributes over 14 days of refrigerated storage (4–5°C). Data was analyzed using repeated measures ANOVA, one-way ANOVA, and Friedman tests. All yogurt samples maintained a viable probiotic count above 10⁶ CFU/g, meeting the required standards. There were no significant differences ($p > 0.05$) in pH, moisture, ash, or protein content among the treatments. However, TGase-added yogurt exhibited higher syneresis and lower viscosity compared to the control. Among the formulations, 0.01% TGase (T2) received the highest sensory acceptance on a 5-point hedonic scale for flavor, texture, and overall acceptability. The study demonstrated that TGase is a viable clean-label alternative to gelatin, enabling the development of a cost-effective, toddler-friendly yogurt with high sensory appeal while meeting commercial standards. However, further optimization is recommended to reduce syneresis and explore natural preservatives to extend shelf life.

Keywords: Toddler-specific, Transglutaminase, Stirred yogurt, Unsweetened, Gelatin-free,

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Effects of Storage Duration and Cultivated Season on Grain Quality Characteristics of Selected Improved and Traditional Rice Varieties in Sri Lanka

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Physical, physicochemical, and milling properties directly impact consumer preference and commercial value of rice. Raw rice cultivated in different seasons are stored for varying durations before consumption due to the seasonality of the production and the continuity of the consumption. This study evaluates grain quality characteristics in 12 selected improved and traditional rice (*Oryza sativa L.*) varieties grown experimentally across three seasons: 2023 *Yala*, 2023/24 *Maha* and 2024 *Yala*, harvested and stored for 3, 10 and 15 months respectively. Paddy varieties were cultivated, harvested and stored under ambient storage conditions (25 °C and 65% RH) until the time of study. Significant differences ($p < 0.05$) in selected rice grain quality characteristics were observed due to varietal and seasonal interaction effect. The brown rice and hull percentages ranged from 74% – 82% and 18% - 26% respectively, while head rice yield varied between 49% - 73% in all three seasons. Physical properties such as length, width, length to width ratio, thousand grain weight and bulk density significantly influenced ($p < 0.05$) by the varietal and seasonal interaction, reporting the highest values mostly in either of the considered *Yala* seasons than that of the 2023/24 *Maha* season. Grain elongation, gel consistency and amylose content were significantly influenced ($p < 0.05$) by the varietal and seasonal interaction effect. Gelatinization temperature of all the selected varieties were not significantly changed among three considered seasons and mostly exhibited an intermediate (68.94 °C), high intermediate (70.34 °C) or high (71.74 °C) gelatinization temperatures. Only *At 311* showed a lower gelatinization temperature of 64.74 °C. The findings provide valuable insights for selecting rice varieties suitable for commercial cultivation and optimizing post-harvest practices in Sri Lanka.

Keywords: Rice grain quality, Seasonal variation, Storage effect, Traditional varieties, Improved varieties

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Review of Safety Concerns on Heavy Metals and Toxins Associated with Mushrooms and Development of a Novel Mushroom Spread using Selected Commercial and Medicinal Mushrooms

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Mushrooms are recognized for their versatility and nutritional value; however, it is essential to investigate the presence of heavy metals and potential toxins in mushrooms, particularly in the context of Sri Lanka. This research investigates the bioaccumulation of heavy metals in mushrooms and safety concerns related to toxins in mushrooms through qualitative research methods, including expert consultations and literature surveys. Subsequent development of a novel mushroom spread incorporating commercial and medicinal mushroom varieties was done. The new product was formulated through a series of benchtop trials, incorporating varying ratios of American Oyster (*Pleurotus ostreatus*) and Abalone (*Pleurotus cystidiosus*) mushrooms, along with Reishi (*Ganoderma lucidum*) powder and Shiitake (*Lentinus edodes*) mushrooms, followed by selection of best preferred formulation through sensory testing. Physicochemical parameters, nutritional composition, and sensory attributes of the final product were analysed. Findings of the qualitative study revealed that while American Oyster and Abalone are widely cultivated commercially in Sri Lanka, the market for medicinal mushrooms, including Reishi, remains underdeveloped in Sri Lanka with limited processed products available. Potential toxins in mushrooms were further highlighted, followed by the ability of mushrooms for significant bioaccumulation of heavy metals, influenced by environmental conditions and substrate composition. The finally developed mushroom spread had a high protein content ($3.34 \pm 0.078\%$), ash content ($4.69 \pm 0.030\%$) and fiber content ($4.78 \pm 0.004\%$), indicating a nutritionally beneficial product. Incorporation of *Ganoderma lucidum* has a significant effect on the taste of the mushroom spread and increasing levels beyond 0.2% was found to be not acceptable. The final product was found to be acceptable in terms of flavor, color and spreadability. In conclusion, this research underscores the need to address safety concerns regarding heavy metals and toxins in mushrooms while developing a nutritious spread that includes both commercial and medicinal mushroom varieties.

Keywords: Heavy metals, Toxins, Mushrooms, Spread, Sri Lanka

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Optimization of Mead Fermentation Incorporating *Hemidesmus indicus*: Exploring Fermentation Dynamics, Sensory Attributes, and Health Benefits

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Mead is a traditional alcoholic beverage containing 8% to 18% (v/v) ethanol, produced through the fermentation of honey with water by yeasts. This study aimed to develop an herbal mead having antioxidant potentials using the optimized hot water extract of *Hemidesmus indicus* (HI) which is known for its therapeutic properties, including anti-inflammatory and antioxidant effects. Process of hot water extraction of *Hemidesmus indicus* powder was optimized in terms of temperature, time and powder to water ratio (PWR) using response surface methodology (RSM). Optimized extract was used in developing mead using bee honey with *Saccharomyces cerevisiae*. Six different mead samples were prepared using with and without HI extract and sugar. Fermentation kinetics (titratable acidity, total soluble solids, pH, alcohol content and yeast growth) were monitored to assess the fermentation efficiency and product stability. Most preferred formulation was selected based on sensory evaluations it was analysed for its total phenolic content (TPC) and total flavonoid content (TFC). Optimized conditions for extraction of HI were temperature of 50 °C, time of 30 min, and PWR of 1.26. The selected formulation based on preference consisted of honey and HI extract only, without added sugar. Total phenolic content (36.91 ± 0.42 mg gallic acid equivalents/L) and total flavonoid content (8.72 ± 1.93 mg quercetin equivalents/L) of the drink indicated the potential antioxidant activity. In conclusion introducing HI into mead fermentation increases phenolic and flavonoid content, improves fermentation efficiency, enriches flavour, and has potential health benefits.

Keywords: Mead, *Hemidesmus indicus*, *Saccharomyces cerevisiae*, Antioxidant, RSM

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Effect of Heat Moisture Treatment, Acetylation and Dual Modification on Morphology, Structure and Physicochemical Properties of Cassava Starch

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Effect of single and dual modifications with heat moisture treatment (HMT) and acetylation on morphology, structure and physicochemical properties of cassava starch were investigated. Cassava starch was extracted from the roots of MU 51 variety. Native cassava starch was modified by HMT at 22 % moisture at 120 °C for 2 h and by acetylation using 8 % of acetic anhydride as well as by the combination of HMT and acetylation. The percent acetylation of acetylated and dual-modified starches were ranged from 1.5 to 2.5 %, with degree of substitution (DS) values between 0.05 and 0.09. There was no observable changes in the granule morphology between native and modified starches under the light microscope and polygonal shaped granules were observed. Fourier transform infrared spectroscopy showed a new peak at 1725 cm⁻¹ on acetylated and dual modified starches, indicating the presence of carbonyl (C=O) groups. There was no significant ($p>0.05$) difference in ΔE , L^* and b^* values. But a^* value of acetylated and dual modified starches were increased compared to native starch. Bulk density decreased after the HMT and increased after the acetylation and dual modifications. Water holding capacity increased after all modifications. Oil holding capacity was increased only on acetylation followed by HMT. All samples showed their highest solubility at 90 °C and, at the temperature of 90 °C solubility of acetylated starch was increased and HMT and dual modified starches was decreased compared to native starch. Swelling power increased with the temperature and there was no significant ($p>0.05$) difference among the native and modified samples at 50, 60, 70, and 80 °C. Swelling power of HMT and dual modified samples were decreased at 90 °C compared to native starch. These findings indicate the potential of HMT, acetylation and their combination to enhance the properties of cassava starch.

Keywords: Heat moisture treatment, Acetylation, Dual modification, Cassava starch, physicochemical properties

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Comparative Analysis of *In Vitro* Glucose Releasing Rate, Anti-Obesity, and Bioactive Properties of Cooked Newly Improved Raw and Parboiled Rice Varieties in Sri Lanka

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This study is about a comparative analysis of the functional and nutritional properties of three newly improved Sri Lankan rice varieties (Ld 376, Bg 375, Bw 372) in both raw and parboiled forms. The research provides novel quantitative data on *in vitro* starch digestibility, bioactive compounds, antioxidant potential, *in vitro* glycemic index, and anti-obesity and anti-diabetic activities before and after parboiling. The study confirmed that the parboiling effect significantly increases the amylose content and resistant starch content ($p < 0.05$), with Ld 376 (parboiled) recording the highest amylose content (34.22%) and Bg 375 (parboiled) recording the highest resistant starch content (5.41%). Antioxidant capacity was analyzed through optimized antioxidant assays, among which 1,1-diphenyl-2-picrylhydrazyl (DPPH) and oxygen radical absorbance capacity (ORAC) recorded noteworthy enhancement in parboiled samples, with increments ranging from 13.2 to 36.3% for DPPH and 95.45 to 274.86% for ORAC. Total phenolic content increased continuously by 35 to 45% across varieties; nevertheless, total flavonoid content demonstrated an inverse relationship with parboiling and declined sharply within the range of 64 - 88%. The study has further revealed that parboiled rice had significantly lower maltose and glucose release rates ($p < 0.05$), correlating with minimizing *in vitro* glycemic index scores. Simultaneously, the parboiling process impacted anti-diabetic and anti-obesity activities by indicating the decline in IC_{50} values of alpha amylase inhibition and lipase inhibition assays. In addition, starch granule morphology analysis indicated the structural changes due to parboiling and cooking. The findings underscore the significance of selecting specific rice varieties and processing techniques to optimize functional and nutritional profiles, with Bw 372 (parboiled) emerging as the most health-beneficial due to its low glycemic index, high antioxidant and total phenolic content, and strong enzyme inhibition properties. This research supports the development of functional rice-based foods to help reduce obesity, diabetes and improve health.

Keywords: Antioxidants, Digestibility, Glycemic index (GI), Parboiling, Rice varieties

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Development of a Local Alternative for Food Adhesives

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A food adhesive is a specialized food-grade substance designed to bind or secure food-related materials which includes multilayered food packaging, paper straws and etc. As it is used along with food, the safety of the product is highly important. Currently, Polyvinyl alcohol and Polyvinyl acetate (PVA) based adhesives, which are food-safe and biodegradable but synthetically produced, are dominating the adhesive market, including the applications in food industry as well. The study aims to assess the potential of cashew bark exudate gum and cassava starch in developing food adhesives, utilizing Borax as a bond strengthener and Zinc oxide as a stabilizer. The formulated adhesives were evaluated for their viscosity, pH, tensile strength, shelf stability, drying time and bond permanency as the principal characteristics of an adhesive. Both cashew exudate-based adhesive and cassava starch-based adhesive exhibited an increasing trend for both pH and viscosity upon the increment of Borax content. Additionally, in the process of drying time adjustment of cashew exudate-based adhesive, considering both drying time and tackiness, 20% ethanol was used as the ideal ratio for solvent. The tensile strength analysis of commercially available PVA-based adhesive showed higher bond strength than the formulated products. However, the tensile strength of cassava starch-based adhesive: $0.12 \pm 0.03 \text{ N/mm}^2$ was significantly higher ($p < 0.05$) than that of the cashew exudate-based adhesive, which records as $0.10 \pm 0.02 \text{ N/mm}^2$. Additionally, bond permanency is also significantly higher ($p < 0.05$) in cassava starch-based adhesive while it is significantly lowest in cashew exudate-based adhesive in comparison with PVA-based adhesive. Though cassava starch-based adhesive has a high tensile strength and high bond permanency, it was not shelf stable, exhibiting layer separation and aggregation of starch due to starch retrogradation, while cashew exudate-based adhesive was shelf stable. Overall, the results indicate that both materials have the potential to be developed into food adhesives through chemical modifications.

Keywords: Adhesive, Cassava starch, Cashew exudate gum

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Comprehensive Morpho-Constitutional Characterization of Urinary Calculi and *In-Vitro* Litholytic Activity Evaluation of Selected Medicinal Plant Extracts for Urolithiasis Management in Sri Lanka

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Urolithiasis, or the formation of calculi in the urinary tract, is a significant health issue globally. The predominant component in most calculi is calcium oxalate (CaOx), and their formation is a multistep process involving supersaturation, nucleation, aggregation, growth, and retention. Traditional treatments, including pharmacological and surgical methods, have limitations such as recurrence and adverse effects. Thus, plant-based therapies are being explored as alternatives for the prevention and management of urinary calculi. This study investigates the litholytic potential of *Kalanchoe pinnata*, *Manilkara zapota*, and *Cucumis melo* extracts on three types of urinary calculi. Urinary calculi were obtained from patients at District General Hospital, Matara, Sri Lanka, following surgical removal. Fourier Transform Infrared (FTIR) spectroscopy and microscopic analysis were conducted to determine the composition and morphology of the stones. Herbal extracts were prepared by aqueous infusion at 90°C and purified through centrifugation. A dissolution test was performed by immersing stones in plant extracts, positive controls (Cystone drug and potassium citrate drug), and a negative control (distilled water) at 37°C for 20 days. Stone dissolution was monitored at 5-day intervals by weight loss and structural analysis. Dissolution rate (DR%) was calculated and statistical analysis was carried out. Fourier Transform Infrared Spectroscopy (FTIR) confirmed the presence of calcium oxalate, uric acid, and calcium phosphate calculi. *Manilkara zapota* showed significant dissolution effects on calcium oxalate (8.64±2.51%) and calcium phosphate stones (8.31±1.11%) ($P < 0.05$). For uric acid stones, *Kalanchoe pinnata* exhibited the highest dissolution effect (38.62±10.08%) ($P < 0.05$). This study highlights the promising litholytic activity of medicinal plant infusions, specifically *Manilkara zapota* and *Kalanchoe pinnata* which indicates a significant dissolution of various urinary calculi. While further research is needed to validate these findings, integrating plant infusions or extracts into clinical practice could offer additional treatment options for managing urolithiasis and preventing recurrence.

Keywords: Calculi, Dissolution rate, Litholytic activity, Plant infusion, Urolithiasis

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Evaluation of Antioxidant, Antidiabetic, Anti-obesity Properties and Cytotoxicity Effect of Leaf Extracts from Four Selected Medicinal Plants in Sri Lanka

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Traditional Sri Lankan medicine is recognized for its effectiveness, minimal side effects, and affordability compared to synthetic drugs. This study investigated the antioxidant, antidiabetic, anti-obesity, and cytotoxic properties of hexane, dichloromethane, ethanol, and water extracts from *Ricinus communis* L., *Croton aromaticus* L., *Toddalia asiatica* (L.) Lam., and *Sida rhombifolia* L. The antioxidant activity was assessed using DPPH, Ferric Reducing Antioxidant Power (FRAP), Total Flavonoid Content (TFC), and Total Phenolic Content (TPC) assays. Antidiabetic and anti-obesity effects were evaluated through α -amylase and lipase inhibition assays, respectively, while cytotoxicity was determined using the brine shrimp lethality assay. Among the tested extracts, *Ricinus communis* L. exhibited the highest antioxidant activity with DPPH (0.531 ± 0.003 mg TE/g, dw), FRAP (2.726 ± 0.025 mg Fe²⁺/g, dw), TPC (5.034 ± 0.054 mg GAE/g, dw), and TFC (1.802 ± 0.043 mg CE/g, dw). A positive, significant linear relationship between antioxidant activity and TPC and TFC content showed that phenolic compounds and flavonoids were the dominant antioxidant components in the medicinal plants studied. The strongest α -amylase inhibition was observed in *Toddalia asiatica* ($IC_{50} = 10.766 \pm 0.150$ μ g/mL in water, 2.367 ± 0.080 μ g/mL in hexane) and *Sida rhombifolia* L. ($IC_{50} = 0.886 \pm 0.033$ μ g/mL in ethanol, 20.548 ± 0.078 μ g/mL in dichloromethane). For lipase inhibition, *Toddalia asiatica* (L.) Lam ($IC_{50} = 4.517 \pm 0.089$ μ g/mL in water) and *Sida rhombifolia* L. ($IC_{50} = 5.875 \pm 0.150$ μ g/mL in ethanol, 4.058 ± 0.052 μ g/mL in hexane) demonstrated the highest activity. Cytotoxicity assays indicated that *Croton aromaticus* L. exhibited the lowest LC_{50} values, particularly in hexane (12.245 μ g/mL), highlighting its potent toxicity. These results indicate that the studied medicinal plants possess antioxidant, antidiabetic, and anti-obesity properties and underscore the potential therapeutic applications, warranting further investigation into their bioactive compounds and mechanisms of action.

Keywords: Medicinal plants, Antioxidant, Antidiabetic, Anti-obesity, Cytotoxicity

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Enhancing Sri Lanka's Competitiveness in Spice Exports: A Strategic Analysis of Raw and Processed Spice Exports Across Key Global Markets

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Sri Lanka, renowned for its high-quality spices, such as cinnamon, pepper, and cloves, seeks to enhance its competitiveness in the global market. This research investigated the factors influencing the competitiveness of Sri Lanka's spice exports, focusing on raw and processed spice products. The study explored key markets, including Europe, the USA, Australia, China, India, and Gulf Cooperation Council countries, to identify trade barriers, regulatory challenges, and opportunities for growth. An exploratory and descriptive research design was employed, utilizing both qualitative and quantitative methods. Quantitative analysis was conducted using export data from the Sri Lanka Customs and Department of Export Agriculture, alongside an evaluation of market trends, import requirements, and certification standards in target regions. The study specifically examined the growth of high-demand spices such as mace, vanilla, and cinnamon, which show compound annual growth rates (CAGR) of 7.36%, 33.18%, and 3.63%, respectively. The study also identified significant unrealized export potential for fresh cinnamon and non-crushed pepper. Trade barriers, including microbiological contamination and stringent certification requirements, were identified as major challenges in key export markets. However, certification programs such as GFSI, Fair Trade, and Rainforest Alliance being crucial for accessing premium markets. Sri Lanka's share in key global markets, such as holding 18% of Australia's cinnamon imports and 28% of India's pepper imports, demonstrates the country's strong position but also the need for targeted strategies to increase market share. To enhance Sri Lanka's competitiveness in the global spice market, the industry must focus on value addition while aligning with global certification standards. Furthermore, leveraging digital platforms for direct consumer access and fostering international trade partnerships can significantly improve market access. Future research should explore scalable production processes and further optimize market-specific strategies for Sri Lankan spice exports.

Keywords: Sri Lankan spices, Export trends, Import country requirements, Trade barriers, Demand trends

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Development of Flavored Air-Frying Oil Sprays Infused with Spice Oleoresins: Formulation, Physicochemical Characterization, and Sensory Evaluation

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This study aimed to develop flavored air-frying oil sprays infused with spice oleoresins for potato chips and fish fillets, introducing a novel concept of flavoring air-fried. The initial selection of base oil for the formulation was carried out among virgin coconut oil, sunflower oil and olive oil by evaluating their smoke point, oxidative stability, volatility, viscosity and spray ability. According to the physicochemical characterization, sunflower oil exhibited the highest smoke point ($223.44 \pm 3.36^\circ\text{C}$) and olive oil and virgin coconut oil possessed relatively lower smoke points ($185 \pm 3.77^\circ\text{C}$ and $187.11 \pm 3.86^\circ\text{C}$ respectively). Virgin coconut oil had the highest oxidative stability with the lowest peroxidase value (0.8156 ± 0.2354) based on iodometric titration compared to sunflower oil (9.228 ± 0.301) and olive oil (9.720 ± 0.568). Organoleptically accepted different formulations of oleoresins extracted from garlic, onion, and red chili were infused into virgin coconut oil, which was chosen as the optimal base oil. Infused oils were separately sprayed (0.65g of oil/100g of potato chips) onto potato chip and air-fried for 13 min at 180°C . The development of flavored air frying oil sprays for fish fillets was done by infusing virgin coconut oil with different combinations of oleoresins of garlic, rosemary, red chili and black pepper. Fresh fish fillets of *Sphyraena barracuda* were separately sprayed with oil formulations and air-fried for 10 min at 160°C . Based on sensory-evaluation studies conducted with 30 untrained consumer panelists, formulations of oleoresin-infused air-frying oils for potato chips 1.5%(v/v), at the ratio of 3:3:4 and (onion: garlic: red chili) and fish fillets 4.0%(v/v) at the ratio 4:2:2:1 (garlic: rosemary: chili: black pepper) respectively received the highest acceptance for their flavor, color, texture, and overall mouthfeel, highlighting their potential as marketable products. This innovative flavoring technique for air-fried food products is likely to capture the interest of food processors, caterers and household consumers, due to its convenience, consistent flavoring, and cost-effectiveness.

Keywords: Air-frying, Oleoresins, Flavored oil, Sensory evaluation

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Development of a Hydrolyzed Collagen Incorporated Green Tea (*Camellia sinensis*) Blend and FTIR Characterization of the Developed Blend

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A novel product of collagen incorporated green tea was developed to enhance the anti-aging benefits through combining hydrolyzed fish collagen, green tea, hibiscus powder, and apple flavor powder. A descriptive analysis was conducted to select the most preferred blend with hydrolyzed collagen. The best selected product was the collagen green tea product with hydrolyzed collagen formulation, and the tea brew was pH 5.25. The final product contains 33.23% crude protein, 5.25% moisture, 1.08% fat, and 5.34% ash. The crude protein content of green tea is 1.23%, and the addition of hydrolyzed collagen increased the protein content of the product from 1.23% to 33.23%. The collagen tea was filtered at two temperatures (60 °C and 25 °C). Collagen denaturation usually occurs at 60 °C, and brewing at 25 °C is done to prevent the denaturation. This approach resulted in higher phenolic and flavonoid content at higher temperatures. The physicochemical properties of the mixture were investigated using Fourier Transform Infrared Spectroscopy (FTIR) to identify possible interactions at the molecular level. The presence of collagen was confirmed by the presence of Amide A (~3300 cm⁻¹), Amide I (1600–1700 cm⁻¹), and Amide II (1500–1600 cm⁻¹) absorption peaks in the pure fish collagen. The FTIR spectra of the products revealed very slight changes, but these do not have any health implications, suggesting molecular interactions between collagen and green tea polyphenols, which may contribute to improved stability and bioavailability. When comparing the FTIR spectra of pure fish collagen with the FTIR spectra of collagen green tea, the absorption values at the peak wavenumber of the pure collagen sample were found to decrease and increase when compared to the absorption values at the same wavenumber in the FTIR spectra of green tea. The polyphenol incorporation can be identified by the peaks at wavenumbers 401 cm⁻¹ and 387 cm⁻¹ in the FTIR spectra of pure tea. This study provides valuable insight into the potential of functional beverages in promoting skin health and preventing aging, and paves the way for further research and product development that satisfy the consumer demand.

Key words: Collagen Green Tea, Fish Collagen, FTIR spectroscopy, Green Tea

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Optimizing Cold Holding Practices in Hotel Buffets by Implementing a Lab-based Simulated Intervention to Control Temperature Fluctuations and Minimize Microbial Risks in Selected High-Risk Foods at Star Hotels in Sri Lanka

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This study focuses on the optimization of current cold holding practices in hotel buffets, mainly targeting on control of temperature deviations and mitigating microbial risks on high-risk, perishable foods, served in buffets of star hotels in Sri Lanka. Due to higher ambient temperatures in tropical countries like Sri Lanka and suboptimal practices currently employed in buffets result in increasing foodborne outbreaks. A controlled laboratory simulation was conducted to compare a 30- minute food replacement intervention (IB) against a control (AB) over 3 hours, using 3 high-risk food items: cold milk, cold vegetable salad, and cold chicken salad. Prior to the intervention, the selected products were assessed for hygienic preparation through direct observation and microbial analysis to ensure baseline safety and quality. A baseline study was done to identify the lapses in cold buffet and a chiller performance study was conducted to evaluate the chiller stability. Microbial safety was assessed over time, between AB and IB treatments. In the same lab simulation, the impact of immersing food containers in ice bath was carried out to determine its effectiveness in controlling cold holding temperatures of food. Results of field observations indicate a higher tendency in star hotels to not employ proper cold holding practices, which results in unsafe cold holding temperatures with compromised microbial counts. The intervention demonstrated significantly improved temperature stability, maintaining core temperatures of food below 10°C. Optimal temperature control was achieved by immersing food containers in ice baths. This study supports time-sensitive food replacement and effective cooling to improve buffet food safety. Implementing this in hotels requires actual buffet trials and further research on ice bath conditions.

Keywords: Cold holding, Food safety, Microbial growth, Time-temperature control, Buffet service

Acknowledgement: *Cinnamon Hotels & Resorts, Sri Lanka*

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Evaluating the Effect of Different Processing Methods on Nutrients, Anti-Nutrients & Antioxidant Properties of African Butter Fruit (*Pentadesma butyracea*) Seed Cake Powder & Selected Product Development

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Pentadesma butyracea seeds have a high fat content and notable nutritional potential. After oil extraction from the seeds, the remaining seedcake has several potential applications. The objective of this study was to evaluate the potential of moist heat treatments in reducing the bitterness of *Pentadesma butyracea* seed cake powder (SCP) and to utilize the treated SCP in product development. Effects of boiling and pressure cooking on the nutritional, functional and sensory properties of the SCP were studied. Three different types of SCP samples (untreated, boiled, and pressure cooked) were prepared and their proximate compositions, anti-nutrients, anti-oxidants, and powder properties were analyzed. The cupcakes were prepared using the three SCPs, and the best powder was selected using a ranking test for preference. Using the best treated powder, three different instant cupcake formulations were developed by changing the levels of SCP, and the best formulation was selected using another ranking test for preference. The selected instant mixture was compared with a chocolate cupcake using a hedonic test. Results indicated that these processing methods significantly ($p < 0.05$) influenced the proximate composition; both treatments increased protein and crude fiber content and reduced crude fat and ash contents. Both processing methods significantly ($p < 0.05$) reduced anti-nutritional components, with pressure cooking achieving the highest reductions in oxalate (66.35%) and tannins (72.75%). The antioxidant properties and functional properties of SCP were also affected, where the total phenolic content, bulk density, and solubility of SCPs significantly decreased ($p < 0.05$) in both methods, while the water holding capacity increased. Cupcake with 5.4% of pressure cooked SCP was selected and it was found to be acceptable compared to the chocolate cupcake. The findings indicate that pressure cooking is effective in minimizing anti-nutrients in the seed cake, enhancing the potential to be used as an ingredient in food products.

Keywords: *Pentadesma butyracea*, Seed cake, Moist heat treatment, Anti-nutrient content

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Gap Analysis and Establishment of Hazard Analysis and Critical Control Points (HACCP) System for a Spice Processing Industry

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The production of chili powder requires intense focus on food safety management due to the hazards that affect product quality and the safety of the consumers. This study was focused on conducting a gap analysis in a chili powder production facility, followed by the establishment of a Hazard Analysis and Critical Control Points (HACCP) system. The research focused on gap identification between current practices and requirements to be satisfied for the HACCP system. Based on the observations, corrective actions were proposed to enhance the strategies to mitigate the food safety issues in the processing plant. The gap analysis was conducted on Good Manufacturing Practices (GMP) and prerequisite programs implemented in the plant. The hazard identification and process control measures were evaluated based on the ISO 22000:2018 as the benchmark. The HACCP plan is developed to identify the biological, chemical, and physical hazards throughout the production process. Two critical control points (CCPs) and two operational prerequisite programs (OPRPs) were identified. The CCPs were established at the drying step, and grinding followed by metal detection steps. Unground dried chili storage and sampling & inspection steps were recognized as the OPRPs. The proposed HACCP plan included the corrective actions, verification procedures, monitoring procedures, and documentation formats and practices. The study revealed that implementation of the HACCP food safety management system has a direct influence on the control of hazards and ensures product quality and safety. Further, the HACCP system enhances the quality assurance and sustainable business and satisfies the regulatory compliance and enhances the market competitiveness by improving the consumer confidence over the marketable products.

Keywords: Chili powder production, Food safety, Food hazards, ISO 22000, OPRPs.

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Dietary Patterns, Physical Activity, and Health Complications among Post-Menopausal Women Visiting Peradeniya Teaching Hospital: A Preliminary Cross-Sectional Study

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Menopause marks the permanent cessation of ovulation and menstruation, causing significant physiological and metabolic changes. In Sri Lanka, where women spend about one-third of their lives in post-menopause, understanding its impact on diet, physical activity, and health is crucial. This study aimed to assess the dietary patterns, physical activity, and health complications among post-menopausal women in Kandy District, examining associations with the post-menopausal stages. A cross-sectional study was conducted among 80 post-menopausal women (aged 45–65) visiting Peradeniya Teaching Hospital in February 2025, using convenience sampling. Data were collected on anthropometric measurements (BMI, waist and hip circumference, waist-to-hip ratio, body fat, visceral fat), dietary intake (24-hour recall, FFQ), physical activity (WHO questionnaire), health history, socioeconomic factors, and NCD risk. Data analysis was performed using IBM SPSS Statistics 22. The mean age of menopause was 47 years. Monthly income of 36% was below Rs. 50,000. While 66% were aware of NCD risk factors, 62% led a sedentary lifestyle. Mean sitting time was 3.64 h/day (SD = 1.31). The mean BMI was 26.47 kg/m² (SD = 4.23), with 78% overweight and 58% obese (based on Asia-Pacific classification). Carbohydrates comprised 42% of dietary intake, while oily foods, sugary foods, and fruits were the lowest (4%). Significant associations were found between post-menopausal stage and fruit consumption ($p = 0.038$), sugary food intake ($p = 0.043$), and diabetes occurrence ($p = 0.022$). Income was linked to grain product consumption ($p = 0.015$). The study revealed a high prevalence of overweight and obesity, with a predominantly carbohydrate-based diet and low fruit/healthy fat intake. Late post-menopausal stage showed lower fruit and sugary food intake and higher obesity and diabetes risk. As the first study of its kind, this study lays the groundwork for future research, including a larger sample and pre-menopausal control group to enhance generalisability.

Keywords: Post-menopause, Dietary patterns, Physical activity, Non-communicable diseases (NCDs), Obesity and diabetes

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Comprehensive Assessment of Physical Properties, Nutritional Profile and Antioxidant Potential in Organic, Conventional, and GAP-Certified Vegetables: A Case Study of Selected Vegetables Grown in Nuwara Eliya

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Agriculture is the backbone of Sri Lankan economy and remains predominantly conventional, with a limited but steadily growing adoption of organic and Good Agricultural Practices (GAP). The SL GAP certification has been implemented in the country since 2016. Research evidence suggests significant differences between organically grown vegetables and conventionally grown vegetables in terms of nutritional profile and functional properties even though the results are inconsistent. However, availability of reliable information of these three cultivation systems is scarce. Thus, the present study aims to comprehensively assess the physical properties, nutritional profile and antioxidant potential of *Daucus carota* and *Brassica oleracea* var. *capitata* cultivated in selected certified organic, conventional and GAP-certified farms in Nuwara Eliya, Sri Lanka. Both vegetables from the three cultivation systems were analyzed for physical attributes (length, width, thickness, head height), proximate composition, mineral content (Atomic Absorption Spectroscopy), polyphenols (Folin–Ciocalteu method), flavonoids (AlCl₃ colorimetric method) and antioxidant activities (DPPH assay), vitamin C content, chlorophylls and β -carotene content. Physical attributes were predominantly higher in both GAP and conventional systems. Vitamin C, chlorophylls and β -carotene contents were significantly higher in organic followed by GAP-certified vegetables compared to conventional vegetables. There were no significant differences across cultivation methods on crude fiber, crude fat, crude protein and ash content except for moisture content which was significantly higher ($P < 0.05$) in conventional vegetables. The GAP-certified vegetables reported significantly higher ($P < 0.05$) potassium and iron content, while calcium levels varied based on the vegetable type and cultivation method. The organic vegetables reported significantly higher ($P < 0.05$) antioxidant capacities followed by GAP-certified vegetables. In conclusion, although organic vegetables and GAP-certified vegetables are priced higher compared to the conventional vegetables, GAP-certified vegetables are a pragmatic, economical choice for Sri Lankan consumer providing good nutritional value.

Keywords: Farming systems, Mineral content, Proximate composition, Polyphenols, Pigments

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Enzymatic Hydrolysis of Shortfin Scad Fish (*Decapete rusrusselli*) Muscle Protein to Develop a Protein Fortified Pasta and Evaluation of its Sensory and Physicochemical Properties

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Fish is a sustainable source of protein with great potential for product innovation. This study focuses on the enzymatic hydrolysis of *Decapete rusrusselli* (shortfin scad) muscle protein to produce fish protein hydrolysate (FPH) powder and its application in product formulation. Initially it was aimed to optimize the hydrolysis conditions of fish muscle protein to achieve the desired degree of hydrolysis (DH) while minimizing the fishy odor, using Corolase 7000 and Corolase 8000 commercial enzymes, assessing their suitability for pasta fortification. The degree of hydrolysis was determined using the trychloroacetic acid method. Soluble protein content of the supernatant was determined by using a biuret standard curve prepared recoding the absorbance at 540 nm. Pasta formulations with 10%–25% FPH were developed and evaluated for their sensory, physical, and physicochemical properties. A ranking test was conducted with 30 untrained panelists to assess consumer preferences based on odor, color, flavor, texture, mouthfeel, and overall acceptability. Optimum cooking time, water absorption percentage, and swelling index were evaluated as physicochemical properties in the cooked pasta. The results indicate that FPH fortification successfully enhances protein content and nutritional value of pasta while improving its sensory attributes. Statistical analysis using the Friedman test confirmed significant ($p < 0.05$) differences among treatments. This study highlights the potential of *Decapete rusrusselli* derived FPH as a source of protein fortification in the food industry, the effectiveness of Corolase 7000 and Corolase 8000 enzymes in enzymatic hydrolysis, and the impact of fish protein fortification on pasta's sensory, physical, and physicochemical properties. Additionally, it demonstrates that the fishy odor in the flesh can be reduced by developing FPH, promoting its broader applications in fish-based food product development.

Keywords: Corolase 7000, Corolase 8000, Sensory properties, Pasta, Fish Protein Hydrolysate (FPH).

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Investigation on Potential Utilization of Modified Corn Starch as a Fat Replacer in Mayonnaise

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This study investigated the efficacy of modified corn starches as fat replacers in mayonnaise, aiming to develop low-calorie emulsions with desirable physicochemical properties. Corn starch was subjected to annealing (ANN), citric acid hydrolysis (CA), acetylation (ACT), and heat-moisture treatment (HMT) to alter its functional characteristics. These modified starches were then incorporated into mayonnaise formulations at 30% and 50% fat replacement levels, and compared to a full-fat (FF) control. The impact of starch modification and fat replacement ratio on color, pH, viscosity, and emulsion stability was evaluated. Physicochemical analyses revealed significant differences among the modified starches, reflecting the distinct effects of each treatment. Notably, ACT, CA, and HMT starches, when used at a 30% replacement level, yielded mayonnaises with high viscosity, comparable to the FF control. In contrast, ANN starch failed to achieve acceptable viscosity at both 30% and 50% replacement levels. All fat-reduced mayonnaises demonstrated enhanced freeze-thaw stability compared to the FF sample, and exhibited high overall emulsion stability. Sensory evaluation revealed that the mayonnaises prepared with ACT 30%, CA 30%, HMT 30%, and the control exhibited comparable scores across appearance, color, aroma, texture, and taste, leading to high overall acceptability. In contrast, the ANN 50% sample showed lower scores in all sensory attributes, correlating with its previously noted lower viscosity. These findings suggest that ACT, CA, and HMT modified corn starches are promising fat replacers in mayonnaise, particularly at a 30% replacement level, offering a pathway to produce low-calorie alternatives without compromising textural attributes.

Keywords: Corn starch, Fat replacer, Mayonnaise, Modified starch

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Development of Fruity Jelly Yoghurt for Enhanced Consumer Acceptability

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Culturing innovative yogurt formulations that combine nutrients with sensory characteristics has responded to the emerging consumer demand for functional dairy products. The present study has focused on developing and evaluating "jelly yogurt" with fruit pieces primarily *tutti* fruity made of papaya. The study sought to determine the optimal jelly flavor and quantity, fruit-to-jelly ratio, and sensory, proximate, physicochemical, and microbiological analysis-based values. The sensory evaluation using a 7-point hedonic scale to assess products showed that strawberry-flavored jelly was the most preferred. From statistical analyses using the Friedman test, it was gleaned that a jelly weight of 40g and a fruit-to-jelly ratio of 2% had the best balance between texture and flavor. The proximate analysis confirmed the formulated jelly yogurt as being compliant with the nutritional standards as it has adequate protein, fat, carbohydrate, and fiber content. The physicochemical analyses indicated that the stability of the product would lie within the acceptable ranges of acidity when additional monitoring of pH was conducted for a duration of 27 days. Microbiological tests confirmed its fermentative viability through counts of *Lactobacillus bulgaricus* and *Streptococcus thermophiles* that were well above the threshold levels. There were no coliforms, and the counts of yeast and molds conformed to permissible limits, thus, showing sound microbial safety. The findings of this research indicated that jelly yogurt is a functional dairy product that shows good sensory acceptability with moderate nutritional values and microbiological stability. More studies are recommended on packaging, shelf-life improvement, and commercial-scale production to further enhance the marketability of the product. This study captures the development of a series of innovative yogurt products for the consumers.

Keywords: Jelly yoghurt, Sensory Evaluation, Proximate analysis, Microbiological stability, Functional dairy product

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Effect of Drying Temperature and Particle Size on Discoloration and Overall Quality Parameters of Desiccated Coconut

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Desiccated coconut (DC) is a valuable export commodity for Sri Lanka. However, discoloration during the drying process, particularly the formation of a yellowish-brown hue in the coconut flakes, affects product quality and marketability. The Codex Standard for DC (CXS 177-1991) mandates that DC should retain a natural white to creamy-white color. This study investigates the combined effects of industry interested drying temperature (91 °C, 92 °C, 93 °C, 94 °C) and particle size (large: 1.7 mm, medium: 1.5 mm, fine: 1.0 mm) on color, physicochemical, microbiological, and sensory characteristics of DC to determine optimal drying conditions. A factorial experimental design was done, with triplicate samples pre-dried at 65 °C for 15 minutes before drying at the selected temperatures for 1 hour in a hot air oven. Colorimetric analysis using a Hunter Lab colorimeter (PCE-CSM 1) revealed that temperature and particle size significantly ($p < 0.05$) influenced lightness (L^*), yellowness (b^*), and redness (a^*) values, with higher temperatures intensifying discoloration. Medium-sized particles dried at 93°C (MS93) exhibited optimal L^* values and minimum undesirable color changes. Physicochemical analysis of MS93 confirmed compliance with SLS 98:2013, with moisture (w/w db) (1.975%), fat (85.735%), ash (2.445%), and free fatty acid (FFA) levels (0.219%) in extracted oil remaining within acceptable levels. Particularly, FFA levels were significantly lower ($p < 0.05$) at 93°C compared to 94°C, indicating less lipid degradation. Microbiological analysis confirmed that all samples met food safety standards. Sensory evaluation showed that MS93 received the highest ratings ($p < 0.05$) for color, aroma, coconut flavor, and overall acceptability. These findings suggest that drying at 93 °C with medium particle size optimizes product quality while reducing discoloration. Future research should explore the long-term stability of DC and the potential cost savings from lower drying temperatures.

Keywords: Desiccated coconut, Drying temperature, Particle size, Discoloration, quality

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Development of an IoT-Enabled Real-Time Spoilage Detection Tool for Selected Ready-to-Eat Food Items in the Food Service Sector

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Food spoilage is a significant concern in the food service sector, particularly for highly perishable ready-to-eat (RTE) food items. This study presents an Internet of Things (IoT)-enabled food spoilage detection tool designed to monitor spoilage by analyzing gas emissions and pH variations. The system comprises hydrogen sulfide and ethanol gas sensors, temperature/humidity sensors, a pH meter, and an Arduino UNO microcontroller to transmit real-time sensor data. The research focused on evaluating the spoilage of RTE white cream onion soup, chicken curry, and prawn curry under both ambient (25°C) and refrigerated (4°C) conditions. Microbial analyses, including aerobic plate count, total coliform count, *E.coli* count, and *Salmonella* spp. detection, were conducted alongside specific sensory evaluations to determine freshness. The microbial test results indicated that white cream onion soup remained acceptable up to the 5th day, while chicken curry and prawn curry were acceptable until the 4th day under refrigerated storage. Tool's sensor data were correlated with microbial test results to establish threshold values for spoilage detection. Additionally, sensory evaluations were compared with microbial findings, highlighting discrepancies in human perception of food freshness. A feasibility assessment with potential users and statistical analysis ($P < 0.001$) confirmed the tool's reliability, supporting its use as a practical alternative to traditional sensory methods in the food service sector.

Keywords: Food spoilage detection, IoT, Ready to eat food, Food service sector, Microbial analysis

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Oat-Incorporated Cow's Milk Beverage with No Added Sugar

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There is an increasing demand for healthy, low-sugar dairy beverages due to the high prevalence of non-communicable diseases. This research focuses on the development of a non-added sugar, oat-incorporated cow's milk beverage with optimal sensory attributes (aroma, taste, oats flavor, mouthfeel, appearance and overall acceptability) and commercial viability. The formulation process included identification of ingredients, product preparation, and sensory evaluation to identify the most acceptable oat concentration for the product. Three different oats concentrations (0.5%, 1%, and 2% oats) were tested by a sensory analysis and the product with 0.5% oats was identified as the most preferred. A dual mixing strategy was applied to enhance product stability while reducing the oats particles sedimentation in the product. In addition to that, enzymatic treatment with lactase was introduced to improve the sweetness of the non-added sugar product. Physicochemical analyses for density, fat content, total carbohydrate content, acidity and total soluble solid confirmed the nutritional properties, while microbiological testing indicated an acceptability of the product up to nine days under refrigerated conditions. Sensory evaluations using a nine-point hedonic scale demonstrate that, except appearance, every other considered sensory property was significant ($p < 0.05$) for aroma, oats flavour, sweetness, overall taste, mouth feel/texture, and overall acceptability. The lactase-treated variant was significantly preferred over the control. The final product meets Sri Lanka Standards (SLS 917:2018) and offers a nutritious, lactose-low or lactose-free product to commercial dairy beverage.

Keywords: Duel mixing, Lactose free, Non-added sugar, Oats-incorporated, Formulation

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Development of an AI-Driven Decision Support System Based on Physicochemical Properties of Ceylon Black Tea to Validate and Predict Tea Tasting Assessments Conducted by the Tea Tasters

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Traditionally, the evaluation of tea quality has been subjective and relies heavily on the expert tea tasters. The subjectivity of tea tasting and complexity of having laboratory analysis of tea components has produced a need of an efficient, quick and an accurate method to determine and validate the tea quality evaluations. This study develops a feedforward artificial neural network-based Decision Support System to forecast tea quality scores (TQS) using chemical, physical, and sensory parameters. A sub-study was conducted, finding that 79.16% of tea manufacturers and 75% of tea buyers considered the model a potentially useful tool to validate tea quality. For the model development, 276 Ceylon black tea samples representing the three elevations, high-grown, mid-grown, and low-grown regions, were analyzed for polyphenols, caffeine, total nitrogen, moisture, and crude fiber, using a Near-Infrared spectrophotometric tea ingredient analyzer. pH of tea liquor, bulk density of tea leaves, and color values of dry tea leaves, liquor and infusion were also quantified. Another sub-study was conducted to identify the relative importance of tea quality parameters considered by the tea evaluators, based on agro-climatic region and grade combinations. Using the tea tasting results and the relative importance percentages, the final TQS was calculated and used in model training. The Resilient Back Propagation algorithm with weight backtracking was used in model training, developing two multilayer perception models with 14 and 8 input nodes. Model accuracies of 92% and 70% respectively were achieved from the models with 1 hidden layer and 10 to 20 neurons offering an objective alternative for tea quality standardization, validation and possible tea quality controlling.

Keywords: Artificial Neural Networks, Tea Tasting, Tea Quality, Decision Support Systems, Ceylon Black Tea

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Comparative Analysis of Bioactive Compounds, Antioxidant Potential, and Development of a Decision-Supportive Mobile Application Using Machine Learning Based Image Processing for Quality Assessment of Three Watermelon Varieties

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Watermelon (*Citrullus lanatus*) is a widely consumed fruit worldwide, yet, consumers often struggle to assess its internal quality; particularly sweetness, flesh color, and flesh firmness, based completely on external cues. This study aimed to develop a decision-supportive mobile application for evaluating the internal quality attributes of three watermelon varieties (Sweet Baby, Rocky 475, and Kinaree 457) using image processing and machine learning techniques. Further, the study explored consumer satisfaction with market-available watermelons through a consumer survey. The bioactive compounds and antioxidant potential of the selected watermelon varieties were also assessed by analyzing the Total Phenolic Content (TPC), 2,2-Diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging activity, and Ferric Reducing Antioxidant Power (FRAP). For model development, features were extracted from captured watermelon images. Machine learning models: Random Forest, Decision Tree, Multi-Layer Perceptron, Support Vector Classifier, and K-Nearest Neighbors were trained using the extracted image features to predict the watermelon variety, sweetness, flesh color, and flesh firmness. The results from the consumer survey revealed that more than 50% of the respondents were discontented with the sweetness and flesh color of the market-available watermelons. Biochemical analysis revealed significant ($p < 0.05$) variations among the varieties, with Kinaree 457 exhibiting the highest TPC (5.07 mg GAE/100g FW) and antioxidant activity with DPPH (7.47 mg TE/100g FW), while Sweet Baby exhibited the highest FRAP activity (5.96 mg Fe²⁺ Eq/100g FW). Correlation analysis demonstrated strong relationships ($r > 0.8$) between watermelon sweetness, flesh color, and flesh firmness with both watermelon weight and extracted image features, including pixel area and entropy. The Random Forest model achieved the highest overall accuracy (95.98%), precision (96.86%), recall (93.97%), and F1-score (95.22%). Therefore, this model was integrated into the mobile application. The present study confirms that the developed mobile application serves as a scientific tool to support quality-conscious consumers in making informed purchasing decisions.

Keywords: Watermelon quality assessment, Machine learning models, Image processing, Consumer satisfaction, Antioxidant activity

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Development and Comparative Analysis of Two Herbal Tea Blends with Black Tea and Green Tea Bases for Supporting Phlegm Relief

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Phlegm disorders, often associated with respiratory complications, can be alleviated using herbal remedies with mucolytic properties. The objective of the research is to develop herbal tea blends using Malabar nut (*Justicia adhatoda*), licorice (*Glycyrrhiza glabra*), and ginger (*Zingiber officinale*) with green tea and black tea as tea bases. Two formulations of herbal blends were optimized using green tea and black tea through a trial-and-error approach. The sensory attributes of brew were tested by semi-trained panel using the 7-point hedonic scale rating test. Consumer preference was evaluated using a paired preference test. The properties of tea liquor, pH, hue, total soluble solids (TSS), total phenolic content (TPC), and total flavonoid content (TFC) were determined. The shelf stability of herbal tea blends was tested for 4 weeks in tea bags under ambient storage conditions. Initial microbiological safety was confirmed by total plate count analysis. The collected data were statistically analyzed to compare the two tea blends. Results of sensory evaluation indicated that there is no significant ($P>0.05$) difference between the two tea blends in terms of sensory attributes and consumer acceptance. The presence of bioactive compounds was confirmed, with variations observed between the green and black tea-based formulations. Thus, optimized herbal tea blends achieved a desirable balance between sensory acceptability and functional properties. pH and total soluble solid (TSS) values of green tea and black tea-based blends were 5.69, 0.8, and 5.09, 1.6 respectively. In conclusion, the developed herbal tea blends possessed a substantial natural remedy for phlegm disorders while ensuring product stability and safety. Investigations on mucolytic mechanisms of active compounds and bioavailability are recommended for validation of the therapeutic efficacy of these blends.

Keywords: Herbal tea, Phlegm disorders, Sensory evaluation, Bioactive compounds

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Development of an Instant Herbal Porridge Incorporating Moringa Leaves (*Moringa oleifer*) and Assessment of its Physicochemical and Nutritional Properties

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This study focused on developing an instant herbal porridge powder incorporating Moringa leaves (*Moringa oleifera*) using spray drying technology. Three porridge formulations with varying Moringa contents (F1=2%, F2=3% and F3=4%) were developed using fresh leaf extracts of Moringa and curry leaves and rice milk prepared by blending pre-soaked rice. A sensory evaluation utilizing 35 untrained panelists was conducted to select the most preferred formulation. According to the sensory ranking test F2 emerged as the most favored formulation with respect to taste, aroma, and overall acceptability compared to both other formulations ($P<0.05$). The F2 porridge was further processed at an inlet temperature of 170°C and an outlet temperature of 75°C, with a water evaporation capacity of 1 L/h in the spray dryer to develop the instant powder. The resulting powder was analyzed for the proximate composition, physio-chemical properties, antioxidant activity, total phenolic content, and reconstitution properties. The developed instant porridge contained 5.82% (± 0.35) moisture, 1.63% (± 0.15) fat, 12.34% (± 1.23) ash, 2.35% (± 0.35) protein, 0.52% (± 0.01) fiber, 83.15% (± 1.58) carbohydrate, and 356.7 kcal/100g (± 4.70) energy content. It exhibited high antioxidant properties (total phenolic content: 3.12 ± 0.49 mg GAE/g; total antioxidant capacity: 1.96 ± 0.48 mg AAE/g) and favorable physicochemical attributes, including bulk density (0.49 ± 0.04 g/cm³), wettability (25.69–30.95 s), dispersibility (0.15 ± 0.02 s), solubility index (0.41 ± 0.02), and water activity (0.29). Based on consumer preference, the optimal reconstitution ratio was 3g per 25–30 mL of boiled water. A 28-day shelf-life study confirmed the microbial stability, with minor but significant changes in solubility and color ($P<0.05$). These findings suggest that spray drying effectively preserves nutritional, functional, and sensory properties, making this instant porridge a viable commercial product.

Keywords: Antioxidant activity, Instant powder, Reconstitution properties, Sensory evaluation, Spray drying,

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Development and Evaluation of Physicochemical and Functional Characteristics of Sri Lankan Scotch Bonnet (*Capsicum Chinense*) Based Ready-To-Serve (RTS) Beverage

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The commercialization of spiced Ready-to-Serve (RTS) beverages as natural, low-calorie drinks with no added sugars presents strong potential in both domestic and export markets. This study aimed to develop an RTS beverage using pineapple juice, king coconut water, and Sri Lankan Scotch Bonnet, and to evaluate its physicochemical, sensory, and antioxidant properties. Initially, four base formulations were prepared by blending pineapple juice and king coconut water in different ratios (1:1, 1:2, 2:1, 2:3). Sensory analysis with 34 untrained panelists identified the 2:1 pineapple to king coconut ratio as the most preferred. Based on this, four additional formulations were created by varying Scotch Bonnet concentration per liter (F1=2.0 g, F2=2.5 g, F3=3.0 g, F4=3.5 g). Sensory evaluations conducted over four consecutive days, using the same panel revealed significant differences ($P<0.05$) in spiciness, aftertaste (3 minutes after consumption), color, aroma, and overall acceptability. The F3 formulation, containing 3.0 g/L of Scotch Bonnet, was selected for further analysis based on the sensory evaluation, which yielded a mean spiciness score of 8.10 ± 2.75 and an aftertaste score of 4.53 ± 3.06 , as determined using a line scale sensory test. Physicochemical properties were analyzed using standard methods: Titratable acidity (acid/base titration), Vitamin C (titration with 2,6-dichlorophenolindophenol), Total sugars (Lane and Eynon's method), Total soluble solid (TSS: digital refractometer), and pH (digital pH meter). The total phenolic content (TPC) and antioxidant activity were assessed using the Folin-Ciocalteu and DPPH assays, respectively. The final beverage recorded 0.52% titratable acidity, 197.34 mg/100 g Vitamin C, 55.5 g/100 mL total sugar, 12.9% TSS, 4.57 pH, 1.67 ± 0.02 mg GAE/g TPC, and 76.06 ± 0.48 μ g AAE/g antioxidant activity. Shelf-life testing over 28 days confirmed product stability for up to 21 days under refrigerated conditions (4°C). These results indicate strong potential for this beverage as a functional, consumer-acceptable, and locally sourced RTS product for commercial markets.

Keywords: Antioxidant, King Coconut, Pineapple, Ready-to-serve, Scotch bonnet, Spicy beverage

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Design and Optimization of a Food Dryer Utilizing Waste Heat from Refrigerators

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In the modern world, sustainability and energy efficiency have grown to be vital. Although conventional dryers use a lot of energy, using waste (untapped) heat from household appliances such as refrigerators offers a sustainable alternative. The aim of the present study is to design and optimize a food dryer that efficiently uses waste heat from a household refrigerator. Four main components make up the system: a drying chamber, fans to control airflow, a heat recovery system that captures waste heat, and a heating element to supply extra heat when rapid drying is needed. To evaluate the drying efficiency and overall performance of the dryer, key parameters were analyzed, including drying temperature, airflow rate, heat distribution within the dryer, and the impact on the refrigerator after integration. Different commodities, such as bitter melon (*Momordica charantia*) and jackfruit (*Artocarpus heterophyllus*) were dried without the heating element. The average temperature inside the drying chamber was found to be 40 °C without the heating element, and the temperature could be controlled as desired up to 60 °C with the heating element. Two air velocities (0.54 m/s and 0.19 m/s) could be obtained by changing the fan speed. Heat distribution was found to be uniform throughout the drying chamber. No significant impact ($p>0.05$) on the internal temperature of the refrigerator was observed after integrating the dryer to the refrigerator. The commodities were dried evenly after 24 hours of drying. The study emphasizes the possibilities of including waste heat recovery systems into household appliances, thereby promoting environmental sustainability and energy economy.

Keywords: Dryer, Energy efficiency, Refrigerator, Sustainability, Waste heat recovery

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Evaluating the Potential of Incorporating the Rice Milk of High and Low Amylose Rice Varieties into Yoghurt

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Rice milk a liquid extracted from rice, has gained popularity as an ingredient and substitute for cow milk. This study aimed to develop and optimize a novel yoghurt formulation incorporating rice milk from two rice varieties with distinct amylose contents: *CIC-Savandara* (Low-amylose), and *CIC-Red* fragrant rice (High-amylose). The physicochemical properties of rice milk were analysed, under different processing conditions. In the present study, six types of rice milk incorporated yoghurts were produced, by replacing cow milk with 40, 30, and 20% of rice milk, along with 100% cow milk yoghurt, and stored for 28 days at 4°C. Microbial, physicochemical, and sensory properties of freshly prepared yoghurts were evaluated. The effects of rice milk incorporation on yogurt storability were assessed in terms of physicochemical, microbial, and sensory changes over time. Results demonstrated that processing parameters and rice variety influenced the physicochemical properties of rice milk, with significant effects ($p < 0.05$) observed for parameters such as pH, titratable acidity, and syneresis rate. The inclusion of *Savandara* and Red fragrant rice milk resulted in yoghurts with desirable physicochemical and sensory properties, with significantly higher ($p < 0.05$) *Lactobacillus* spp. survival rates than cow milk yoghurt. The yoghurt with 40% *Savandara* rice milk demonstrated significantly higher ($p < 0.05$) scores for flavor and overall consumer acceptability. Rice milk incorporated yoghurts had resistant starch ranging from $0.08 \pm 0.04\%$ to $0.90 \pm 0.13\%$ while crude protein ranged from $2.19 \pm 0.03\%$ to $3.27 \pm 0.09\%$. The syneresis rate and pH reduction over the storage period were lower in rice milk-incorporated yoghurts than in 100% cow milk yoghurt. The preference for sensory attributes were significantly declined over time and was acceptable up to 21 days. The findings highlight the potential of *Savandara* & Red fragrant rice milk as a viable ingredient for yoghurt production.

Keywords: Rice milk, Yoghurt, Amylose, Physicochemical properties, Storage stability

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Development and Evaluation of a Spice Oleoresin Blend as a Substitute for Raw Spice Mix in Chicken Curry Preparation

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Chicken is one of the most widely consumed meats worldwide, often prepared using various spices in different forms and quantities. However, raw spices present challenges such as flavor inconsistency, microbial contamination, and non-compliance with regulatory standards. Oleoresins, concentrated extracts from dried spices and herbs, offer a potential alternative to ensure consistency and safety. This study aimed to develop a convenient, high-quality oleoresin blend for chicken curry that replicates the flavor profile of traditional raw spices. The first formulation (F1) was developed based on a preferred Sri Lankan chicken curry recipe, while three additional formulations (F2, F3, F4) were created by adjusting oleoresin quantities to achieve varying levels of spiciness. The blends were incorporated into chicken, and sensory evaluations were conducted using ranking and a 9-point hedonic scale to identify the most preferred formulation. Based on sensory data, F1 and F3 were selected for further analysis. Physicochemical properties, shelf stability, and microbial quality of the selected formulations were assessed. The half-life of piperine in F1 and F3 was 33 and 43 weeks, respectively. Microbial analysis over four weeks confirmed that both formulations met safety criteria. The bulk density of F1 and F3 was $476.19 \pm 6.5 \text{ kg/m}^3$ and $405.4 \pm 6.59 \text{ kg/m}^3$, while their tapped density was $857.14 \pm 9.10 \text{ kg/m}^3$ and $882.35 \pm 9.10 \text{ kg/m}^3$, respectively, indicating poor flowability and high cohesiveness. The wettability of F1 and F3 was 32 ± 4.51 seconds and 4.44 ± 0.1 minutes, respectively, with both blends being highly susceptible to humidity emphasizing the need for an effective packaging. These findings suggest that the developed oleoresin blends have the potential to replace traditional raw spice mixtures in chicken curry preparation, offering improved consistency and safety.

Keywords: Spice mixtures, Oleoresin-based spice cube, Sensory quality, Microbiological quality, Physicochemical properties

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Investigation of Factors Influencing Uneven Color Development during Ripening Banana in Ethylene Chambers

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Ripening is genetically programmed highly coordinated irreversible phenomenon which includes many biochemical changes. This research explored factors that affect irregular color changes in three banana varieties, *Ambul kesel*, *Kolikuttu kesel*, and *Seeni kesel*, while ripening inside ethylene chambers. The optimal ripening conditions were evaluated by analyzing the effects of temperature (22, 24, 26 °C), relative humidity (RH: 65, 80, 95%), and ethylene exposure durations (45, 90, 135 min) on peel color, firmness, pH, and total soluble solids (TSS). A factorial design was performed for pairwise comparisons between groups. Research results demonstrated that temperature emerged as the primary factor influencing both color attributes and firmness, as increased temperatures promoted rapid ripening and a darker peel appearance, as indicated by lower L* measurements. The peel integrity remained stable when the relative humidity (RH) reached 95%, as it provided powerful protection against the deterioration process. The duration of ethylene exposure during this process directly affected the rate of ripening, but shorter times of 45 min produced slower ripening outcomes. Temperature and RH displayed noticeable interactions, which underscored the necessity of maintaining balanced conditions to achieve consistent ripening outcomes. The best ripening outcomes occurred when *Ambul kesel* received ethylene treatment for 45 min at 22 °C with 65% RH, and *Seeni kesel* required 90 min exposure under 22–24 °C with 80% RH, and *Kolikuttu kesel* ripened best at 22 °C with 95% RH for 45 min.

Keywords: Banana ripening, Ethylene chambers, Color development, Temperature, Physicochemical properties

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Analysis of Nutritional and Functional Components in Selected Black Tea Grades across Major Elevations in Sri Lanka

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Tea is the second most consumed beverage in the world after water and is grown in 30 countries worldwide. This study aims to determine the effect of major three elevations of tea cultivation on nutritional and functional components of selected black tea grades in Sri Lanka, focusing on three elevations (high, mid, low), two processing methods (orthodox, CTC) and black tea grades (BOP, OP, BP1). Simple sugar content of tea was analyzed using HPLC while protein, crude fiber, polyphenol and caffeine contents were analyzed using near infrared analysis. Fat and ash contents of tea were assessed using Soxhlet extraction and muffle furnace respectively. The effect of elevations, tea grades and processing method was found to be significant (The fructose, glucose, sucrose, total sugar, crude protein, crude fat, crude fiber and total ash contents of the black tea samples were found to be in the range of 5.86 – 11.35 mg/g, 1.89 – 10.51 mg/g, 3.17 – 18.63 mg/g, 36.41 – 17.09 mg/g, 26.12 – 16.65%, 1.19 – 0.65%, 19.89 – 12.5%, 6.42 – 5.53%, respectively while polyphenols and caffeine were found in the range of 18.66 – 14.2% and 5.32 – 3.27% respectively. There was a significant difference ($P < 0.05$) between elevations, tea grades and processing methods. The highest amount of sugar contents were observed in high elevation while highest percentage of total ash and crude fiber were observed in low elevation. The highest percentage of polyphenol content was observed in mid elevation. However the crude protein and caffeine content is lowest in high elevation than other two elevations. Also the lowest content of fat was observed in mid elevation. When it comes to the processing methods, the highest content of fructose, glucose, total sugar, crude protein, crude fat and polyphenols were found in orthodox processed black tea while the highest content of sucrose, crude fiber, total ash and caffeine contents were found in CTC processed black tea.

Keywords: Black tea, Elevations, Grades, Processing methods

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Gap Analysis and Implementation of Hazard Analysis and Critical Control Points (HACCP) Food Safety Management System (FSMS) for Pickled Gherkin Processing Industry

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Pickled gherkins is one of the processed commodity exporting from Sri Lanka. However the quality and safety is utmost important to satisfy customer requirements. The project was aimed to design and implement a Hazard Analysis and Critical Control Point (HACCP) FSMS for a large scale pickled gherkin processing plant to meet the compliance with the Global Standard, Brand Reputation through Compliance Global Standards (BRCGS) requirements. Initially, a comprehensive gap analysis was conducted to identify discrepancies in-between existing production practices and the BRCGS production site standards. The methodology was based on site visits, observation of production operations reviewing past records and noncompliance of prerequisite programs (PRPs) and operational pre requisite programs (OPRPs). Questionnaire based checklist was used in Gap Analysis to assess compliance. The HACCP plan was developed based on the Codex Alimentarius guidelines, including hazard identification, risk assessment, and determination of control measures. Based on the study two OPRPs in both vinegar- and brine-based pickled gherkin production were identified. However, no critical control points (CCPs) were identified since the pickled gherkin is used as a semi processed ingredient for the subsequent value added processing. The gap analysis revealed structural and operational deficiencies, such as damaged flooring in the drum washing area, inadequate drainage, and ineffective pest control measures. Recommendations included floor repairs, improved drainage systems, and installation of insect-proof screens to enhance compliance with BRCGS requirements. Overall, the study highlights the importance of structured food safety management in the pickled gherkin industry. Implementation of the proposed HACCP system and fulfilling the identified gaps will facilitate to satisfy the regulatory compliance, leading to food safety, quality assurance and sustainability in product exportation. Further studies are suggested to enhance the stakeholders' role in supply chain to ensure the sustainable quality and safety management strategies.

Keywords: HACCP, Pickled gherkin production, Gap analysis, Food processing.

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Identifying the Optimal Storage Period for Tom EJC Mangoes before Processing: An AI-Based Approach

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Due to the primary use of visual inspection for ripeness assessment, the food industry faces difficulty in determining the optimal storage duration for mangoes to ensure desired processing quality. This research aims to develop an Artificial Intelligence (AI) model to predict the optimal storage period for TEJC mangoes using measurable parameters to enhance accuracy, which will help waste reduction and improve product quality. The methodology involved storing mangoes under controlled conditions for eight days, collecting data daily for physiochemical characteristics such as Total Soluble Solids (TSS), pH, firmness, and colour, along with image capture. The data from this immense dataset was further used to test and train the AI model. The results upheld significant physiochemical changes in the process of ripening, like an increase in TSS and pH, a decrease in firmness, and considerable changes in l^* , a^* , b^* colours. Statistical findings showed high associations between these parameters, and those were well simulated by the AI model. The CNN-based algorithm accurately identifies the ripening stage of TEJC mangoes. The code developed predicts the ripening stage of TEJC mangoes using a trained Convolutional Neural Network (CNN) model. The overall model achieved an accuracy of 66.96% on the training set and 62% on the testing set. In conclusion, this study successfully illustrated the potential of an AI-based approach to identify the optimal storage period for TEJC mangoes by analysing key ripening indicators. To further enhance the model's applicability, future research should consider the influence of environmental factors and expand the model to include other mango cultivars.

Keywords: Tom EJC, Artificial Intelligence, Ripening, Physiochemical parameters

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Assessing Nutrition Knowledge Gaps and Developing a Mobile-Phone-Based Nutrition Education Platform for Pregnant Women in Sri Lanka

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Emphasising the importance of nutrition education, research has indicated that maternal nutritional knowledge during pregnancy is significantly related to both maternal and child health and nutrition outcomes. Traditional methods of nutritional education may not reach everyone or be sufficient emphasizing the need for alternative approaches such as mobile phone interventions. Previous qualitative studies suggested mHealth could enhance nutritional advice delivery in Sri Lanka. Therefore, this study aims to develop a user-friendly nutrition education mobile application tailored to the needs of pregnant mothers in Sri Lanka. A three-phase approach was used where phase one assessed the nutritional knowledge of pregnant women using a cross-sectional survey (n=78) in Kandy, Hambantota, and Nuwara Eliya. Phase two focused on developing and validating a dietary guidelines booklet through a literature review and consultation with the experts. Phase three includes designing a mobile phone app “MaMaWell” to enhance nutrition knowledge among pregnant women. Survey results indicated the lowest nutrition knowledge score among women from Nuwara Eliya (1.68 ± 0.69) and the highest among women from Kandy (2.13 ± 0.62). Maternal nutrition knowledge was significantly associated with their education level and resident districts ($P < 0.05$). About 55% of the sample did not know their recommended weight gain during pregnancy based on their pre-pregnancy BMI, while around 28.2% indicated that a mobile phone-based application is a convenient platform for nutritional information. The developed dietary guidelines booklet was revised based on the comments from the experts and was used to design the dietary guidelines and recommendations provided by “MaMaWell”. The application was successfully developed using Adalo which is a no-code app builder. As the next phase, a formative evaluation of application will be conducted to assess the feasible and acceptable by the target population and its impact on improving the nutritional knowledge among Sri Lankan pregnant women.

Keywords: Nutrition education, Pregnant mothers, mHealth, Knowledge, Mobile application

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Evaluating the Effectiveness of Organic Acids in Maintaining Microbial, Nutritional, Sensory, and Physicochemical Attributes of Fresh-cut Pumpkins (*Cucurbita maxima*) and Radishes (*Raphanus sativus*)

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This study investigated the effects of selected post-cut treatments on the quality attributes and safety of fresh-cut pumpkins and radishes. As organic acid treatments citric acid (2.5% and 5%), and acetic acid (2.5% and 5%) and as conventional methods salted and chlorinated water was assessed. Cleaned and cut vegetables were dipped in the solutions for 4 minutes, washed, air dried, packaged in food cling wrap, and stored under refrigerated conditions (4-8°C). The physicochemical, nutritional, functional, sensory, and microbial properties were determined at 3-day intervals for 6 consecutive days. The physicochemical results indicated that both acetic acid and citric acid treatments effectively preserve the color, firmness, pH, titratable acidity, and total soluble solids of both commodities compared to control samples. The microbiological analysis revealed that treatment with 5% acetic acid effectively suppressed microbial growth in fresh-cut vegetables compared to the control samples by reducing the total plate count (TPC) by 5.97% and yeast and mould growth by 20.32% in pumpkins while reducing the TPC by 6.39% in radishes with complete inhibition of yeast and mould growth with during the six-day storage. The vitamin C content, total phenolics, and antioxidant activity of the acetic acid-treated samples showed a significant ($P<0.05$) reduction throughout the storage period while significant retention by citric acid-treated samples compared to the control. According to the sensory evaluation using a 30-member untrained panel, both the color and aroma of pumpkins and radishes were effectively preserved by the organic acid treatments and overall acceptability was highest for the 5% citric acid-treated pumpkins and 2.5% acetic acid-treated radishes. Even though there were some reductions in nutritional and functional properties, the overall results indicated that organic acid treatments effectively preserve the quality and safety attributes of fresh-cut pumpkins and radishes while acting as safer alternatives to disinfection with chlorinated water.

Keywords: Acetic Acid, Citric Acid, Fresh-cut Pumpkins, Fresh-cut Radish, Preservation

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Investigation of Nutritional Composition and Bioactivity of *Ganoderma cf. applanatum* Collected from Central Province, Sri Lanka

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Mushrooms have long been recognized as functional foods due to their rich nutritional composition, culinary value, and bioactive properties. Among them, the genus *Ganoderma*, belonging to the family Ganodermataceae, includes medicinally and economically significant fungi with a wide global distribution. This study focused on nutritional composition and bioactivity of *Ganoderma cf. applanatum* collected from central province, Sri Lanka. Nutritional analysis was conducted to determine proximate composition, while phytochemical screening identified key bioactive compounds in ethanol, methanol, hot water, and water extracts. Antioxidant activity was assessed using the DPPH assay, and total phenolic and flavonoid contents were quantified. Antimicrobial activity was evaluated against selected bacterial strains using methanol, hexane, and ethyl acetate extracts. Toxicity was assessed using the brine shrimp lethality assay. The proximate analysis revealed a high carbohydrate (50.32%) and fiber content (11.22±0.01%) with moderate crude protein (15.41%) and low crude fat content (5.98±0.01%). Phytochemical screening confirmed the presence of phenols, flavonoids, and tannins, while alkaloids were absent. Antioxidant activity varied significantly among extracts, with ethanol and methanol exhibiting the highest DPPH radical scavenging activity (87.77±0.02% and 82.77±0.01%, respectively) compared to water extract (71.71±0.01%). The highest (p<0.05) total phenol content (1.04±0.06 mg GAE/g) and total flavonoid content (2.57±0.02 mg RE/g) were observed in ethanol extract. In antimicrobial activity, only the hexane extract exhibited some activity against *Pseudomonas aeruginosa* (8.50±0.71 mm) at a concentration of 20 mg/mL. The brine shrimp lethality assay indicated no significant toxicity with a LC₅₀ value of 2,486.84 µg/mL, supporting its potential for safe consumption. This study suggest that *Ganoderma cf. applanatum* from Sri Lanka possesses valuable nutritional and bioactive properties, highlighting its potential for medicinal and functional food application.

Keywords: *Ganoderma applanatum*, Nutritional composition, Antioxidant activity, Phenolic content, Antimicrobial activity

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Nutritional Recommendations for Menstrual Health in Young Adults: Integrating Cycle Tracking and Dietary Insights through a Mobile Application

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Menstrual health plays a pivotal role in women's overall well-being, yet menstrual disorders remain highly prevalent, especially among young adults while posing detrimental effects on their quality of life. Even though pharmacological approaches are a popular method of relieving menstrual discomforts, nutrition, and diet also have the potential to be used as promising approaches. Available mobile applications provide advice for a healthier menstrual cycle, but their recommendations may not be compatible with the Sri Lankan context, highlighting the need for a country-specific solution. Therefore, this research aimed to develop a mobile application that provides nutritional recommendations for better menstrual health, while simultaneously tracking the menstrual cycle. The study was carried out in four phases; a literature review to identify the associations between nutrition and menstrual disorders, an online survey to assess knowledge regarding menstrual health and usage of nutrition as a management method, formulation of general nutritional recommendations for promoting menstrual health in consultation with medical and nutrition experts, and the development of the mobile application, "FemmeWell". Flutter was used as an open-source UI framework, with Hive for local data storage, synchronized with Firebase for cloud storage. The recommendations derived from the research were incorporated into the app to ensure evidence-based guidance. Survey findings revealed no significant correlation ($P>0.05$) between the demographic variables and the nutrition knowledge related to menstrual health. Also, only 10% of the study sample used diet as a menstrual symptoms management method while 95.24% reported willingness to use a mobile application for nutritional information. Further, studies are required to assess the impact of the developed app usage on improving the use of diet to relieve menstrual discomforts. This study highlights the potential of tech-driven nutritional interventions for menstrual health and the necessity of addressing behavioral aspects alongside knowledge dissemination.

Keywords: Menstrual health, Menstrual disorders, Nutritional recommendations, Mobile application, Behavioral change

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Development of Anthocyanin-based Colorimetric Freshness Indicator to Validate the Shelf Life of Buffalo Curd under Refrigerated Storage

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Buffalo curd is a widely consumed fermented dairy product in Sri Lanka, but its short shelf life and inaccuracy of expiration dates pose challenges in quality assurance and food waste reduction. This study aimed to develop an anthocyanin-based colorimetric freshness indicator integrated into intelligent packaging to validate the shelf life of buffalo curd under refrigerated storage. Anthocyanin, known for their pH-sensitive color changes, were extracted from red cabbage (*Brassica oleracea* var. *capitata* f. *rubra*), butterfly pea flower (*Clitoria ternatea*), and beetroot (*Beta vulgaris*), and their total anthocyanin content and pH-dependent color variations were analyzed. Among the tested sources, red cabbage anthocyanin exhibited the most distinct and responsive color variations, making them ideal for pH-sensitive applications. Gel discs were formulated using agarose and carrageenan as gelling agents, with glycerol incorporated as cross-linking agent to control dye diffusion. The gel formulations (3% and 5% agarose and carrageenan, with and without 3% glycerol) were optimized based on anthocyanin retention, and pH responsiveness. The indicator gel disc was placed on the surface of the freshly prepared buffalo curd after setting in cups and subjected to accelerated storage conditions (40°C), with colorimetric changes monitored over six hours and correlated with pH measurements of the curd. Results showed a progressive pH decline in buffalo curd, which corresponded with visible color transitions in the gel indicators. A strong correlation was observed between pH decline and color changes, enabling the development of a shelf-life validation chart that translates accelerated storage data into real-time refrigerated conditions (4°C). The results confirmed that carrageenan-based gels exhibited clear color variation, enhancing visibility in industrial applications. The intelligent packaging system developed in this study provides a real-time freshness indicator, improving consumer confidence, and reducing food waste. This research presents a novel approach to validating the shelf life of dairy products and contributes to the advancement of smart food packaging strategies.

Keywords: Buffalo curd, Anthocyanin, Freshness indicator, Intelligent packaging, Shelf-life validation

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Development and Physicochemical Evaluation of Oleoresin based Instant Masala Tea Tablets with Optimized Sensory Standards

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This study aimed to address the limitations of traditional masala tea preparation and existing commercial alternatives by developing oleoresin-based instant masala tea tablets. The research focused on optimizing flavor retention, dissolution efficiency, and sensory appeal using co-crystallization technology. Consumer surveys (n=140) were conducted to assess preferences for masala flavor strength and serving conditions, guiding initial formulations that replaced ground spices with oleoresins. Solvent extraction yielded pepper oleoresin with a 12% yield and a piperine content of 8.50%. Sensory evaluations were conducted with 30 untrained panelists using ranking and nine-point hedonic tests. The first set of formulations showed significant differences ($P < 0.05$) in taste, mouthfeel, and overall acceptability, while the second set revealed significant differences only in overall acceptability. Free-choice profiling (FCP) combined with Generalized Procrustes Analysis (GPA) identified key sensory attributes influencing consumer preferences, explaining 34.97% of the variance across the first and second dimensions. These attributes included aroma, spiciness, sweetness, bitterness, creaminess, and lingering aftertaste. Panelists preferred formulations that balanced spice intensity with subtle sweetness and a creamy texture, particularly highlighting cardamom and ginger notes. The final product exhibited improved physicochemical properties, such as enhanced solubility and reduced sedimentation, while maintaining flavor consistency and extended shelf stability. Accelerated storage tests confirmed the durability of the product under varying conditions. This innovative approach bridges a critical market gap by offering a scalable, high-quality masala tea solution that combines authentic flavor profiles with convenience and portability. The findings contribute to both academic understanding and commercial applications in food science, providing a strong foundation for future product development in the beverage industry.

Keywords: Co-crystallization, Free-choice profiling, Masala tea, Oleoresin, Sensory Evaluation

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Analysis of Functional Properties of Protein Extracted from Horse Gram (*Macrotyloma uniflorum*)

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Horse gram (*Macrotyloma uniflorum*) is an underutilized legume with a high protein content. This study investigates the functional properties of protein extracted from a major horse gram variety cultivated in Sri Lanka and compares them with those of soy protein isolate. The proximate composition analysis of horse gram flour were assessed according to the methods described in AOAC, 2023. The results indicate that horse gram contained 24.71 ± 0.01 % crude protein, 0.77 ± 0.00 % crude fat, 6.76 ± 0.00 % crude fiber, and 3.5 ± 0.00 % ash. The horse gram protein isolate and soy protein isolate exhibited comparable water absorption capacities (1.88–1.92 g/g) and oil absorption capacities (2.03–2.09 g/g). The solubility, foaming capacity, foaming stability, emulsion activity, and emulsion stability of horse gram protein isolate varied significantly ($P < 0.05$) across the pH range of 2–10 compared to soy protein isolate. Notably, horse gram protein isolate demonstrated limited gelation ability in contrast to soy protein isolate. Since the functional properties of horse gram protein isolate owned a considerable value, this study concludes that it can be used as an ingredient in food industry.

Keywords: Horse gram, Soy protein isolate, Protein extraction, Functional properties

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Evaluation of Single-Stage Milling Quality Characteristics of Chili Powder

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Chili powder is a widely used spice, but its quality can be significantly affected by the milling process. Traditional multi-stage milling generates high temperatures, leading to the degradation of volatile compounds responsible for aroma and flavor. This study evaluates the feasibility of replacing multi-stage milling with a single-stage milling system to improve efficiency and product quality. Two chili powder samples, one processed through single-stage milling and the other through multi-stage milling, were analyzed for particle size distribution, color, volatile compound retention, and sensory attributes. Sensory evaluations, including triangle tests, hedonic scale rating tests, and free choice profiling, were conducted with untrained panelists. Results showed that a significant number of panelists could differentiate between the two chili powder samples ($p < 0.05$). While no statistically significant differences were observed in aroma and flavor preference, color preference was higher for the single-stage milled sample ($p = 0.006$). Particle size distribution analysis revealed that multi-stage milling produced finer and more uniform particles, whereas single-stage milling resulted in larger and more heterogeneous particles. Color analysis indicated slightly higher lightness, redness, and yellowness in single-stage milled samples, though differences were not statistically significant. Notably, the single-stage milled sample retained a significantly higher amount of volatile organic compounds compared to the multi-stage milled sample. These findings suggest that single-stage milling can enhance chili powder quality by preserving volatile compounds. However, optimizing moisture content and refining particle size uniformity are necessary to improve its overall sensory appeal and industrial applicability.

Keywords: Chili Powder, Volatile compounds, Single-stage milling, Multi-stage milling, Particle size distribution

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Development of a Lab-based Smart Automation Model for Identifying Customer Nutrient Intake and Quantifying Plate Waste in Large-scale Hotel Buffet Systems

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The hospitality industry faces ongoing challenges in managing food waste and accurately assessing guest nutrient intake, particularly in buffet settings where traditional monitoring methods are labor-intensive and often imprecise. While AI-driven waste-tracking systems and IoT technologies like Smart-Log have shown promise in addressing these issues individually, there remains a lack of integrated solutions that simultaneously monitor nutrient intake and quantify plate waste in buffet environments. This study aimed to design, develop, and validate a lab-based smart automation system that can concurrently track individual guest nutrient intake and measure food waste in large-scale hotel buffet services. The prototype was initially tested in a real buffet setting, focusing on two commonly served dishes—rice and chicken—for targeted refinement. The system consists of three core components: weight sensors, a keypad-based identification system, and an AI-powered image analysis model. Weight sensors were used to measure both the quantity of food served to and left uneaten by each individual, allowing precise tracking of consumption and waste. The keypad system was introduced to uniquely identify each guest, enabling personalized monitoring. These components were connected via an Arduino platform to ensure real-time data collection. To analyze composition of plate waste, a trained teachable machine image classification model ($R^2 = 0.86$; RMSE = 19.11) was employed, successfully identifying discarded food items by type. All collected data were integrated into a custom-developed mobile application, which incorporated a food composition database to calculate and display individual nutrient intake. The app also tracked food waste per guest and across the buffet area, offering users personalized nutritional profiles after each meal. The system encourages healthier eating habits and supports more efficient resource use. This integrated prototype presents a novel and practical approach to reducing food waste and promoting nutrition awareness in the hospitality industry.

Keywords: Food waste, Sensor, Teachable machine, Image processing, Nutrient intake

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Development of Cost-Effective, Energy Dense, Macronutrient Balanced, Blenderized Tube Feeding Formulas for Nutrition Management of Malnourished Adults in Sri Lankan Hospitals

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The high cost of commercially available enteral nutrition formulas has driven the increased use of blenderized tube feeding (BTF) in Sri Lankan hospitals, particularly for managing adult malnutrition. This study aimed to develop cost-effective, energy-dense, and macronutrient-balanced BTF formulas suitable for clinical use. The target was to achieve approximately 1 kcal/ml energy density while aligning with the World Health Organization (WHO) guidelines for macronutrient distribution: carbohydrates (55–75%), fats (15–30%), and proteins (10–15%). Following preliminary trials with different rice forms (cooked raw rice, overnight cooked rice, and cooked roasted rice) to minimize viscosity, roasted white Nadu rice was selected as the carbohydrate base. Three natural, soup-based BTF formulations (F1, F2, F3) were developed using locally available ingredients, including roasted white Nadu rice, dhal, peanuts, milk powder, dates, coconut milk, and cow's milk, guided by the Sri Lanka Food Composition Tables. A fourth formulation (F4) was created using maltodextrin, soy and casein protein isolates, and medium-chain triglyceride (MCT) powders, serving as a potential alternative to commercial powdered enteral formulas. The energy densities achieved were 0.82 kcal/ml (F1), 0.71 kcal/ml (F2), 0.68 kcal/ml (F3), and 1.00 kcal/ml (F4), with macronutrient ratios (carbohydrates: fats: protein) closely adhering to WHO guidelines: 51:30:19 (F1), 50:36:14 (F2), 52:30:18 (F3), and 55:30:15 (F4). All formulas were evaluated for physicochemical, microbiological, rheological, and osmolar properties to assess clinical safety and suitability. The findings highlight the potential of F4 as a cost-effective powdered alternative to imported enteral nutrition products, while demonstrating the feasibility of using locally sourced ingredients to meet hospital nutrition needs in resource-constrained settings. However, further clinical trials are recommended to validate their effectiveness in patient care.

Keywords: Blenderized tube feeding formulas, Energy density, Macronutrients

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Assessment of Nutritional Composition and Glycemic Index of White, Finger Millet and Multigrain Breads

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Glycemic index (GI) is a widely explored concept in research settings and currently gaining popularity due to GI labeling and the development of dietary recommendation strategies. This study aimed to investigate the nutritional composition and GI values of three commercially available bread types: white bread, multigrain bread and finger millet bread. The nutritional composition of breads was analyzed following standard AOAC methods. Eighteen non-diabetic healthy individuals with a BMI of 21.2 ± 1.7 kg/m² and aged 23–28 years participated in the *in vivo* GI study. The studies were conducted following the standard FAO/WHO method, measuring the blood sugar response over a two-hour period from the point of consumption. The nutritional properties of the three bread types varied significantly ($P < 0.05$). White bread exhibited the highest protein content ($8.10 \pm 0.14\%$) along with the lowest moisture ($29.10 \pm 0.14\%$), fat ($2.40 \pm 0.14\%$) and ash content ($1.30 \pm 0.14\%$). In contrast, finger millet bread and multigrain bread contained $7.20 \pm 0.14\%$ and $5.40 \pm 0.00\%$ protein, respectively. Dietary fiber content was not significantly different ($P > 0.05$) between multigrain bread ($3.40 \pm 0.14\%$) and finger millet bread ($3.10 \pm 0.14\%$); however, both were significantly higher than that of white bread ($2.10 \pm 0.14\%$) ($P < 0.05$). Significant differences were also observed in both total carbohydrate content and total available carbohydrate content across bread types ($P < 0.05$). The GI values for white bread, finger millet bread and multigrain bread were 63.93 ± 8.14 , 53.50 ± 4.81 and 45.78 ± 4.14 , respectively. Thus, both finger millet and multigrain breads were classified as low-GI breads compared to the medium-GI white bread, making them suitable for better blood sugar control in healthy individuals and a viable option for diabetic patients in managing blood sugar levels.

Keywords: Glycemic index, Bread, Blood sugar response, Dietary fiber

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Design and Development of a Web Application with an AI-Based Glycemic Load Prediction Model Using Nutritional Composition Data

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Despite the availability of dietary strategies like low Glycemic Index (GI)/Glycemic Load (GL) diets for managing diabetes, there remains a critical gap in translating scientific knowledge into accessible tools for effective dietary management among at-risk populations. The objective of this study was to develop and validate an AI-based GL prediction model integrated into a web application for dietary management among Sri Lankan adults. A dataset of 775 food items, compiled from 106 research papers, was used to train machine learning models. The Random Forest ensemble model achieved the highest accuracy ($R^2 = 0.80$, RMSE = 9.53) and was deployed in a web application built with Angular 17, Python and AWS EC2. The AI model utilized macronutrients; available carbohydrate, protein, fat and dietary fiber composition to predict GL, while the application enabled dynamic adjustments for portion sizes and mixed-meal GL estimation. Usability testing with 40 participants revealed a significant increase in GL awareness (mean difference in knowledge scores: 5.775, $p < 0.05$), with 90% reporting improved confidence in selecting low-GL foods. Expert evaluations (31 respondents) rated the app highly for accuracy, relevance and overall satisfaction (4.65 ± 0.48 , 4.61 ± 0.56 , 4.58 ± 0.5 , $p < 0.05$) respectively. This AI-driven GL prediction is a reliable and effective alternative to traditional GI-based methods and the web application provides individuals and healthcare systems to adopt scalable, data-driven dietary strategies effectively. This framework paves the way for future innovations, such as integrating image detection for automated food recognition to predict GL, further streamlining diabetes management in clinical and community settings.

Keywords: Glycemic load prediction, Glycemic index, Machine learning, Dietary management, Web application

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Formulation and Characterization of a Functional RTS Beverage from Dried Roselle (*Hibiscus sabdariffa*) Calyces: A Study on Phytochemical Content, Quality Attributes, and Consumer Sensory Response

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Hibiscus sabdariffa L. (Roselle) is an underutilized plant in Sri Lanka, belonging to the Malvaceae family. Its calyces are rich in bioactive compounds with significant pharmacological benefits. However, scientifically validated, value-added Roselle products are scarce in Sri Lanka. This study aimed to develop a commercially viable, functional Ready-To-Serve (RTS) Roselle drink, utilizing its potential health benefits to promote local production and consumption. Dried Roselle Calyces were extracted in to water at 90 °C for 10 minutes. Heat treatment was done at 85 °C for 30 minutes. The RTS beverage was formulated by comparing varying amount of dried Roselle calyces with two different levels of sweetener (5% W/V and 8% W/V of sucralose) and compared the control sample with two locally available food flavors (Strawberry and Guava). Sensory evaluation assessed the most acceptability formulation via paired preference test and ranking test. The most acceptable formulation consists of 150 g of dried Roselle calyx, 8% W/V of sucralose and strawberry flavor. It had significantly higher ($p < 0.05$) consumer preference for sensory attributes. Physicochemical analyses were conducted to ensure the stability and palatability of the beverage, reporting values of 1.2°B for TSS, 2.391 ± 0.01 for pH, and 2.27 % for titratable acidity. Phytochemical screening was indicated the positive results for tannin, flavonoids, terpenoids, steroids, anthocyanin, and saponin and given negative results for saponin. The total phenol content was 0.387 ± 0.055 mg/ml GAE, total flavonoids 237.2 ± 1.78 µg/mL RE, and antioxidant activity 811.16 ± 2.75 µg/ml of the RTS. The shelf life study, conducted under ambient temperature conditions, indicated that the beverage remained stable and free from significant spoilage for 28 days. The results suggest that the Roselle calyx based RTS beverage provides health benefits without compromising taste and quality.

Keywords: RTS beverage, Dried Roselle calyx, Physiochemical properties, Bioactive compound, Functional food

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Evaluation of the Impact of Selected Rice Based Diets on Postprandial Blood Glucose Levels in Healthy Sri Lankan Adults

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This study evaluated the Glycemic Index (GI) values of commonly consumed Sri Lankan rice-based dishes prepared using three novel rice varieties: CIC Savandara-Mix, CIC Super Kernel, and CIC Red Fragrant (Broken). Standard recipes were used to prepare selected rice-based dishes, including milk rice (*kiribath*), *diyabath* (a traditional cold rice soup), rice porridge, and fried rice. The proximate composition of these dishes was analyzed using selected AOAC methods, and *in vivo* GI values were determined using a group of twenty-five healthy volunteers. The results indicated that CIC Savandara-Mix rice had a medium GI (58 ± 8.4), while dishes prepared from this rice variety exhibited low GI values: milk rice (51 ± 5.0) and *Diyabath* (40 ± 5.8). Similarly, fried rice prepared using CIC Super Kernel rice showed a low GI (40 ± 5.0). In contrast, CIC Red Fragrant (Broken) rice was categorized as a medium GI food (67 ± 6.8), along with its derived dishes: broken rice porridge (62 ± 10.6) and string hoppers with coconut gravy (served as a mixed meal; 59 ± 9.1). Additionally, the study explored the potential of commercially available *Katta sambol* as a carrier food in GI testing. No statistically significant difference ($p < 0.05$) was observed between the GI values of milk rice (CIC Savandara-Mix; 51 ± 5.0) and the same dish served with a minimal sufficient amount of *Katta sambol* (50 ± 6.5). This finding suggests that *Katta sambol* may be a viable accompaniment for GI studies, warranting further research. These results provide valuable insights for dietary recommendations aimed at preventing type 2 diabetes among Sri Lankans by incorporating contextually relevant local cooking and dietary practices.

Keywords: Glycemic Index, Rice, Rice based dishes, Sri Lankan dishes

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Firmness Matters: Strategies to Prevent Seasonal Softening in Pickled Gherkin

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The softening of pickled gherkins during certain seasons poses a major challenge in maintaining product quality, affecting their texture, consumer satisfaction, and shelf life. This study explores the key factors behind gherkin softening by examining the effect of temperature changes, calcium levels, enzymatic activity, mineral composition, and presence of microorganism. A detailed approach was used to measure calcium concentration, firmness, enzyme activity, and microbial populations under different seasonal conditions. Microscopic analysis of gherkin cell walls revealed that structural breakdown was linked to higher temperatures and rainfall fluctuations. Calcium was found to be essential in preserving firmness, as lower calcium levels weakened pectin cross-linking, leading to increased pectin dissolution in the brine. Further mineral composition analysis showed that an excess of potassium and magnesium created competition for calcium, intensifying the softening effect. The study also identified spoilage-related microorganisms, including pectinolytic fungi that contributed to softening by producing enzymes capable of breaking down cell wall components. The results of experiments have shown the impact of temperature on softening issue at the production. To counteract seasonal softening, targeted strategies such as calcium fortification, controlled fermentation conditions, and improved temperature regulation during processing and storage are recommended. Additionally, enhanced microbial management including better brine sanitation and antimicrobial treatments can help to slow down enzymatic degradation. These findings offer valuable insights for the pickling industry, emphasizing the importance of a multi-pronged approach to maintaining gherkin firmness, ensure long-term product stability, and improved consumer satisfaction.

Keywords: Gherkin, Softening, Calcium, Pectin, Seasonal

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Development and Quality Assessment of Cold Brew Coffee Formulation.

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Cold brew coffee has gained significant popularity as a smooth, less acidic alternative to traditional hot-brewed coffee. This study aimed to develop and commercialize a high quality cold brew coffee formulation with optimized sensory attributes, extended shelf-life, and a scalable production process. This study successfully achieved its overall objective of developing a final product that aligns with consumer preferences while ensuring consistency and stability in commercial-scale production. Specifically, the research led to the optimization of the formulation to enhance key sensory attributes such as taste, aroma, and texture. High quality Arabica coffee beans were selected from local suppliers, and the brewing process was standardized at 8 °C (1:14 coffee-to-water ratio, 14-hour extraction). Chemical analysis revealed an extraction yield of $18.6 \pm 0.5\%$, pH of 4.85 ± 0.02 , and titratable acidity of 0.65 ± 0.03 g/100ml. Sensory evaluations indicated a strong consumer preference for city-roasted coffee, with 85% of panelists favoring its flavor complexity and smoothness. Full city-roasted coffee exhibited higher total dissolved solids (4.2 ± 0.1 g/l) and a bolder taste. Shelf life enhancement was validated through microbial analyses conducted pre and post pasteurization (at 62°C for 22 min), while the study also resulted in the development of a scalable brewing process and suitable packaging solutions. The study concluded that cold brew coffee production is viable for commercialization. Recommendations include refining extraction parameters, ensuring microbial stability.

Keywords: Sensory evaluation, Extraction yield, Titratable acidity, Microbial safety, Total dissolved solids

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Evaluation of Physicochemical and Functional Properties of Value-added *Pentadesma butyracea* Fat Spreads and, Shelf-life Assessment

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The African butter tree (*Pentadesma butyracea*), native to West Africa, produces fat from its seed kernels with potential applications in the food industry. This study evaluated the physicochemical, functional, and storage stability properties of two value-added *Pentadesma butyracea* fat spreads. One formulation (FG) contained *Pentadesma* fat, black pepper powder, garlic powder, dried oregano leaves, and salt, while the other (FC) included *Pentadesma* fat, roasted chili powder, sugar, and salt. Proximate composition, heavy metal content, antioxidant properties [total polyphenol content (TPC), total flavonoid content (TFC), DPPH radical scavenging activity, and ferric reducing antioxidant power (FRAP)], and microbiological parameters (total plate count, yeast and mold, and total coliform) were analyzed. A shelf-life study was conducted over two months using microbial analysis and sensory evaluation. The total fat, moisture, crude protein, ash, crude fiber, carbohydrate, and salt (NaCl%) content for FG were, $90.12 \pm 0.03\%$, $0.11 \pm 0.02\%$, $1.78 \pm 0.01\%$, $1.08 \pm 0.07\%$, $5.21 \pm 0.07\%$, 1.70% , $1.50 \pm 0.03\%$, respectively and for FC, those values were, $92.27 \pm 0.03\%$, $0.15 \pm 0.01\%$, $1.28 \pm 0.01\%$, $2.83 \pm 0.12\%$, $2.82 \pm 0.07\%$, 0.66% , $3.88 \pm 0.02\%$, respectively. TPC was 0.83 ± 0.02 and 1.10 ± 0.02 mg GAE/g for FG and FC, respectively, while TFC was 35.61 ± 0.27 and 26.58 ± 0.20 $\mu\text{g QE/g}$. DPPH radical scavenging activity was 35.44 ± 0.10 $\mu\text{g TE/g}$ (FG) and 36.19 ± 0.03 $\mu\text{g TE/g}$ (FC), while FRAP values were 1.36 ± 0.02 mg TE/g (FG) and 1.33 ± 0.01 mg TE/g (FC). Heavy metals (As, Cd, Hg, Pb) were undetectable. Microbial counts for both formulations remained within acceptable limits throughout storage, with no coliform detected. Sensory attributes remained stable over two months ($P < 0.05$). These findings indicate these two fat spreads are microbiologically safe, nutritionally beneficial, and shelf-stable for at least two months.

Keywords: Fat spreads, Antioxidant properties, Shelf-life, Sensory attributes

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Assessment of Microbiological and Sensory Quality of Lettuce, Cabbage and Gotukola Subjected to Different Disinfection Treatments

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Ensuring the microbiological safety and sensory acceptability of fresh leafy vegetables is essential for consumer health and marketability. This study evaluates the effects of four disinfection treatments; 0.1% citric acid, 2% salt water, 2% vinegar (acetic acid), and 100mg/L chlorinated water, on the microbiological quality and sensory attributes of lettuce, cabbage, and gotukola. The objective was to determine the most effective treatment for reducing microbial load while maintaining desirable sensory properties. The methodology involved treating vegetable samples with the specified disinfectants, followed by sensory and microbiological analyses. Sensory evaluation included triangle tests, ranking tests, nine-point hedonic scaling, and free-choice profiling, conducted with untrained panelists. Microbiological quality was assessed using total plate count (TPC) analysis with the pour plate technique, where samples were incubated at 35°C for 24, 48, and 72 hours, and microbial load was recorded. Results indicated that 0.1% citric acid achieved the highest microbial reduction (99.9%), followed by chlorinated water (99.8%), acetic acid (99.6%), while salt water was least effective (38.7%-55.5%). Sensory analysis showed that citric acid-treated samples were generally well-accepted, while chlorinated water had the lowest preference across all vegetables. Cabbage showed significant sensory differences across treatments, with citric acid ranking the highest, whereas salt water and acetic acid were least preferred. Free-choice profiling revealed that citric acid and chlorinated water had distinct sensory descriptors, with citric acid being favored for its freshness and mild taste. In conclusion, 0.1% citric acid emerged as the most effective treatment, offering both high microbial reduction and acceptable sensory quality. This study highlights its potential as a natural, safe, and consumer-preferred disinfectant for fresh produce, balancing food safety and sensory acceptability more effectively than conventional treatments.

Keywords: Food safety, Sensory evaluation, Lettuce, Gotukola, Cabbage

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Impact of Rice Flour Particle Size on Its Physical Characteristics and Preference for Sensory Attributes of String Hoppers

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The particle size of rice flour plays a crucial role in its functional properties, but its effect on the quality of traditional string hoppers is not well understood. This study explored the impact of rice flour particle size (<63 µm and 100–200 µm) and initial moisture content (6% and 15%) of raw rice on the physical properties of the flour and the sensory characteristics of string hoppers. Red raw rice was milled following standardized procedures, sieved into separate particle size fractions, and evaluated for water absorption capacity, swelling capacity, and viscosity. A thorough sensory evaluation was carried out using ranking tests with both untrained (n=30) and trained (n=5) panels, assessing six key attributes: color, aroma, firmness, flavor, stickiness, and overall acceptability. The results indicated that rice flour with a particle size of <63 µm and 6% moisture content exhibited the highest water absorption capacity ($P<0.05$), which is essential for effective dough hydration and extrusion processing. There were no significant ($P>0.05$) differences in swelling capacity across particle sizes, suggesting that gelatinization properties were minimally impacted. Viscosity measurements showed significant ($P<0.05$) differences, with finer particles demonstrating optimal pseudoplastic behavior, which is ideal for dough formation and uniform strand consistency. Sensory evaluation revealed a clear preference for <63 µm flour, attributed to its smooth texture, consistent strand formation, and improved mouthfeel. Retrogradation studies conducted over four hours after preparation showed that finer particle formulations retained better firmness. Microscopic analysis confirmed the uniform structure of <63 µm flour, which explains its superior hydration and textural properties. These results emphasize that reducing particle size (<63 µm) and controlling moisture content (6%) significantly enhance both functional and sensory qualities. For industrial applications, specialized fine-milling techniques, such as jet milling with classifier systems, are recommended to achieve a consistent particle size distribution. This research addresses a critical knowledge gap in traditional food science, providing evidence-based solutions to improve production efficiency while maintaining the sensory authenticity of this cultural staple.

Keywords: Rice flour, Particle size, String hopper, Sensory evaluation, Moisture content

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Comprehensive Assessment of Product Quality in Single-Stage Milling of Curry Powder Mixtures

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The milling process significantly influences the quality of spice mixtures, particularly in industrial curry powder production. This study evaluated the effectiveness of single-stage milling using moisture-reduced raw materials as an alternative to multi-stage milling, which generates excessive heat, leading to volatile aroma and flavor loss. The research was conducted at Ruhunu Foods (Pvt) Ltd, assessing the energy efficiency of the process, physicochemical properties of resulting curry powders and its sensory attributes. The study involved three key stages, sample preparation (where the initial moisture content of raw materials was reduced before milling by using dehumidified air), evaluation of the milling process (assessing energy consumption, throughput, and efficiency) and comparison of physicochemical and sensory properties between curry powder samples. Chemical analysis measured volatile compounds, while color and particle size distribution were analyzed using a colorimeter and sieve set. Sensory attributes were evaluated through triangle tests, hedonic rating scales, and free choice profiling. Key findings showed that single-stage milling retained more volatile compounds (0.33 ml/100 g) compared to multi-stage milling (0.29 ml/100 g). Single-stage milling process had power requirement of 19.8 kW and a throughput of 105 kg/h. It also produced a finer, more uniform powder, while multi-stage milling resulted in lighter color ($L = 71.99 \pm 0.0801$) but coarser texture. Sensory analysis favored single-stage milled samples for their enhanced aroma and flavor retention. The results suggest that adopting single-stage milling with controlled moisture levels can enhance product quality while improving process efficiency. Therefore, this study recommends industrial application of single-stage milling in spice processing to optimize flavor retention and cost-effectiveness.

Keywords: Single-stage Milling, Multi-stage Milling, Curry Powder, Volatile Compounds, Sensory Analysis.

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Promoting the Utilization of *Kappaphycus alvarezii* (Doty Doty) Brown Algae: Disinfection, Deodorisation, and Quality Evaluation Through Chemical and Physical Treatments

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Kappaphycus alvarezii (Doty Doty) is a marine alga rich in nutrients and bioactive compounds. However, the strong unpleasant oceanic (fishy) odour limits its applications in food products specially when consumed in fresh form. In this study, four surface disinfection treatments and two deodorising treatments were introduced for *K. alvarezii* as treatment combinations to deodorise and improve its microbiological quality in order to promote its fresh consumption in Sri Lanka. The sensory and microbiological quality of *K. alvarezii* were evaluated after the treatments using sensory evaluations (Triangle tests, Nine-point Hedonic tests, Preference Ranking tests, Free Choice Profiling tests) and microbiological tests (Total Plate Count, Halophilic Bacteria Count). Disinfection treatments were; blanching (at 80°C for 60 seconds), chlorination (100 ppm for 10 minutes), addition of lime juice (3% v/v for 10 minutes), salt (2% w/w) and vinegar (1% v/v). Deodorisation treatments were; green tea, and ethanol (20% v/v). All eight treatment combinations showed a significant ($p < 0.05$) deodorization of *K. alvarezii* compared to the untreated algae in the triangle sensory tests and it can be recommended equally for deodorization purpose. In the Hedonic test, the odour difference among the treatment combinations were not significantly ($p > 0.05$) different. But the colour of the treated algae showed a significant ($p < 0.05$) difference between the treatments. Blanching and green tea soak treatment combination and lime juice and ethanol treatment combinations were most preferred by the sensory panellists in terms of the colour. Ethanol treatments had changed the flavour of the algae significantly ($p < 0.05$). However, all the disinfection treatments lowered the microbial load below the threshold level (10^5 CFU/g). Therefore, all the disinfection treatments were effective to improve the microbiological safety of fresh *K. alvarezii*. Results of this study support the raw consumption of *Kappaphycus alvarezii*, an alga commercially cultivated in Sri Lanka after treating with the tested disinfections.

Keywords: *Kappaphycus alvarezii*, Deodorisation, Disinfection, Sensory quality, Microbiological quality

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Impact of Gamma Irradiation on Quality and Shelf Life of White Raw Rice Packaged under Vacuum Conditions

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Gamma irradiation is a widely accepted innovative technology. This study was carried out to evaluate the effect of different gamma irradiation doses on physical parameters and microbial quality of White Raw Rice in Sri Lanka, packaged under vacuum conditions. Freshly milled White Raw Rice samples were collected from different milling centers and were irradiated at doses of 0 kGy, 1 kGy, 3 kGy and 5 kGy by industrial Co-60 gamma irradiator. Under physical parameters, water activity and colour (in the Hunter colour scale) were measured for each treatment. Under microbial safety, total Yeast and Mould count was measured. All treatments were duplicated. The highest water activity of vacuum-packed irradiated raw rice just after irradiation was 0.65 ± 0.05 and the lowest was 0.62 ± 0.03 . The highest water activity of raw rice one month after irradiation was 0.65 ± 0.04 and the lowest was 0.64 ± 0.04 . Mean "L" values of colour were not significantly different ($P > 0.05$) from the control sample. Irradiation significantly affected the 'a' and 'b' values, as well as the Chroma and Hue values ($p < 0.05$) across all treated samples. The average Yeast and Mould counts in the control sample of raw rice just after irradiation was $1.74 \times 10^4 \pm 2.26 \times 10^4$ CFU/g, and after one month of irradiation was $3.57 \times 10^4 \pm 4.0 \times 10^4$ CFU/g, where irradiated samples showed a drastic reduction with the dose. All irradiated samples showed a significant reduction ($p < 0.05$) of yeast and mould counts in both just after and one month after irradiation. It is concluded that the 3 kGy is better for microbial safety while preserving the physical properties. To further validate these findings, long-term studies should be conducted for at least one year to assess the stability of irradiated rice over extended storage periods. Additionally, future research should evaluate the sensory properties of irradiated rice to determine consumer acceptability.

Keywords: White raw rice, Gamma irradiation, Shelf life, Microbial safety, Vacuum packaging

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Regulatory Non-compliances, Quality Issues and Challenges in Made Tea Exportation

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Sri Lanka has long been a global leader in tea exports, playing a crucial role in the country's economy. However, in recent years, the industry has faced multiple challenges, including regulatory inefficiencies, financial constraints, and quality control issues. This study aims to analyze and rank these challenges and propose strategic recommendations to facilitate the export processes to enhance Sri Lanka's competitiveness in the global tea market. A mixed-methods approach was employed, combining quantitative surveys with qualitative insights from industry experts. Structured surveys were conducted with four Sri Lankan tea exporters, and data were analyzed using frequency analysis, mean ranking, and non-parametric statistical methods. Additionally, qualitative feedback from key stakeholders provided deeper insights into industry pain points and potential solutions. The findings reveal that documentation delays, strict regulations, high taxation policies, and currency instability are among the top challenges affecting exporters. While Sri Lanka maintains high standards for tea exports, ground-level quality control remains an issue with concerns such as mold and yeast contamination. Additionally, exporters emphasized the need for improved government support, enhanced trade policies, and streamlined export procedures to maintain Sri Lanka's position as a leading global tea supplier. Key recommendations include digitalizing export approval processes, reducing tax burdens, strengthening SME support, and enhancing Sri Lanka's tea branding globally. This research provides valuable insights for policymakers, industry stakeholders, and exporters, offering a data-driven and industry-informed roadmap for revitalizing Sri Lanka's tea sector and ensuring long-term sustainability in an increasingly competitive global market.

Keywords: Sri Lanka tea export, Regulatory challenges, Quality control, Financial constraints, Mixed method approach

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Effect of Ripening Stages on Antioxidant Properties, Resistant Starch Content and *In-Vivo* Glycemic Index of Three Commonly Consumed Banana Varieties in Sri Lanka

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Banana (*Musa* spp.) is considered as a staple fruit in Sri Lanka and widely consumed due to their taste, nutritional benefits and bioactive compounds. A comprehensive non-destructive and destructive assessment of banana fruits were conducted using most commonly consumed varieties in Sri Lanka, *Seeni*, *Embul* and *Kolikuttu* by analyzing their physical, chemical parameters and bioactive compounds at three distinct ripening stages; green-yellow stage, yellow with green tips stage and fully yellow stages. The aim of this study was to investigate the effect of ripening stage on bioactive compounds, *in-vivo* glycemic index (GI) and antioxidant properties of three banana varieties cultivated in Sri Lanka. The results revealed significant changes in biochemical composition during ripening. Resistant starch (RS) content of *Seeni* banana (1.84 ± 0.28 g/100 g fresh weight) was significantly lower ($p < 0.05$) than other two varieties at fully yellow ripening stage. However, *Kolikuttu* variety comprised highest digestible starch (DS) content of 3.26 ± 0.35 g/100 g fresh weight and total starch of 6.33 ± 0.35 g/100 g fresh weight at the same stage. *In-vivo* glycemic response evaluation shown that the GI varied significantly ($p < 0.05$) between varieties and ripening stages. *Seeni* bananas exhibited the highest GI at the fully yellow stage as 56.62 ± 4.67 , while *Embul* and *Kolikuttu* varieties exhibited lower GI of 52.26 ± 4.76 and 52.17 ± 4.33 , respectively. At the yellow with green tips ripening stage, all varieties exhibited significantly lower ($p < 0.05$) GI as, *Seeni*: 43.22 ± 1.97 , *Embul*: 41.08 ± 4.04 , *Kolikuttu*: 37.86 ± 2.51 , making them a preferable choice for diabetics and health-conscious consumers. Total phenolic content (TPC) was highest in *Embul* and *Kolikuttu* varieties at fully yellow stage of 387.36 ± 2.88 mg GAE/100 g and 389.60 ± 15.30 mg GAE/100 g, respectively. Pearson's correlation analysis further confirmed significant ($p < 0.05$) associations between starch fractions, sugar levels, and GI with the a^* value, firmness and fruit density. The study's findings provide critical insights for dietary recommendations, supporting the consumption of bananas at specific ripening stages to optimize glycemic control, offering a foundation for future innovations in metabolic health management.

Keywords: Glycemic index, Banana ripening, Resistant starch, Antioxidants, Diabetics

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Investigation of Morphological, Structural and Physicochemical Properties of Starch and Flour Extracted from Madu (*Cycas* sp.) Grown in Sri Lanka

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Cycas sp. is an underutilized carbohydrate source in Sri Lanka with the potential of contributing to the human diet. The flour and starch extracted from *Cycas* can serve as functional food ingredients and as alternatives to conventional starch sources. This study aimed to characterize *Cycas* starch and flour in terms of structural, physicochemical, and morphological properties. The nutritional composition of *Cycas* starch revealed a low crude protein ($0.70 \pm 0.02\%$), crude fat ($0.27 \pm 0.06\%$), and ash ($0.23 \pm 0.01\%$) content, indicating a higher purity. The flour was found to be a rich source of carbohydrates ($62.13 \pm 2.49\%$), protein ($13.07 \pm 0.36\%$), fat ($1.09 \pm 0.12\%$), fiber ($1.47 \pm 0.27\%$), and ash ($2.16 \pm 0.00\%$) content. The moisture content of the flour and starch was $11.97 \pm 0.04\%$ and $8.23 \pm 0.54\%$, respectively. Light microscopy revealed that the starch granules were round, with diameters ranging from 0.68 to 1.72 μm . The FT-IR spectrum of *Cycas* was identical to that of starch, confirming its carbohydrate nature. The starch had an amylose content of $15.89 \pm 2.62\%$, a bulk density of 0.56 ± 0.00 g/ml, and a pH of 7.28 ± 0.06 . In comparison, the flour had a bulk density of 0.71 ± 0.00 g/ml and a pH of 6.08 ± 0.07 . The L^* value (97.51 ± 0.41) of starch indicated satisfactory whiteness, whereas the flour exhibited a higher b^* value (8.8 ± 0.16), suggesting a yellowish tone. The water and oil holding capacities of starch were 1.39 ± 0.09 g/g and 1.15 ± 0.18 g/g, while those of the flour were 0.78 ± 0.13 g/g and 1.33 ± 0.08 g/g, respectively. Solubility of both starch and flour increased with temperature, reaching its highest at 80 °C, with flour showing greater solubility than starch. A similar trend was observed for swelling power in both starch and flour. The study shows that underutilized flour and starch from *Cycas* sp. have the potential to be used in the food industry, as they have physicochemical and functional properties suitable for food applications.

Keywords: *Cycas* sp., Morphology, Physiochemical properties, Starch, Underutilized crop

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Developing a Fermented Nut Spread with Enhanced Nutritional and Functional Properties using Peanut, Soybean and Velvet Bean

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Peanut butter is a widely consumed spread valued for its nutritional properties; however, its relatively high cost and distinct beany flavor can limit consumer acceptance. This study aimed to formulate a cost-effective, nutritionally enhanced alternative by incorporating soybean (*Glycine max*) and velvet bean (*Mucuna pruriens*) with peanuts to improve affordability and nutrient profile while maintaining desirable sensory characteristics. Peanut, soybean, and velvet beans (40:40:20 w/w) were fermented together for 24 hours using the starter culture containing *Lactobacillus bulgaricus* and *Streptococcus thermophiles*. The beans were then thoroughly washed and dried at 55 °C for 10 hours, followed by roasting at 180 °C. The beans were milled using a colloidal mill to obtain the nut spread. Microbial safety of the final product was tested using the total plate count. Consumer preference was evaluated using a 5-point hedonic scale, comparing the fermented spread to a control (non-fermented spread). The nutritional composition was determined using proximate analysis. Physicochemical parameters including pH, total soluble solids (TSS), water activity, color, and texture profile were assessed and compared with the control followed by determination of antioxidant properties. Results showed that the protein content in the fermented sample ($37.98 \pm 0.16\%$) was higher compared to the non-fermented ($36.45 \pm 1.75\%$) and commercial peanut butter ($22.5 \pm 1.44\%$). Fat content was found as $29.71 \pm 1.21\%$ (fermented), $28.61 \pm 1.10\%$ (non-fermented), and $32.33 \pm 2.08\%$ (commercial). The pH of the fermented spread was 5.48 ± 0.23 , compared to 6.10 ± 0.21 in the control. TSS values were 68.9 ± 0.6 and 68.5 ± 0.7 , while both samples had equal water activity (0.717 ± 0.042). Texture parameters showed improved spreadability. Total phenolic content of the fermented spread was 9.33 ± 1.04 mg GAE/g DW with a DPPH radical scavenging activity of $76.50 \pm 2.76\%$. The developed fermented nut spread exhibited elevated protein levels with a comparable fat content to commercial peanut butter, and enhanced antioxidant and physicochemical properties compared to the non-fermented sample.

Keywords: Fermented nut spread, Soybean, Velvet bean, physicochemical properties

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Development of *Kappaphycus alvarezii* Seaweed-Chitosan Based Biopolymer Film: Effect of Coconut Water and Coconut Vinegar Incorporation

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Due to the growing environmental concerns associated with petroleum-based plastics, investigating sustainable, biodegradable alternatives for packaging materials has become crucial. Therefore, this study explores the development of biopolymer films with *Kappaphycus alvarezii* whole seaweed gel, rich in carrageenan, and chitosan, a biopolymer derived from chitin. Further, it investigates the effects of incorporating mature coconut water (CW) and coconut vinegar (CV) as natural solvents. Films were fabricated using an optimized 9:1 ratio (v/v) of *K. alvarezii* gel (2% w/v seaweed) to chitosan solution (1% w/v in 2% acetic acid). CW and CV were incorporated separately at percentages ranging from 10% to 50% (v/v). The resulting films were characterized for thickness, transparency, water vapor permeability, tensile strength and, elongation at break (EAB). Results indicated that both solvent types and percentage significantly influenced film properties ($P < 0.05$). Increasing the percentage of either CW or CV led to significant increases ($P < 0.05$) in the film thickness, solubility, and WVP, while decreasing transparency and tensile strength. Compared to CW, CV incorporation resulted in significantly thicker, more soluble films with higher WVP, but significantly lower ($P < 0.05$) tensile strength and lower EAB. Specifically, 10% CV yielded the highest tensile strength (7.47 ± 0.94 MPa) with the lowest elongation ($3.75 \pm 0.86\%$), while 50% CV produced the thickest (0.17 ± 0 mm), least transparent, and most permeable films. CW incorporation resulted in films with higher EAB and lower WVP compared to CV based films at equivalent percentages. In conclusion, incorporating CW or CV into *K. alvarezii*-chitosan films allows for specific property variation, where CW mainly improved EAB, while CV increased thickness, WVP, and solubility but decreased tensile strength and flexibility, especially at higher percentages.

Keywords: *Kappaphycus alvarezii* Seaweed, Chitosan, Coconut water, Coconut vinegar, Composite film

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Development of a Tuna Broth Incorporated with Crude Mung Bean (*Vigna radiata*) Extract: Assessing the Effect on the Histamine Content

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Histamine is a biogenic amine formed in fish due to bacterial activity that causes food poisoning when its concentration exceeds 100 ppm. The Diamine Oxidase (DAO) enzyme in legume sprouts provides a method for reducing histamine concentration to a safe level. Thus, this study aimed to develop a tuna broth incorporating crude mung bean (*Vigna radiata*) extract to reduce the potential histamine content. The optimal conditions for histamine reduction were tested, and proved that incubation time of 30 minutes, a pH of 7, and a temperature of 37°C. Mung bean sprouts were harvested at 5, 7, and 9 days of age, and their crude extracts were prepared and tested for their histamine degradation using a standard histamine solution. Optimal age of sprouts and percentage of mung bean crude extract were determined to histamine reduction. Tuna broth was prepared by incorporating the selected mung bean extract. The results of two-way ANOVA analysis showed that the interactions of age of mung bean sprouts, and percentage of crude extract on histamine reduction was significant ($P < 0.05$). Tukey's post-hoc test showed that combination of 7 day old, 20% crude extract produced the highest histamine reduction. This proved the best combination to minimize histamine concentrations, 25% reduction from 7,89 ppm to 5,92 ppm in tuna broth.

Keywords: Tuna Broth, Diamine Oxidase, Mung Bean, Histamine, *Vigna radiata*

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Valorization of Coconut Milk Press Cake: A Novel Approach for Protein Bar Development

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Coconut milk press cake (CMPC) is a by-product of coconut milk processing and a potential source of edible protein. This study explored the extraction of high- quality protein ($59.43 \pm 0.61\%$) from CMPC using alkaline extraction followed by isoelectric precipitation. The extracted protein was then used to develop a protein bar as a food application. Three formulations (PBF1, PBF2, PBF3) were developed with different sweeteners: brown sugar, honey, and dates. Sensory evaluation assessed aroma, flavor, texture, and overall acceptability. Based on sensory acceptability and physicochemical properties, PBF1 was selected for further evaluation. The CMPC contained moisture ($0.83 \pm 0.25\%$), fat ($39.06 \pm 2.27\%$), and protein ($19.14 \pm 1.77\%$). The physicochemical properties of PBF1 were recorded as color ($L^* = 75.69 \pm 0.43$, $a^* = -0.06 \pm 0.57$, $b^* = -1.55 \pm 0.64$), pH (4.87 ± 0.04), hardness ($2.35 \pm 0.45\text{N}$), water activity (0.73 ± 0.01), and bulk density ($1.37 \pm 0.31 \text{ g/cm}^3$). The proximate composition of PBF1 included moisture ($4.16 \pm 0.44\%$), fat ($23.76 \pm 1.55\%$), protein ($15.77 \pm 0.61\%$), ash ($1.87 \pm 0.33\%$), fiber ($3.14 \pm 0.42\%$), carbohydrates ($51.31 \pm 1.60\%$), and an energy value of 482.12 kcal/100g . PBF1 met the requirements of a protein source under EU Regulation 1924/2006. Sensory evaluation showed significant differences ($P < 0.05$) in aroma, flavor, and overall acceptability, while texture differences were not significant ($P > 0.05$). This study confirms that protein can be effectively extracted from CMPC using alkaline extraction. This offers a sustainable way to utilize coconut industry by-products and the extracted protein has potential applications in various food products.

Keywords: Coconut milk press cake, Alkaline extraction, Protein, Protein bar

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Development of Bio-Based Coating Methods to Reduce Sprouting and Weight Loss of Potato

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The potato (*Solanum tuberosum* L.) is one of the most widely consumed food in the world. Problems related to potatoes in the postharvest stage are weight loss and sprouting that cause significant economic losses. This research was carried out to enhance the postharvest shelf life of potatoes by developing bio-based coating methods to minimize weight loss and prevent sprouting. Potatoes were treated with four coating formulations, including neem oil (NM), aloe vera (AV), chitosan (CT), and control (CON) without any treatment. The coated potato tubers were stored under ambient conditions with an average temperature of 25 °C and 80% relative humidity. Potato Samples were stored 5 weeks in corrugated cardboard boxes. Data on moisture content, carbon dioxide production rate, physiological weight loss, disease incidence, disease severity, sprouting incidence, and firmness were collected in weekly intervals. Sensory analysis was carried out at the end of the storage period. Aloe vera coating showed the highest moisture content (81.40%), lowest carbon dioxide production rate (0.08%), lowest physiological weight loss (0.26%), lack of disease incidence, minimized disease severity, lowest sprouting incidence (0.87%), and highest firmness (190.22 N). The results of this study concluded that AV was the optimal bio-based coating method for extending shelf life and reducing postharvest losses of potatoes.

Keywords: Aloe vera, Neem, Chitosan, Bio-based coating, Postharvest

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Development of Probiotic Rich Rice-Based Non-Dairy Yoghurt Analogue Using *Lactobacillus plantarum* and *Lacticaseibacillus rhamnosus* GG: A Novel Food Innovation

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The development of a rice-based yoghurt analogue (RBYA) has emerged in response to the growing demand for plant-based yoghurt alternatives, mainly due to individuals with plant based diet and individuals with milk allergies. After conducting a sensory analysis best rice variety was selected for the development of three treatments based on the culture, only *Lactobacillus plantarum* (T1), only *Lacticaseibacillus rhamnosus* GG (T2) and the combination (T3). The physicochemical properties of T1, T2, and T3 were analyzed. There was no significant difference ($p>0.05$) in pH among treatments but with the time, there was a significant difference ($p<0.05$). Water holding capacity of individual product significantly differ ($p<0.05$) with the time but there was no significant difference ($p>0.05$) between treatment. Total soluble solid, titratable acidity did not significantly differ ($p>0.05$) with time or within treatments. Hardness (cycle 1) of T1, T2 and T3 were 88.00 g, 60.00 g, 111.00 g respectively and hardness (cycle 2) of T1, T2, and T3 were 69.00 g, 46.00 g, and 73.00 g respectively. Adhesiveness of T1, T2, and T3 were 3.4 mJ, 2.3 mJ, 3.3 mJ respectively. Microbial analysis was conducted for *Lactobacillus* bacteria, yeast and mold using MRS agar and PDA agar media. Proximate analysis of all three treatments didn't show significant difference among them. Shelf life was decided on physicochemical and microbial analysis observations and it was 14 days. As future directions hope to develop this product further using flavor and preservatives. As conclusion production of RBYA was conducted successfully.

Key words: Rice based, Yoghurt analogue, Fermentation, Dairy free, Probiotics

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Detection of Rice Flour Adulteration in Turmeric Powder using Laboratory Methods and Development of an AI based Tool

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Turmeric powder is widely used for its culinary and medicinal properties; however, its adulteration with substances similar to properties of pure turmeric powder poses significant concerns regarding quality, authenticity, and consumer health. This study aimed to develop an AI based tool for detecting rice flour adulteration in turmeric powder by combining chemical, sensory and microscopic analysis. A consumer survey was conducted to evaluate public awareness regarding turmeric adulteration as a pre study. Pure turmeric powder was mixed with rice flour (0.1, 0.5, 1, 2.5, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, and 100 % (w/w)) to create a series of rice flour adulterated turmeric powder samples. The starch iodine complex formation was employed by iodine test, while sensory evaluation assessed changes in color due to rice flour adulteration in turmeric powder. Microscopic image analysis was utilized to differentiate rice flour adulterated turmeric powder from pure turmeric powder based on presence of rice flour granules. Survey results showed that the majority of respondents were aware of turmeric adulteration. Results of the iodine test showed its suitability for detecting rice flour adulteration in turmeric powder in laboratory scale. The AI based tool enabled rapid and accessible adulteration detection. The findings of this study contribute to enhancing food quality assurance and promoting consumer health by addressing common adulteration practices in turmeric powder.

Keywords: Adulteration, AI based tool, Starch iodine complex formation, Sensory analysis, Consumer awareness

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Development of a Tropical Fruit-Based Salsa Dip, Physicochemical Analysis and Microbial Safety

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Tropical fruit-based condiments are gaining popularity due to their exotic flavor and potential health-promoting properties. The current research was directed towards the development, formulation, and evaluation of a tropical salsa dip with mango, pineapple, onion, and green chili as principal ingredients, Cumin powder as a flavoring agent, and Ascorbic acid as a preservative. The research focused on the optimization of the formulation, microbiological stability, and establishment of the physicochemical and sensory characteristics of the product for commercialization. The development process involved the selection of raw materials, recipe creation, balancing the ratio, sensory analysis, and physicochemical and microbiological analysis. Three products were formulated and were evaluated for sensory testing to determine consumer acceptance. The best-ranked mixture was selected for further testing. Pasteurization between 90-95°C was employed for creating microbial stability and extending the shelf life. Thorough physicochemical and proximate analysis were conducted to examine moisture content, pH, acidity, and other key quality attributes. Microbiological stability was examined through microbial growth observation at 7-day intervals for 5 weeks, at 1-day intervals for 6 days under refrigeration after opening, and after incubation for 7 days at 37°C to simulate possible temperature abuse. Results revealed that total plate counts, mold and yeast counts were at safe levels throughout the study period, confirming the effectiveness of pasteurization and the addition of preservatives. A packaging and label design were created to meet regulatory needs and consumer acceptance. The end product had very good sensory acceptability, microbial stability, and extended shelf life, which can be a potential product for commercial production. This study demonstrates the market potential of tropical fruit-based salsa dips and sets the basis for product development and scaling

Keywords: Microbiological Stability, Physicochemical Analysis, Salsa Dip, Sensory Evaluation, Tropical Fruits.

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Development and Characterization of a Sports Energy Supplement Series for Athletes Targeting Enhanced Performance

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Natural ingredients in sports supplements help reduce health risks and anti-doping violations. This research formulated sports supplements using natural ingredients to enhance performance across different exercise phases. An energy gel (EG) was developed for pre- and during-event use, while an energy bar (EB) was designed for post-event recovery. EG formulations (EGF1, EGF2, and EGF3) used non-parboiled white rice flour, maltodextrin, coconut water, citric acid, salt, sodium benzoate, menthol flavor, and xanthan gum, with sugar levels of 5%, 10%, and 15%, respectively. EB formulations (EBF1, EBF2, and EBF3) contained dates, peanuts, salt, soy lecithin, non-parboiled white rice flour, and sodium benzoate, incorporating dried chicken powder and cinnamon (EBF1), soybeans (EBF2), and dried chicken with ginger (EBF3). Sensory evaluation was conducted for assessing aroma, overall flavor, mouthfeel, and acceptability of EGs, and aroma, flavor, texture, and acceptability of EBs. Based on sensory acceptability and physicochemical properties, EGF3 and EBF1 were selected for further evaluation. EGF3 had a pH of 3.48 ± 0.07 , a viscosity of 309.67 ± 4.04 cP, titratable acidity of $1.71 \pm 0.03\%$, and water activity of 0.94 ± 0.01 . Sodium and potassium contents were 242.67 ± 0.58 mg and 78.75 ± 1.56 mg, respectively. EBF1 had moisture ($6.85 \pm 0.77\%$ (w.b.)), protein ($17.61 \pm 1.40\%$), fat ($12.88 \pm 0.62\%$), ash ($3.03 \pm 0.47\%$), carbohydrate (63.07%), and hardness (4.80 ± 0.67 N). The viscosity of the developed EG was comparable to commercial products ($p > 0.05$), while the EB was classified as a protein source. The findings highlight the potential of natural ingredients in functional sports supplements. Future clinical trials are needed to assess their impact on athletic performance.

Keywords: Sports supplements, Natural ingredients, During-event, Energy gel, Energy bar

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Decomposition of Soil Organic Matter in Intensively Cultivated Vegetable Fields in Nuwara Eliya and Under Three Tree Species in Horton Plains, Sri Lanka

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Soil organic matter decomposition is connected to vital ecosystem services such as sustaining biodiversity and regulating climate change. This study investigated the rates of soil organic matter decomposition and responsible microorganisms in selected agricultural fields in Nuwara-Eliya and Horton plains. Disturbed soil samples were collected from agricultural fields amended with cattle manure (CM), poultry manure (PM) and compost (n=5) from Nuwara Eliya. Undisturbed soils were collected under three tree species in Horton plains (n=5). Soil samples were analyzed for selected chemical and microbiological properties. In an incubation study, decomposition of CM, PM and compost was evaluated by amending them to respective field soil samples. Soils were analyzed for CO₂ evolution and responsible decomposing organisms periodically. Soils of the CM amended fields showed the highest CO₂ evolution (0.02 mg g⁻¹ h⁻¹), microbial biomass C (423 mg kg⁻¹) and populations of cellulose and lignin decomposers irrespective of lower C and N % in comparison to compost amended soils. The highest rate of CO₂ evolution was observed on 11th and 14th days after incorporating compost and manure, respectively and coincided with the highest populations of lignin decompose. The cumulative CO₂ evolution was highest in the CM incorporated field soils and followed by the compost and PM added soils. These results suggest that soils amended with CM over long term are characterized with higher cellulose and lignin decomposers and rapid organic matter turnover than those managed with PM and compost. In the forest ecosystem, the highest soil organic C (16.51%), total N (1.51%), populations of cellulose and lignin decomposers, and CO₂ evolution were observed for soils collected under *Wal kurudu*. Forest soils showed 3-fold higher C, 8-fold higher CO₂ evolution and populations of cellulose and lignin decomposers in comparison to the agricultural soils implying a higher loss of carbon under favorable conditions.

Keywords: Agricultural soils, Cellulose, Forest soils, Decomposition, Soil organic carbon

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Assessment of Microplastic Contamination in Plastic-Mulched Watermelon (*Citrullus lanatus*) Cultivated Fields in Anuradhapura District, Sri Lanka

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Contamination of agricultural soils with microplastics due to plastic mulch application has gained considerable attention throughout the world in recent years. This study aimed to assess microplastic contamination in fields where watermelon is cultivated with plastic mulch covers. Three fields in Anuradhapura district of Sri Lanka where water melons have been grown with plastic mulch for three years, were selected for this study. Representative soil samples were collected from 0-10 cm depth in both mulch-applied and surrounding area of each field without plastic mulch. Soil samples were subjected to density separation and wet peroxidase digestion for extraction and purification of microplastics. Stereomicroscopy and Raman spectroscopy were used for quantification and polymer type identification of microplastics. Significantly high ($p < 0.05$) microplastic content was observed in surrounding areas compared to that of plastic mulch applied beds in fields 1 and 2 which could be due to microplastic contamination *via* run off. However, in field 3 the microplastics content in surrounding area (280 particles kg^{-1}) was significantly lower than that of plastic mulch applied beds (447 ± 61 particles kg^{-1}). Beads were the predominant type of microplastic in soils at all three locations. Polyvinyl chloride (PVC), Polyethylene terephthalate (PET), Polypropylene (PP) and Polyethylene (PE) were identified in the areas without plastic mulch and PVC, PET, PP, PE and Polystyrene (PS) were identified in the plastic mulch applied lands. The application of plastic mulch did not show a significant effect on the microplastic content which could be because substantial degradation of the plastic mulch has not been occurred within three years period. Moreover, the results suggest that there could be multiple contamination sources other than plastic mulch, may contribute to microplastic contamination in Sri Lanka's agricultural fields.

Keywords: Plastic mulch, Microplastic, Beads, Contamination, Polymer type

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Digital Mapping of Soil pH in Sri Lanka Using a Machine Learning Approach

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Accurate national-scale soil pH maps are indispensable for decision-making in soil management. This study was conducted to develop an accurate digital soil pH map for Sri Lanka. Soil pH was measured in previously collected 1461 surface soil (0-30 cm) samples across the country. A random forest (RF) model was trained on randomly selected 80% of the measurements of the dataset, and validated using the remaining samples. Spatial covariates representing soil wetness, topography, vegetation and biomass production, and climate were used in this study as potential spatial controllers of soil pH. Measured soil pH values ranged from 3.01 to 9.75, and High correlation was observed between measured soil pH values and precipitation, evapotranspiration, and solar radiation. Variable importance analysis identified mean annual precipitation as the most influential factor of soil pH, followed by global horizontal irradiation, nighttime land surface temperature, elevation, and evapotranspiration. The trained RF model showed a satisfactory model fitting ($R^2 = 0.5$) with high prediction accuracy (RMSE = 0.6) and low bias (MEE = -0.01). This was further confirmed by model validation results (RMSE = 0.6, MEE = -0.1, and $r = 0.67$). The final soil pH map was generated at a resolution of 500 m. The highest mean pH value was observed in the dry zone (6.8), followed by the intermediate zone (6.4) and wet zone (5.7). This study successfully generated a high-resolution spatial database of soil pH for Sri Lanka, representing the most accurate mapping of this parameter to date. The resulting data set provides a robust foundation for prioritizing areas in need of targeted pH management interventions, thereby supporting strategies to enhance soil health and boost crop productivity.

Keywords: Soil pH, Machine learning, Digital soil mapping, Random forest, Environmental covariates.

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Impacts of Deficit Irrigation Strategies on the Growth of Chili (*Capsicum annuum* L.) Cultivated in Reddish Brown Earth Soil in Sri Lanka

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Deficit irrigation strategies are important for water use efficiency in chili production. However, the performance of soil sensors for reliably imposing deficit irrigation thresholds and the impact of these thresholds on chili growth remains largely unexplored for soils of Sri Lanka. Therefore, this study assessed the suitability of the TEROS 21 sensor for developing soil water retention curve (SWRC) and evaluated the effects of soil matric potential (SMP)-based deficit irrigation on chili growth. The sensor was used to develop a SWRC using repacked soil pots, and the SWRC was compared to that obtained using the standard pressure plate method. A pot experiment imposed four deficit irrigation ranges (T1: -11 to -20 kPa, T2: -21 to -30 kPa, T3: -31 to -40 kPa, and T4: -41 to -50 kPa). When the SMP fell within a deficit range, water was applied to restore field capacity. Growth parameters, including plant height (PH), leaf area (LA), number of leaves (NL), canopy diameter (CD), stem diameter (SD), and SPAD readings, were measured. The TEROS 21 sensor developed a SWRC with higher accuracy ($R^2 = 0.99$ and $RMSE = 0.003 \text{ cm}^3 \text{ cm}^{-3}$), comparable to the conventional pressure plate method. LA, NL, CD, and SPAD readings were significantly higher ($P < 0.05$) in T1 and T2 compared to T3 and T4. No significant difference ($P > 0.05$) was observed between T1 and T2 for almost all the growth parameters. Further analysis revealed that LA, NL, SD, and SPAD readings were more sensitive to water stress. The results indicate that, maintaining SMP at -21 to -30 kPa optimizes the growth of chili while conserving 26% of irrigation water. Future research should validate SMP thresholds under field conditions and assess their impact on chili yield.

Keywords: Deficit irrigation, Chili, Soil water retention curve, Soil matric potential, TEROS 21 sensor

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Assessing the Effects of Substrate and Fertilizer Mixtures on the Growth and Yield of Salad Cucumber (*Cucumis sativus* L.) Cultivated Under Protected Agriculture Conditions

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Salad cucumber cultivation in controlled environments offers year-round production potential in Sri Lanka, but optimizing substrate and fertilizer use is critical to enhance water and nutrient efficiency. This study examined the effects of four substrate mixtures (coir dust: coir chips: burnt paddy husk 1:1:1, 1:1:0, 3:2:1, and 3:2:0) and two fertilizer mixtures (Albert and Kodimix) on the growth and yield of salad cucumber grown in a polytunnel in the up-country wet zone. Plant growth parameters such as plant height (PH), leaf area (LA), number of leaves (NL), number of flowers (NF), number of days to first harvesting (NH) and total fresh fruit weight were recorded. Electrical conductivity, pH and water holding capacity at saturation of each substrate mixture was measured. Additionally, the total amount of water drained from each substrate-fertilizer mixture was recorded, and the concentrations of nitrogen, phosphorus, potassium, calcium, and magnesium were measured. Plants applied with the Kodimix fertilizer mixture exhibited significantly ($p < 0.05$) higher growth and yield across all substrate mixtures compared to those applied with Albert mixture. PH, LA, NL, and NF were significantly higher in the Kodimix applied substrate mixtures of 3:2:1 and 1:1:1. The amount of water drained and the loss of N, P, K, Mg, and Ca in the drained water were significantly lower in the 3:2:1 and 1:1:1 Kodimix applied substrate mixtures, likely due to the significant ($p < 0.05$) interaction effect between the substrate and fertilizer mixture: Burnt paddy husk enhanced water and nutrient retention in the 3:2:1 and 1:1:1 mixtures, while Kodimix-induced growth increased nutrient and water uptake in Kodimix-applied pots. These findings suggest that Kodimix, when combined with the 3:2:1 and 1:1:1 substrate mixtures, enhances salad cucumber yield, reduces nutrient loss, and improves water use efficiency compared to the Albert fertilizer mixture.

Keywords: Salad cucumber, Substrate mixture, Kodimix, Albert mixture

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Effects of Foliar Application of Cu and Zn on Growth and Quality of Cabbage (*Brassica oleracea* var. *capitata* L.) Cultivated in an Ultisol

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Low productivity of cabbage (*Brassica oleracea* var. *capitata* L.) grown in Ultisols could be attributed to low plant nutrient availability. This study investigated the effects of foliar application of Zn and Cu on the growth and harvest quality of cabbage grown in an Ultisol under greenhouse conditions. The experiment comprised of eight treatments with the application of Zn and Cu at different concentrations; T1: Negative control, T2: Positive control, T3: Zn (100 ppm), T4: Cu (50 ppm), T5: Zn (200ppm), T6: Cu (100 ppm), T7: Zn (100 ppm) + Cu (50 ppm), and T8: Zn (200ppm) + Cu (100 ppm). Four week old KE 739 hybrid cabbage seedlings were transplanted into pots fertilized with NPK and compost at recommended rates. The pots were arranged in a Randomized Complete Block Design (RCBD) with seven replicates. Foliar application of Cu and Zn was performed on the 30th and 45th days of after transplanting. Total plant weight, head shape index, SPAD meter values and head weights were measured. Univariate and repeated measures ANOVA were conducted to assess treatment effects. The application of Cu and Zn, whether individually or in combination, did not significantly affect plant parameters. However, application of Cu at 50 ppm significantly ($p < 0.05$) increased head weight by 65.1% compared to the positive control (T2) and enhanced the agronomic efficiency of micronutrient fertilizers by 2.56%. These findings suggest that foliar application of Cu can improve the productivity of cabbage grown in Ultisols.

Keywords: Micronutrients, Head Shape Index, Cabbage, Ultisols

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Mycorrhizae Fungi Associated with Selected Maize (*Zea mays* L.) Varieties under Different Soil Phosphorus Levels

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Arbuscular mycorrhizal (AM) fungi are known to play a vital role in improving phosphorus uptake in maize. This study investigated the plant growth and root infection rates by hyphae and arbuscules of AM fungi in selected maize varieties grown with different phosphorus (P) levels under controlled and field conditions. Maize plant samples of six varieties at the flowering stage were collected from DIMO Agri Techno Park, Lenadora. Roots were stained using trypan blue, and AM infection was counted using a compound microscope. The AM infection significantly differed among varieties and varied from 11% to 40%. Two varieties that showed the highest infection, 'CIC Supiri' and '1314', were grown in pots with four treatments: control (no fertilizer), N+P+K as recommended by the Department of Agriculture (DOA), N+K+50% P, and N+K+50% P + AM fungi inoculant. The first three treatments were further evaluated with CIC Supiri at DIMO Agri Techno Park. Plant and soil samples were collected from pot and field experiments after six weeks of planting and analyzed for soil available P, tissue P contents and root infection using standard methods. Inoculation of AM fungi led to a significantly higher arbuscule infection percentage in both varieties (100%) than non-inoculated treatments (<50%). Irrespective of 50% cut down of P fertilizer, added inoculant has increased tissue P contents to a level comparable to that of the treatment with recommended fertilizer (1108- 1118 mg kg⁻¹). Under field conditions, treatment added with 50% P showed a significantly higher arbuscule infection percentage (100%) than the treatment with recommended fertilizer (40%) yet their tissue P contents remained comparable (1148 mg kg⁻¹). Arbuscule infection rate and available P in soil showed negative correlations ($r=0.48-0.78$) and arbuscular infection rate with plant tissue P showed a positive trend. These results suggest that indigenous and inoculants of AM fungi can enhance phosphorus uptake and growth of maize in phosphorus-deficient soils.

Keywords: Mycorrhizal fungi, Maize, Available phosphorus, plant phosphorous, Varieties

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Winners of FAuRS 2023

Oral Presentations Sessions

- Theme I: Agricultural Production and Product Improvement**
Nimantha H.H.P
*Efficacy of African Marigold (*Tagetes erecta*) in cabbage insect pest management in Sri Lanka.*
Co-authors: Samita, S., Jayasinghe W.H., Ranil R.H.G., Suriyagoda L.D.B., Rankoth L.M.
- Theme II: Technological Interventions and Applications in Agriculture**
Athukorala R.U.
Feasibility Analysis of Used Cooking Oil as an Alternative Fuel Source & Designing of a Hybrid Stove
Co-authors: Jayanath N.Y., Amarathunga K.S.P., Samarasekara M.A. and Karunarathna A.K.
- Theme III: Food Quality, Safety and Product Development**
Attygalle S.U.
Exploring Underutilized Yams in Sri Lanka: An Integrative Assessment of Nutritional, Bioactive, and Processing Attributes of Dioscorea Species and Prospective Food Applications
Co-authors: Mendis B.E.P., Rajapakse R.P.N.P., and Nissanka S.P.
- Theme IV: Community, Environment and Management**
Karunarathne A.G.S.N.
Optimizing Nitrogen Fertilizer Allocation across Diverse Agro-climatic Zones for Enhanced Rice Production: An analysis using an integrated crop and economic model
Co-authors: Weerahewa H.L.J. and De Silva S.H.N.P.

Poster Presentations Sessions

- Theme I: Agricultural Production and Product Improvement**
S.A.D.N. Senanayake
*Substituting the Fishmeal by Commercial Cricket Meals in Swordtail (*Xiphophorus helleri*) Diet : Pertinence to Growth, Colouration, Salinity Tolerance and Histopathological Alterations*
Co-authors: Athauda A.R.S.B. and Perera G.S.C.
- Theme II: Technological Interventions and Applications in Agriculture**
Peiris M.M.U.H.S.
Development of a Rapid PCR Based Protocol for Direct Detection of Salmonella Contamination in Raw Meat

Co-authors: Kottawatta K.S.A., and Kodithuwakku S.P.

**Theme III: Food Quality, Safety and Product Development
Madusanka U.B.D.P.**

Effect of agar and cinnamon essential oil based edible coating on the quality and shelf life of tea bun.

Co-authors: Prasantha B.D.R., and Udayakumara E.M.S.

**Theme IV: Community, Environment and Management
Rajakaruna R.M.N.L.**

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

Co-authors: Nissanka S.P.

**The Overall Best Poster Presentation
Madusanka U.B.D.P.**

Effect of agar and cinnamon essential oil based edible coating on the quality and shelf life of tea bun. Madusanka UBDP, Prasantha BDR, and Udayakumara EMS

Co-authors: Prasantha B.D.R., and Udayakumara E.M.S.

Merit Awards for Undergraduate Research

**Theme I: Agricultural Production and Product Improvement
Rupasingha A.D.U.K**

Morphological and molecular identification of some economically important shrimp species in western coast of Sri Lanka

Co-authors: Athauda A.R.S.B., Herath D.R. and Yatawaka S.

**Theme II: Technological Interventions and Applications in Agriculture
Lewkebandara H.G.**

Development of an Efficiency Enhanced Urea Fertilizer Using Rice Husk Biochar and Urease Inhibitor for Zea mays L.

Co-authors: Dharmakeerthi R.S.

**Theme III: Food Quality, Safety and Product Development
Chandrasiri H.M.Y.T.**

Effect of Atmospheric Non-Thermal Plasma on Physical and Rheological Characteristics of TomEJC Mango (Mangifera indica) Fruit Powder

Co-authors: Amunugoda P.N.R.J., Prasantha B.D.R. and De Silva G.

**Theme IV: Community, Environment and Management
Athukorala R.U.**

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

Co-authors: Jayanath N.Y., Amarathunga K.S.P., Samarasekara M.A.
and Karunarathna A.K.

The Overall Best Merit Award for Undergraduate Research
Lewkebandara H.G.

*Development of an Efficiency-Enhanced Urea Fertilizer Using Rice Husk Biochar and
Urease Inhibitor for Zea mays L.*

Co-authors: Dharmakeerthi R.S.

The Most Outstanding Emerging Researcher
Attygalle S.U.

*Exploring Underutilized Yams in Sri Lanka: An Integrative Assessment of Nutritional,
Bioactive, and Processing Attributes of Dioscorea Species and Prospective Food
Applications*

Co-authors: Mendis B.E.P., Rajapakse R.P.N.P., and Nissanka S.P.

3MT[®] (Three Minute Thesis) Competition

Winner: Attygalle S.U.

*Exploring Underutilized Yams in Sri Lanka: An Integrative
Assessment of Nutritional, Bioactive, and Processing Attributes of
Dioscorea Species and Prospective Food Applications*
Co-authors: Mendis B.E.P., Rajapakse R.P.N.P., and Nissanka S.P.

1st Runner-up: Jayasinghe J.A.D.K.H.

Development of a web tool for ISO 22000:2018 for the cake industry
Co-authors: Somarathne G.M., Chathuranga P.H.T., Priyantha
K.P.S., Amarasinghe R.A.A.U. and Madhujith W.M.T.

2nd Runner-up: Fransis R.N.

*Development of frozen ginger puree cube and reduction of its post-
quality deterioration*
Co-authors: Hemantha S.K.D., Senadhirajah V., Somaratne G.M. and
Madhujith W.M.T.

Invention and Innovation

Winner Chathumal K.P.

Design and development of a cloud-based automated system with artificial Intelligence for a spice dehumidifier
Co-authors: Amaratunga K.S.P.

1st Runner-up **Kumarasinghe B.A.V.M.**
Development of innovative flavored tea tablets and tablet dispenser for convenient use
Co-authors: Amarathunga K.S.P., Arampath P.C. and Mohotti A.J.

2nd Runner-up **Athukorala R.U.**
Hybrid cooking stove that utilizes LPG and used cooking oil and their blends as a fuel source
Co-authors: Jayanath N.Y., Amarathunga K.S.P., Samarasekara M.A. and Karunarathna A.K.

Research Brief Competition

English **Fransis R. N.**
Development of frozen ginger puree cube and reduction of its post quality deterioration
Co-authors: Hemantha S.K.D., Senadhirajah V., Somaratne G.M. and Madhujith W.M.T.

Sinhala **Shalika J.A.N.**
*Characterization of Composite Flour Derived from Kiri Ala (*Xanthosoma Sagittifolium*) and Hulankeeriya (*Maranta Arundinacea*) and the Determination of the Potential of Substituting Wheat Flour in Pasta Production*
Co-authors: Daundasekara D.M.S.S. and Samarakoon E.R.J.

Tamil **Jayavahini S.**
Design, Fabrication & Testing of a Paddy Collecting and Bagging Machine for Sun Drying on Cement Floors
Co-authors: Dharmasena D.A.N.

Research Video Competition

Winner **Nagasinghe P.K.**
Effects of nitrogen fertilization on potato tuber quality
Co-authors: Mendis B.E.P., Rajapakse R.P.N.P. and Nissanka N.A.A.S.P.

1st Runner-up **Rajakaruna G.V.**

Utilization of agricultural extension and advisory services provided by private organizations in Tambuttegama.

Co-authors: Dissanayeke U.I.

2nd Runner-up

Premarathne H.P.S.R.

Decomposition of crop residues and diversity of soil microorganisms as affected by different nutrient management practices in banana plantation

Co-authors: Dandeniya W.S. and Haputhantri T.R.

Scientific-Eye Photography Competition

Winner

Thennakoon T.M.P.M.

Proper Density, Higher Yield : 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

Co-authors: Rankoth L.M., Alahakoon A.H.M.Y.T. and De Silva S.H.N.P.

1st Runner-up

Soyza W.M.M.

Exploring Rice Yield Potential through Morphological and Molecular Analysis: Morphological and Molecular Evaluation of Yield Parameters of a Panel of Recommended Rice Cultivars

Co-authors: Udawela. U.A.K.S., Perera S.A.C.N.

2nd Runner-up

Christopher M.S.

Basmati Trio: Low GI, High Flavour :Exploring the Relationship among Nutritional Composition, Glycemic Index, and Functional Properties of Newly Introduced Basmati-Type Rice Varieties in Sri Lanka

Co-authors: Somaratne G.M., Gunasekara D.C.S., Prasantha B.D.R. and Abeysiriwardena D.S.D.Z.

Graphical Abstract Contest

Winner

Weerasinghe M.H.N.C.

Antagonistic potential of endophytic microbes in rubber leaves to control Circular Leaf Spot Disease

Co-authors: Fernando T.H.P.S. and De Costa D.M.

1st Runner-up

Jayalath W.P.T.P.

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

Co-authors: De Silva S.H.N.P., Ranil R.H.G., Samita S. and Rankoth L.M.

2nd Runner-up **Sawbhagya L.H.N.**

Influence of varying nitrogen and water supply on source-sink relations in two rice varieties with different sink capacities

Co-authors: De Costa W.A.J.M.

ResearTOON Competition

Winner **Bandara H.B.T.U.M.**

Effect of methyl jasmonate on product synthesis of Gyrinops walla shoots under solid culture

Co-authors: Eeswara J.P.

1st Runner-up **Pathirana M.G.**

Cross protection ability of Sclerotium rolfsii- Derived Immunity Activators for the management of soil borne plant pathogens

Co-authors: Perera H.D.D., Rienzie K.D.R.C. and De Costa D.M.

2nd Runner-up **Weerasinghe M.H.N.C.**

Determination of the diversity of culturable endophytic microbial community in the leaves of healthy and circular leaf spot disease infected rubber plants

Co-authors: Fernando T.H.P.S. and De Costa D.M.

Research Storybook Competition

Winner **Nimantha H.H. P.**

The beautiful guardian of cabbages (Efficacy of African Marigold (Tagetes erecta) in cabbage insect pest management in Sri Lanka)

Co-authors: Samita S., Jayasinghe W.H., Ranil R.H.G, Suriyagoda L.D.B. and Rankoth L.M.

1st Runner-up **Deniyawaththa M.N.H.T.B.**

A versatile remedy (Development of a Hybridized Half-Fat Cooking Cream through Integration of Dairy and Coconut Fat)

Co-authors: Perera N., Somaratne G.M. and Madhujith W.M.T.

2nd Runner-up **Attanayake H.A.S.V.**

*The story of sorting big onion with artificial intelligence
(Development of an artificial intelligence based identification system
for industrial sorting of big onion)
Co-authors: Amaratunga K.S.P.*

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