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Faculty of Agriculture Undergraduate Research Symposium

FAuRS - 2025

FAuRS

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University of Peradeniya

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7th November 2025

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Message from the Vice Chancellor

It is with great pleasure that I extend my greetings on the occasion of the Undergraduate Research Symposium (FAuRS) 2025 of the Faculty of Agriculture. I congratulate all paper presenters and researchers participating in this important academic event.

While scientific innovation and technological adoption in agriculture have advanced significantly, less attention has been paid to the broader transformation that integrates science, agriculture, and society. As a comprehensive university, the University of Peradeniya is uniquely positioned to foster interdisciplinary research that addresses this need, bringing together knowledge from multiple domains.

Undergraduate research plays a vital role in nurturing critical thinking, problem-solving abilities, and lifelong learning. Equally important is the development of communication skills, which enable students to effectively share their research outcomes with diverse audiences. I am confident that FAuRS 2025 will provide a meaningful platform for young researchers in agriculture to present their findings to the scientific community, policymakers, and industry stakeholders, while also inspiring them to pursue impactful research in the years ahead.

I wish to extend my sincere appreciation to the Dean of the Faculty of Agriculture, the FAuRS Coordinator, the Organizing Committee, and all staff members for their dedicated efforts in successfully organizing this significant annual event.

I wish FAuRS 2025 every success.

Professor W.M.T. Madhujith
Vice-Chancellor
University of Peradeniya

07th November 2025

Message from the Dean

It is with great pleasure that I forward this message to the Faculty of Agriculture Undergraduate Research Symposium (FAuRS) -2025, which is held for the 11th consecutive year.

A significant milestone in the history of our Faculty was the introduction of the undergraduate research component to the curriculum in 1975. This initiative not only sharpened the research skills of our students but also laid the foundation for grooming them as young scientists who contribute meaningfully to agriculture and related fields.

Since its inception in 2014, FAuRS has become a landmark annual event in the Faculty calendar. It provides our undergraduates with an invaluable opportunity to present their research findings before an esteemed audience of scientists, experts, and industry professionals. In addition, students actively participate in a series of competitions that help them enhance their academic, professional, and communication skills.

This year, for the first time, the Faculty has organized a Job Fair to be held alongside FAuRS. This initiative will enable our students to engage directly with leading private sector organizations, opening doors to their future careers while strengthening the collaborations between academia and industry.

I take this opportunity to extend my sincere gratitude to the Organizing Committee for their dedication and hard work in making this event a success. I also warmly congratulate all paper presenters and graduating students and wish them every success in their future endeavors.

Prof. B.C. Jayawardana
Dean
Faculty of Agriculture

07th November 2025

Message from the Chief Guest

It is a pleasure to extend warm congratulations to the Faculty of Agriculture, University of Peradeniya, on the occasion of your Undergraduate Research Symposium (FRuRS 2025) on 7 November 2025.

The University of Peradeniya has long been a pillar of academic excellence and innovation, serving as the pioneer in higher education and research in Sri Lanka. Its contributions to the agricultural sector have had enduring impact; advancing scientific understanding and fostering sustainable solutions that have benefitted communities across the country.

New Zealand values our longstanding partnership with Sri Lanka and the University of Peradeniya. Our ongoing engagement reflects our shared commitment to enhancing food security, climate resilient and sustainable farming practices, and improving livelihoods.

I am enthusiastic about the opportunities for deeper collaboration between our two nations; education, and our ongoing people to people connections, will be a key part of it.

Let me take this opportunity to commend the Dean, the staff of the Faculty of Agriculture, and the students presenting today, for your tireless efforts in nurturing and working as the next generation of agricultural scientists and practitioners. No doubt you will continue to inspire and to shape the future of Sri Lanka.

I wish all participants a successful and enriching symposium.

H. E. David Pine
High Commissioner of New Zealand
7th November 2025

Message from the Keynote Speaker

I convey my congratulations to the University of Peradeniya's Faculty of Agriculture and its latest batch of graduates! I am hoping for the success of their Undergraduate Research Symposium (FAuRS) 2025. This event has evolved over the years into a hallmark of academic excellence. We appreciate seeing the curiosity, creativity, and commitment of Sri Lanka's future agricultural professionals. FAuRS reflects the enduring strength of Sri Lanka's higher education in agricultural sciences.

Research and Action are the foundations upon which today's agricultural sector will advance and global collaboration will be forged. FAuRS provides a great platform for young researchers to exchange ideas, challenge assumptions, and envision a more resilient future. It empowers young researchers, with guidance from the top-notch Faculty of Agriculture to transform knowledge into real-world impact.

Since 1952, the United States-Sri Lanka Fulbright Commission has fostered academic, cultural, and professional exchanges between citizens of Sri Lanka and the United States. We are encouraged to see this next generation of scholars engaged in research that bridges disciplines, communities, and nations.

I hope this symposium inspires participants to pursue their research journeys with passion, integrity, and purpose, and to see their work as a contribution not only to knowledge sharing, but to building a more peaceful and prosperous world!

Patrick McNamara, Ph.D.
Executive Director
United States-Sri Lanka Fulbright Commission
7th November 2025

Message from the Coordinator

On behalf of the Organizing Committee, it is my great pleasure to extend this message to mark the 11 th Faculty of Agriculture Undergraduate Research Symposium (FAuRS). Over the years, FAuRS has evolved into one of the most significant academic events in the Faculty calendar, bringing together graduating students, academics, scientists, and industry partners in a vibrant exchange of knowledge, innovation, and expertise.

FAuRS provides a unique platform for our graduating students to present their research findings and engage in meaningful dialogue with the wider scientific community, as well as industry professionals and experts at both national and international levels. These interactions not only enhance students' confidence and communication skills but also prepare them to emerge as future leaders and innovators in agriculture and allied disciplines.

In addition to research presentations, FAuRS features a range of non-technical competitions that encourage students to sharpen innate and acquired talents in science communication and innovation. As a Faculty, we view this symposium as a valuable opportunity for students to strengthen their research capabilities, cultivate meaningful professional linkages, and lay a strong foundation for their future careers.

I sincerely extend my gratitude to the Vice-Chancellor, Dean, Heads of Departments, and all academic and non-academic staff for their guidance and support. I also thank the invited chairpersons, judges, and students for their invaluable contributions to the success of this symposium. A special word of appreciation is due to my colleagues in the Organizing Committee, whose untiring dedication and meticulous efforts made this event possible. I am also grateful to our sponsors and well-wishers for their generous support, which played a vital role in staging FAuRS with professionalism, distinction, and decorum.

I sincerely hope that FAuRS 2025 will be a productive and memorable experience for all participants, and I extend my best wishes to all graduating students for a bright and successful future!

Dr. Uvasara Dissanayeke
Coordinator
FAuRS 2025
7th November 2025

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Theme 1

Agricultural Production and Productivity Improvement

Accelerating Decomposition of Broiler Litter using Three Microbial Inoculants: Evaluation of Physicochemical Properties and Nutrient Dynamics

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Broiler litter, a common by-product of intensive poultry farming, is produced in considerable quantities. This study was conducted to evaluate the effect of three microbial inoculants on accelerating broiler litter decomposition and producing a value-added soil amendment with improved properties. Fresh broiler litter was treated with three types of microbial inoculants: Live-gro®, J-power-BS-1®, and a mixed population of Lactic Acid Bacteria (LAB) species that were originally obtained from milk samples. The inoculums were applied in three different application rates (10%, 5%, and 2.5%). which represent the volume of inoculant relative to the total volume of the prepared solution. Each treatment had five replicates. During the decomposition period of 30 days, temperature, pH and electrical conductivity were measured at 5-day intervals. Total nitrogen, ammonia nitrogen, available phosphorus, available potassium, and organic carbon content were measured in the initial broiler litter and at the end of the 30 days. Further, a plant growth experiment was conducted using maize (*Zea mays*) for a period of 2 weeks and stem height, plant dry weight, and shoot/root ratio were measured. To analyze the microbial safety of the decomposed litter, a coliform test was conducted. Results revealed that the total nitrogen content was higher ($P<0.05$) in broiler litter treated with Live-gro® and J-power-BS-1® than in broiler litter treated with LAB isolated from milk at the end of 30 days. The highest ($P<0.05$) available potassium was reported in broiler litter treated with LAB isolated from milk at 5% application rate, on day 30. Live-gro® (5%, 2.5%) and J-power-BS-1® (10%, 5%, 2.5%) treated litter samples showed the highest ($P<0.05$) available phosphorous content at the end of 30 days. The highest ($P < 0.05$) organic carbon content and carbon-to-nitrogen ratio were observed in litter samples treated using LAB isolated from milk at 2.5% application rate, and J-power-BS-1® at 10% application rate, respectively. Maize plants grown in the media with decomposed broiler litter treated with LAB isolated from milk (5%) reported the highest ($P<0.05$) shoot to root ratio after 2 weeks. The present study showed that Live-gro® and J-power-BS-1® can successfully improve nutrient content in decomposed broiler litter, while LAB isolated from milk showed enhanced specific nutrient dynamics. The findings provide evidence to support the ability of three inoculums in accelerating the decomposition of broiler litter to produce soil amendments.

Keywords: Broiler litter, Decomposition, Microbial inoculants, Soil amendment

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Application of Hydrogen Peroxide and *Trichoderma harzianum* for Root-Zone Sanitation and Growth Promotion of Lettuce, Grown in Deep Water Culture Hydroponics

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Sudden wilting has become a major constraint in commercial lettuce (*Lactuca sativa* L.) cultivation under Deep Water Culture (DWC) hydroponic systems, particularly in recirculating setups where the same nutrient solution is reused across multiple cropping cycles. The objective of this study was to comparatively assess the effectiveness of chemical (Hydrogen Peroxide) and biological (*Trichoderma harzianum*) root-zone sanitation methods on the growth performance and nutrient uptake of lettuce in DWC systems. The experiment was conducted in a greenhouse under controlled environmental conditions using a Completely Randomized Design (CRD) in a two-factor factorial arrangement. Two lettuce varieties, Green Batavia (*L. sativa* var. *capitata*) and Romaine (*L. sativa* var. *longifolia*) were subjected to three treatments: Hydrogen Peroxide (H_2O_2; 50% food-grade) applied at 10 mL per 100 L nutrient solution at 15-day intervals (T_1); *Trichoderma harzianum* suspension inoculated at 15-day intervals (T_2); and a control representing standard commercial practice (T_3). Growth parameters (shoot and root length, shoot and root dry weight) were measured at 10, 20, and 28 days after planting, while nutrient (N, P, K) and chlorophyll analyses were performed at the final harvest. Results showed that both H_2O_2 and *Trichoderma* significantly improved plant growth and nutrient uptake compared to the control ($p < 0.05$). A clear varietal difference was observed across all measured parameters. When considered separately, H_2O_2 enhanced root development, nitrogen and potassium accumulation, and overall vigor in Romaine lettuce through improved oxygenation and root-zone disinfection, whereas *Trichoderma* promoted greater shoot biomass and chlorophyll content in Green Batavia via beneficial root-microbial interactions. The overall results indicated effective root-zone sanitation is vital for sustaining lettuce productivity in DWC systems. H_2O_2 is more suitable for Romaine while *Trichoderma harzianum* works better for Green Batavia. These findings provide useful guidance for hydroponic growers who seek a sustainable and efficient root-zone management strategy.

Keywords: Deep Water Culture, Green Batavia, Hydrogen Peroxide, Romaine, Root-zone sanitation, Sudden wilting, *Trichoderma harzianum*,

Acknowledgement: This research was supported by Lassana Agri Innovations Pvt. Ltd.

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Assessing the Influence of Biochar Application in Varying Soil Moisture Regimes on the Growth and Nitrogen-use Efficiency of Rice

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Nitrogen (N) plays a vital role in rice growth and yield, but a significant portion of applied N is lost through leaching, volatilization, and denitrification, especially under different water management practices. Evaluating biochar application under varied irrigation regimes offers a sustainable solution to reduce N losses, improve nutrient-use efficiency, and enhance rice productivity. However, limited studies in Sri Lanka have examined how biochar affects rice growth and N-use efficiency (NUE) under different irrigation regimes. This study addresses that gap by assessing the combined effects of biochar application and irrigation methods on rice performance and soil nutrient dynamics. The experiment was conducted as a pot study under glasshouse conditions using soil collected from Dodangolla farm, treated with paddy husk biochar at 0, 2.5, 5, and 10 g per pot under two irrigation regimes, namely, continuous flooding (CF) and Alternate Wetting and Drying (AWD). Rice variety Bg 300 was used in the study. Plant height, stem and leaf and grain dry weights, SPAD values, photosynthetic rate, and stomatal conductance were measured. Results revealed that biochar application increased soil-N (up to 0.77 mg g^{-1}) and K (59 mg kg^{-1}) while reducing organic matter (OM) content at higher biochar rates. Moderate biochar levels (5–10 g per pot) improved SPAD values, photosynthetic rate (22.4 µmol m^{-2} s^{-1}), and dry weights of shoots, leaves, and grains under AWD. The AWD also enhanced leaf-N (0.60 mg g^{-1}) and soil pH compared to CF, while EC and stomatal conductance were similar between AWD and CF. Integrating biochar with AWD can enhance NUE and soil health while reducing water and fertilizer use, supporting sustainable rice cultivation in Sri Lanka.

Keywords: Alternate Wetting and Drying, Biochar, Continuous Flooding, Nitrogen Use Efficiency, Rice

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Assessment of Antioxidant Activity of Selected Maize (*Zea mays* L.) Accessions

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Maize (*Zea mays* L.) is a valuable cereal crop grown worldwide, and its kernels contain antioxidants that are useful targets for biofortification. Although the genetic diversity of the Sri Lankan maize germplasm has been assessed, the variation in the antioxidant properties within the germplasm remains unexplored. This study was conducted to evaluate the variation in antioxidant properties of 16 selected maize accessions and to determine the suitability of kernel colour as a predictor of antioxidant activity. The antioxidants and phenolics of maize kernels were extracted using ethanol, and total phenolic content (TPC), total flavonoids (TFC), 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity (DPPH-RSA), and ferric reducing antioxidant power (FRAP) were assessed spectrophotometrically. For the kernel colour, five distinguishable clusters were identified based on colourimeter readings. Among the selected 16 maize accessions, significant variations ($p<0.05$) were observed in TPC (810.09 ± 98.09 to 2851 ± 307.14 µg GAE/g) and TFC (1359.06 ± 118.69 to 5767.34 ± 742.20 µg RE/g), with considerably high deviations existing between the accessions. Significant variations ($p<0.05$) were also observed for DPPH-RSA (2.02 ± 0.05 to 3.01 ± 0.05 µmol TE/g) and FRAP (10.35 ± 1.07 to 23.08 ± 2.79 µmol TE/g), but the deviation was noticeably less pronounced between accessions. The accession *Kahata* was found to be among the top performers with respect to TPC, TFC, and FRAP. The parameters TPC and TFC showed significant positive correlations ($p<0.05$) of 0.71 and 0.94 with FRAP values, respectively. In conclusion, maize accessions such as *Kahata*, CAL147, CAL1471, CLO2450, and *Sudu Kappal* exhibited profound potential with respect to antioxidant activities, marking them promising accessions for future breeding programs.

Keywords: Antioxidants, Flavonoids, Kernel colour, Phenolics, Radical scavenging

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Assessment of Cell-Mediated Immunogenicity & Immunosuppression in Broiler Chicken Vaccinated with Recombinant Vector, Immune-Complex, and Live Attenuated Infectious Bursal Disease Vaccines

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Infectious bursal disease (IBD) is a significant challenge to the health and productivity of broiler chickens worldwide. The control of IBD is mainly dependent on various traditional and new molecular vaccines. The immunogenicity of the vaccines, as well as vaccine-induced immunosuppression, represent major concerns for broiler production globally. Thus, this study was conducted to assess the cell-mediated immunogenicity and immunosuppressive effects of three commonly used commercial IBD vaccines in Sri Lanka, i.e., a recombinant vector, an immune complex, and a live attenuated vaccine via expression analysis of selected cell-mediated immune response cytokine genes [Interleukin-2 (*IL-2*), Interleukin-5 (*IL-5*), and Interferon-gamma (*IFN-γ*)]. Two hundred Ross 308® male broiler chickens were allocated to four treatments using a complete randomized design, with each treatment comprising five experimental cages and ten birds per cage. Birds received their respective vaccines according to the manufacturer's protocols, and blood samples were collected at days 21 and 35 post-hatch for downstream molecular analysis. Total RNA was extracted from blood, then reverse transcribed to complementary DNA (cDNA), and real-time quantitative polymerase chain reaction (RT qPCR) was performed to quantify the relative expression. The expression of the β-Actin gene served as the reference gene. At day 21, the recombinant vector vaccine group showed the highest ($p<0.05$), and the immune complex vaccine showed the moderately highest IL-2 expression, with 2.6-fold and 1.6-fold increases ($P<0.05$), respectively. At day 21, recombinant vector, immune complex, and live attenuated groups demonstrated possible immunosuppression with low ($p<0.05$) levels of *IFN-γ* and *IL-5* expression, with the lowest ($p<0.05$) *IFN-γ* gene expression recorded in the immune complex vaccine group on day 21. At day 35, there was no significant ($p>0.05$) difference between treatments for *IL-2* and *IFN-γ* gene expression. Overall, the recombinant vector vaccine elicited the strongest cell-mediated immunity, while the immune complex vaccine may have produced immunosuppressive effects during early post-vaccination phases.

Keywords: Cell-Mediated Immunity, Immunogenicity, Immunosuppression, Cytokine Genes, Quantitative Polymerase Chain Reaction

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Assessment of Fish Meal Quality in Self-Mixed Poultry Feed in Gampaha District: Focus on Nutrient Variability, Adulterations and Cost Implications

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Self-mixed poultry feed often has imbalanced nutrient profile due to limited ingredient specific nutrient analysis and reliance on table values. Since variability in ingredient quality is a key contributor to this issue, the present study aimed to evaluate the nutritional variability of fish meal (FM) at the self-mixer level in Gampaha District, with particular attention to its nutritional quality and cost implications. A total of 30 FM samples were collected from self-mixers and analyzed for crude protein (CP %), crude fat (CF %), total volatile basic nitrogen (TVB-N), sodium chloride (NaCl %), ash %, and acid-insoluble ash (AIA g kg^{-1}). Data were statistically analyzed using descriptive statistics and simple linear regression using R statistical package. Nutrient composition showed a high variability, CP from **18.3 to 93.4 %**, CF from **2.3 to 30.0 %,** and ash from **7.2 to 40.6 %,** indicating possible adulteration. The AIA varied from 0.9 g kg^{-1} to 123.0 g kg^{-1}. The NaCl ranged from **0.7 to 15.7 %,** while TVB-N varied from **13.3 to 188.9 mgN/100g**, reflecting variation in freshness and storage conditions. Non-significant relationships suggested no meaningful association of price with CP or other nutrients ($p>0.05$). Although self-mixers commonly rely on color to judge the quality of FM, regression analysis between CP content and color parameters (L*, a*, b*) showed no consistent relationship. In overall, the FM used in self-mixed poultry feeds showed inconsistent nutritional quality with no direct association with price. The need for routine laboratory evaluation before feed formulation, the establishment of appropriate regulatory guidelines, and improved farmer awareness are emphasized to enhance feed formulation accuracy and overcome the issue of nutritionally imbalanced self-mixed feed.

Keywords: Adulteration, Cost implication, Fish meal, Nutrient variability, Poultry feed

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Assessment of Locally Manufactured Wrapping Films and Film Layers on the Quality of Maize Bale Silage in Sri Lanka

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The quality of bale silage depends on several external factors, including the properties of the wrapping material. Commercial producers in Sri Lanka commonly use imported wrapping films for bale silage production, which increases production costs. This study investigated the quality of silage wrapped with locally produced film at different numbers of film layers. The experiment was conducted at the silage production site of Golden Grain (Pvt.) Limited, Giradurukotte. Fodder maize was harvested at the mid-dough stage (R5). The chopped forage was baled using 30 layers of imported film as the control (standard), while the treatments consisted of bales wrapped with 30 and 35 layers of locally made film. The silage bales were stored for six weeks, after which silage quality was analyzed. The experiment was arranged in a Completely Randomized Design (CRD). The pH, dry matter (DM), lactic acid (LA), soluble carbohydrate (SCHO), ammonia nitrogen (NH_3-N), and gross energy (GE) contents of the silages were not significantly different ($P>0.05$), with mean values of 3.77±0.01, 34.80±0.24%, 7.22±0.08%, 1.22±0.04%, 0.04±0.01%, and 16.66±0.02 MJ/kg DM, respectively. These results indicate that maize harvested at the R5 stage provided an ideal substrate for anaerobic fermentation, leading to desirable silage characteristics such as low pH, high DM, and high LA content. The low residual SCHO content further indicated efficient fermentation. Although the silage wrapped with 30 layers of imported film had significantly ($P<0.05$) higher CP content (7.23±0.13%), silage produced using locally manufactured films also showed acceptable CP levels (7.03±0.08%) with similar NH_3-N content ($P>0.05$), indicating minimal proteolysis. Locally manufactured wrapping films can be effectively used for maize bale silage production without compromising overall silage quality. However, further investigations on long-term storage and aerobic stability are recommended before making final conclusions regarding the suitability of locally made wrapping films for commercial silage production in Sri Lanka.

Keywords: Ammonia nitrogen, Crude protein, Lactic acid, pH, Soluble carbohydrate

Acknowledgement: This research was conducted in collaboration with the Golden Grains (Pvt.) Ltd., Giradurukotte.

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Assessment of Management Practices Influencing Goat Welfare in Semi-Intensive Goat Farms: A Cross-Sectional Study of Galgamuwa and Ehetuwewa Veterinary Divisions in Kurunegala District, Sri Lanka

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A questionnaire survey collected data from 40 semi-intensive goat farms located in Galgamuwa and Ehetuwewa Veterinary Divisions in Kurunegala district to assess management practices that influence on goat welfare in semi-intensive goat farms (average flock size of 45, predominantly with adult females of 29). Data were collected on housing, feeding, health management, pregnancy and kid care. The findings revealed that farmers predominantly used simple raised sheds with slatted floors, providing basic protection and ventilation though variations in cleanliness and space availability were observed. Feeding practices were mainly pasture-based with limited supplementation, often influenced by seasonal feed availability. Health management relied largely on farmer experience with variable awareness of disease prevention and treatment. Kid management practices showed moderate adherence to recommended care with gaps remained in pregnancy management practices. Body condition scoring revealed significant welfare concerns across farms. On average, 86% of animals per farm were classified as thin, with particularly high prevalence among adult females (mean=53.4%) and kids (mean=26.8%). Adult males showed lower thin body condition prevalence (mean=6%). Statistical analysis showed significant associations between rearing purpose and body condition, with farms raising goats for meat and milk consumption showing different welfare outcomes ($p<0.05$). Crossbred animals were significantly associated with better hygiene maintenance ($p=0.018$) and isolation practices ($p=0.04$). Financial constraints significantly impacted disease prevention practices, particularly hygiene maintenance ($p=0.015$) and isolation of sick animals ($p=0.011$). Fencing type was significantly associated with predator protection ($p<0.001$), while water container type and cleaning frequency showed significant associations with contamination ($p=0.041$ and $P<0.001$, respectively). Provision of separate clean kidding areas was significantly associated with reduced stillbirths ($p=0.041$). However, no significant correlations were found between farmer experience, education level or training status and welfare indicators or modern management practices ($P>0.05$).

Keywords: Goat welfare, Semi-intensive system, Management practices, Welfare indicators, Galgamuwa and Ehetuwewa Veterinary Divisions

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Assessment of Manure Storage, Usage, and Waste Management in Small-Scale Cattle Farms in the Galaha Region

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Cattle manure plays a crucial role in soil fertility and sustainable agricultural production, particularly in small-scale farming systems. However, improper manure storage and waste handling practices can contribute to environmental degradation, greenhouse gas emissions, and public health concerns. This study focused on the assessment of manure collection, storage, utilization, and waste management practices in small-scale cattle farms located in the Galaha region of Sri Lanka. Data were collected from 40 farms using a structured questionnaire covering general farm information, manure handling methods, awareness on manure and waste handling and challenges related to manure management. Descriptive statistics, chi-square tests and correlation analyses were performed using SPSS software to examine the relationships among manure management practices and influencing factors. There was a significant relationship between storage method and effective manure use ($P<0.05$). The findings revealed that there is a considerable variation in manure handling methods, with several farms lacking proper storage facilities and scientific knowledge on effective manure utilization. Limited awareness, labor shortages, and inadequate infrastructure were identified as major challenges for sustainable manure management. This study highlights the need for improved training, infrastructure development, and adoption of environmentally friendly manure handling practices to enhance resource efficiency and reduce negative environmental impacts in small-scale cattle farms in the Galaha region, Kandy.

Keywords: Cattle manure, Manure storage, Manure utilization, Small-scale farms, Waste management.

Acknowledgement: Assistance provided by the Veterinary Office, Galaha is gratefully acknowledged.

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Assessment of Welfare Status of Layer Chickens in Small-Scale Backyard Production Systems in Matara District, Sri Lanka

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Backyard poultry farming is crucial for household nutrition and income in Sri Lanka, yet the welfare of layer hens in these systems remains poorly assessed. This study comprehensively evaluated the welfare status of layer hens in the small-scale backyard systems of the Matara and Kekanadura veterinary divisions. The study evaluated farmer socio-economics, management practices, resource provision, and animal-based welfare indicators. Data were collected from 30 households via a structured questionnaire and direct animal observations. Results revealed that most farmers were males (90%) aged 50-65 years (57%). Flock sizes averaged 17 birds, primarily kept for egg production. Semi-intensive housing was dominant (67%), with a mean space allowance of 2.83 Sq Ft/Bird. A critical welfare constraint was identified in healthcare, with 46.7% of farmers not vaccinating their flocks, correlating with a high prevalence of respiratory diseases (63%). While most birds (70%) were in good body condition, feather condition was a concern, with 43.3% showing damage, losses, or pecking marks; stress-induced feather pecking was observed in 50% of flocks. A significant positive correlation was found between flock size and welfare index (spearman's $\rho = 0.507$, $p < 0.01$), and analysis of variance indicated significant welfare differences between housing systems ($p < 0.01$). The study concludes that key welfare issues stem from inadequate vaccination, suboptimal space allocation, and poor feather condition. Interventions should focus on improving farmer knowledge on preventive healthcare and housing management to enhance welfare and productivity.

Keywords: Animal Welfare, Backyard Poultry, Layer Chickens, Management Practices

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Biomass Yield and Nutrient Accumulation in Spinach Microgreens Cultivated under Different Growth Media

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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. This study evaluated the impact of different growth media on biomass yield and nutritional quality of spinach (*Spinacia oleracea* L.) microgreens. Six types of growth media were used as treatments; compost (T1), vermicompost (T2), cocopeat (T3), compost+vermicompost (1:1-V/V;T4), compost+cocopeat (1:1-V/V; T5), and vermicompost+cocopeat (1:1-V/V;T6). The experiment was done under controlled conditions using a completely randomized design with three replicates per treatment. The media were tested for their physical and chemical properties, and the microgreens were harvested 21 days after sowing to measure biomass, moisture, nitrogen (N), phosphorus (P), potassium (K), chlorophyll, carotenoids, antioxidant activity, polyphenols, ascorbic acid, and ash content. The growing media showed a wide range of nutrient levels; total N ranged from 2.15 to 9.01 mg g^{-1}, P from 0.46 to 1.34 mg g^{-1}, and K up to about 47 mg kg^{-1}. The pH ranged from 5.8 to 7.6, electrical conductivity from 0.9 to 2.5 mS/m, and organic carbon from 0.06 to 0.56%. Out of all treatments, the vermicompost+cocopeat mix (T6) produced the highest fresh and dry weights, nutrient uptake, and ascorbic acid content. The compost mixes (T4 and T5) also showed better K level. Cocopeat alone (T3) gave the lowest yield and nutrient uptake, but it had the highest antioxidant and total polyphenol content, possibly due to nutrient limitations. The findings suggest that vermicompost+cocopeat is an effective medium for optimizing spinach microgreen yield and nutritional value, while cocopeat alone may be suitable when enhanced antioxidant content, provided that nutrient supplementation is considered. This research offers practical insights for small-scale and urban farmers seeking sustainable and efficient spinach microgreens production strategies.

Keywords: Cocopeat, Compost, Growth Media, Microgreens, Vermicompost

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Changes in NH_4^+ and NO_3^- Contents in an Alfisol Supplied with a Biochar-Based Novel Urea Fertilizer

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Slow-release nitrogen fertilizers are increasingly explored as a way to synchronize nitrogen availability with crop demand. Incorporating urea into modified biochar matrices may reduce rapid nitrogen conversion and losses. This study attempted to develop a slow-release urea(U) fertilizer using $MgCl_2$ modified (M) poultry litter biochar, the Limux® urease inhibitor (I) and some bio-degradable binding agents. Biochar was produced at 500°C as non-modified (BC) and modified biochar (BC-M), and both materials were characterized to determine their adsorption characteristics. Two new fertilizers were produced by soaking BC-M in solution containing either U (BC-M+U) or U+ I (BC-M+U+I) and coated with binding agents. A microcosm leaching column study was conducted using an Alfisol, supplied with 5 treatments; no urea control (0U), U, U+I, BC-M+U and BC-M+U+I at an equal N rate (239.61mg/kg) except for 0U. Leachates were analyzed for NH_4^+ and NO_3^- contents for two weeks. The pH of BC-M was significantly lower than that of BC ($P<0.05$) while EC was significantly higher ($P<0.05$). BC-M had higher pore spaces and iodine value 50.94% than that of BC. The FTIR analysis revealed that, modification introduce more -OH and C=O bonds which could facilitate better urea adsorption. Soil treated with U+I had the highest cumulative NH_4^+-N contents throughout the experimental period, but four days after treatment application both BC-M+U and BC-M+U+I had comparable NH_4^+-N in leachates. In contrast, soil treated with U, recorded lower NH_4^+-N contents than all treatments but 0U. The intermediate NH_4^+–N concentrations observed in BC-M+U and BC-M+U+I suggested a gradual release of U into soil and their subsequent hydrolysis. The cumulative NO_3^--N contents of the leachates were not significantly different ($P>0.05$) across all treatments throughout the experimental period. The observed results could be due to short experimental period and loss of NH_3 through volatilization; hence further research is required.

Keywords: Modified biochar, Nitrogen dynamics, Slow-release urea, Urease inhibitor

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Characterization of Rambutan Germplasm at FRDI Using Morphological Traits and Molecular Markers

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Rambutan (*Nephelium lappaceum* L.) is an economically and nutritionally important tropical fruit crop in South and Southeast Asia, exhibiting considerable morphological diversity but limited genetic characterization among Sri Lankan cultivars. Comprehensive evaluation of both phenotypic and molecular diversity is critical for germplasm conservation, breeding, and cultivar identification. This study aimed to assess the morphological and genetic variation among 27 rambutan accessions conserved at the Field Genebank, Fruit Research and Development Institute (FRDI), Horana, Sri Lanka. Morphological diversity was evaluated using both qualitative and quantitative leaf traits. Genomic DNA was extracted using a modified CTAB protocol, and PCR amplification targeted the nuclear ribosomal ITS region. The Shannon–Weiner diversity index (H) indicated the greatest variation for leaflet color ($H = 0.642$), while margin, venation, surface, and arrangement were invariant ($H = 0$). Quantitative data analyzed in Minitab 21 using ANOVA revealed highly significant differences among accessions ($p < 0.05$). Hierarchical clustering based on leaf morphology produced 8 clusters, with clusters C3 and C2 comprising 41% and 15% of the studied accessions, respectively. Four Malwanee clonal accessions (Ra 12, Ra 17, Ra 29, and Ra 42) were distributed in separate clusters. The ITS region (ITS1 and ITS4) was amplified in the selected accessions. However, further optimization and sequencing of the amplified products are required to validate and better resolve the genetic differentiation among Sri Lankan rambutan accessions.

Keywords: Genetic diversity, ITS, Morphological traits, Rambutan

Acknowledgement: Fruit Research and Development Institute (FRDI), Horana, Sri Lanka

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Climate-smart Biofortification of Rice: Balancing Zinc–Iron Enrichment Under Water-Limited Conditions

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Zinc (Zn) and iron (Fe) deficiencies remain as major global nutritional challenges. As a result, biofortification of rice combined with water-saving irrigation offers a promising strategy to enhance human nutrition. This study evaluated the effects of water management regimes (alternate wetting and drying [AWD] vs. continuous flooding [CF]) and micronutrient applications (control, Fe, Zn, Zn + Fe) on the growth of rice variety Bg 300. A factorial experiment with six replicates per treatment (n=48) was conducted using 14 kg of soil per pot. Continuous flooding significantly increased shoot dry weight by 12% compared to AWD. Micronutrient supplementation markedly enhanced the growth, with stem and leaf dry weights increasing by 95–135% relative to the control. Application of Fe alone or Zn alone resulted in the highest gains in stem and leaf. (stem: 8.13–8.05 g; leaf: 4.27–4.15 g), while the combined Zn and Fe application showed intermediate effects. Photosynthetic rate was suppressed by micronutrient application up to 32% lower than the control, whereas stomatal conductance remained unaffected. These results demonstrate that targeted Fe and Zn fertilization can substantially increase the growth of rice without compromising water-use efficiency, highlighting AWD irrigation as a viable climate-smart strategy for nutritionally-enriched rice production.

Keywords: Alternate Wetting and Drying, Climate-smart Agriculture, Continuous flooding, Vegetative biomass

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Companion-cropping of Marigold (*Tagetes erecta*) for Controlling Leaf Curl Disease of Chilli (LCDC)

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Chilli (*Capsicum annuum* L.) is an essential spice crop cultivated in Sri Lanka. However, its productivity is affected by the Leaf Curl Disease of Chilli (LCDC), which causes significant yield losses. Therefore, this experiment was carried out at Mahailluppallama during the *Yala* season of 2025 to assess the effectiveness of using African marigold (*Tagetes erecta*) as a companion crop in chilli cultivation, aiming to reduce agrochemical usage and enhance land productivity. The study employed a Randomized Complete Block Design with three replicates and four treatments: chilli sole crop without insecticides (T1), chilli sole crop with insecticides (T2), chilli plus marigold in a 2:1 row ratio transplanted simultaneously (T3), and chilli plus marigold in a 2:1 row ratio with marigold transplanted 10 days later (T4). Data on plant growth, yield, disease severity, mite damage, and economic returns were collected. Results showed that T1 achieved the highest chilli yield and income, whereas T2 was the least productive and economically viable. However, total income per hectare was significantly higher in T3 and T4 compared to other treatments. The treatments involving marigold demonstrated significantly lower ($p<0.05$) mite-induced pod damage and yield loss. Additionally, the treatment effect on days to crowning was significant ($p<0.001$), as per the survival analysis using a mixed-effects Cox proportional hazards model. T3 (Hazard Risk; HR=0.17, p=0.0069) and T4 (HR=0.18, p=0.0084) reduced the hazard of crowning by approximately 82–83% relative to the control (T1), indicating they were effective in delaying disease-related physiological disorders in chilli plants. T4 exhibited better land-use efficiency with a partial Land Equivalent Ratio (pLER) of 1.16 compared to T1. Marigold flower yield and income were also higher in T3. Overall, these findings suggest that using marigold as a companion crop can improve chilli plant health, reduce LCDC severity, and enhance land productivity and farmers' income.

Keywords: Hazard Risk (HR), Integrated Pest Management (IPM), Intercropping, Partial Land Equivalent Ratio (pLER), Sustainable agriculture

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Comparative Analysis of Fish Catch Composition and Gear Selectivity in Gurunagar and Passaiyoor, Jaffna Lagoon

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Fishing is a vital sector in Sri Lanka's coastal economy, particularly in the Northern Province where the Jaffna Lagoon plays a central role in sustaining livelihoods. This study was conducted to compare two fishing methods, longlines and stake nets used at two major lagoon landing sites: Gurunagar and Passaiyoor in Jaffna Lagoon. Research focused on analyzing fish catch composition and evaluating fisher satisfaction across the two sites. Data were collected through market auction records and a structured survey involving 60 fishermen. Catch analysis revealed significant differences ($P<0.05$) in the abundance of key species such as Skipjack tuna (*Katsuwonus pelamis*), Seer fish (*Lutjanus argentimaculatus*.), Mackerel tuna (*Scomberomorus commerson*), Ribbon fish (*Trichiurus lepturus*) and Emperor fish (*Lethrinus nebulosus*) between Gurunagar and Passaiyoor. Higher catches of Seer fish (*Lutjanus argentimaculatus*.), Anchovy (*Sphyraena barracuda*.) and Emperor fish (*Lethrinus nebulosus*) recorded in Passaiyoor. However, no significant difference ($P>0.05$) was observed in the catch rates of Horse mackerel (*Caranx ignobilis*.), Sardine (*Sardinella longiceps*.) and Anchovy (*Sphyraena barracuda*). Survey results indicated that Passaiyoor fishermen reported higher satisfaction levels and conversely, Gurunagar fishermen faced multiple challenges. Overall, the study concludes that stake net operations, as practiced in Passaiyoor, offer a more sustainable and economically viable fishing method in the Jaffna Lagoon compared to longline fishing.

Keywords: Sri Lanka Fisheries, Jaffna lagoon, Coastal livelihoods, Stake net fishing, Longline fishing*

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Comparative Analysis of Live Weight and Reproductive Performance of Ross and Cobb Broiler Parent Stocks During the Laying Phase

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Comparison of performance of exotic broiler parent strains under Sri Lankan conditions is vital to achieve high profitability of local breeder farms. The present study was conducted to compare the live weight and reproductive performance of Cobb and Ross broiler breeder strains, during the laying phase of parent stocks under closed house conditions in Sri Lanka. Data were extracted from the parent stock records of a leading commercial breeder farm in Pasyala. Parameters measured included hen-day egg production, hen-housed egg production, average egg weight (g), average body weight (g), and hatching percentage during a single laying period of 7 batches of Cobb parents and 2 batches of Ross parents managed in 9 closed houses following standard management guidelines of the breeds. Random samples of 10 birds from each house was used for live weight while performance of the whole house (10000 birds per house) was used for the other traits. Analysis of Variance procedure was carried out to determine the differences in the two breeds and age categories of birds and their interaction effect, with Duncan's multiple range test for mean comparison (p=0.05). Cobb strain recorded significantly higher mean values for egg weight (62.83 ± 1.99 g) and hatching percentage (94.09% ± 2.27%) compared with Ross strain (61..88 ± 1.68 g and 89.44% ± 2.06%, respectively). However, Ross strain recorded significantly higher mean body weight (3349.94 ± 40.66 g) compared with Cobb (3263.90 ± 44.93 g). Hen-day and hen-housed egg productions of Cobb strain (62.02% ± 4.14% and 60.38% ± 4.86%, respectively) were not significantly different from those of Ross strain (63.43% ± 3.99%, 59.85% ± 5.10%, respectively). Both age effect and strain*age interaction effect were significant for all traits considered where Cobb and Ross strains reaching peak egg laying at 30-35 weeks and 40-45 weeks of age, respectively.

Keywords: Breed comparison, Broiler breeding, Hen-day production, Hen-housed production, Parent lines.

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Comparative Evaluation of Fermentation Quality, Stability and Nutrient Retention in Fodder Maize, CO-3 and Guinea Grass Silages Treated with the Novel Inoculant SILOSOLVE® FC

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Efficient silage fermentation is essential for preserving nutrients and ensuring year-round feed availability in tropical dairy production systems. However, the performance of silage inoculants can vary depending on forage type and application rate. The objective of this study was to evaluate the effects of different doses of a novel silage inoculant SILOSOLVE® FC on fermentation quality and nutrient retention, to examine the interactions between forage type and inoculant dose on silage stability, and to characterize the fermentation profiles across fodder maize, CO-3, and Guinea grass silages. The three forage types, fodder maize (*Zea mays*), CO-3 (*Pennisetum purpureum* × *Pennisetum americanum*), and Guinea grass (*Panicum maximum*), and their mixture (1:1:1) were ensiled with different dosages (0, 1, 2, and 3 g/ton) of the novel silage inoculant for 35 days. Fermentation characteristics, nutrient composition and aerobic stability (7 days) of silages were analyzed. Significant species-specific variations were evident in nutrient composition and fermentation metabolites. Fodder maize and the mixed forage inoculated silages exhibited superior acidification with lower pH and higher lactic acid concentrations ($P<0.05$) compared to CO-3 and Guinea grass silage, correlating with improved nutrient preservation marked by higher dry matter and crude protein retention. CO-3 and Guinea grass silage showed lower ($P<0.05$) amount of soluble carbohydrates than the other two types. Guinea grass silage showed elevated fiber fractions linked to lower ($P<0.05$) digestibility compared to the other three silage types. Inoculant dose effects were significant ($P<0.05$) for parameters including ash, acid detergent fiber and lactic acid concentration, demonstrating dose-dependent improvements in fermentation quality. Ammonia-N content in fodder maize silage was reduced ($P<0.05$) at 1 and 2 g/ton doses, signaling improved protein preservation. Interaction effects imply that forage type modulates inoculant efficacy on silage nutrient dynamics. None of the silage types exceeded the ambient temperature + 3°C during the tested period of aerobic stability. The novel inoculant SILOSOLVE® FC demonstrated significant potential to enhance fermentation quality and nutrient retention, particularly in fodder maize and mixed forage silages, indicating its suitability for improving silage production.

Keywords: Silage, SILOSOLVE® FC, Aerobic stability, Fermentation quality, Nutrient retention

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Comparative Evaluation of Selected Invasive Aquatic Plants for their Antibacterial Effect on Common Fish and Shrimp Bacterial Pathogens

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This study explored the antibacterial properties of four invasive aquatic plants *Pontederia crassipes*, *Salvinia molesta, Ludwigia peruviana, and Limnocharis flava* against three bacterial pathogens: *Aeromonas spp., Edwardsiella spp*., and *Vibrio spp*. Aqueous and ethanolic extracts were prepared from each plant, and their antibacterial activity was evaluated using the Zone of Inhibition (ZOI) by Kirby Bauer disc diffusion assay. Gentamicin was used as the positive control, while sterile water served as the negative control. The data were analyzed using a three-way ANOVA to assess the effects of bacterial species, plant type, and solvent, as well as their interactions. All three main factors significantly influenced antibacterial activity ($p < 0.001$): bacteria ($F(2,74) = 580.27$), plant ($F(5,74) = 10646.73$), and solvent ($F(1,74) = 3403.22$). Significant interaction effects ($p < 0.001$) showed that the antibacterial response depended on the specific combination of these variables. Post hoc analysis revealed that *Aeromonas spp*. was the most sensitive bacterium and ethanolic extracts were generally more effective than aqueous ones. Among the tested plants, *Ludwigia peruviana* and *Limnocharis flava* displayed the strongest antibacterial activity, whereas *Pontederia crassipes and Salvinia molesta* showed weaker effects. Gentamicin produced the highest inhibition zones. With an excellent model fit ($R^2 = 0.999$), the results suggest that certain aquatic plants particularly *Ludwigia peruviana* and *Limnocharis flava* have strong potential as natural antibacterial agents and may serve as alternatives to conventional antibiotics, highlighting their potential for developing ecofriendly phytotherapeutic alternatives in aquaculture.

Keywords: antibacterial activity, fish pathogens, invasive plants, *Ludwigia peruviana, Limnocharis flava*

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Comparison Among Exotic Swine Breeds and Estimation of Heritability for Reproductive Traits in a State Nucleus Herd in North Western Province

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A study was carried out to compare the reproductive performance of three exotic swine breeds (Duroc, Landrace, and Large White) maintained at a large Government nucleus herd in North Western Province, and to estimate heritability for the reproductive traits. A total of 349 animal records collected from 2018 to 2024 were analyzed, representing Duroc (n = 53), Landrace (n = 174), and Large White (n = 122) breeds. Reproductive traits included litter size (LS), number born alive (NBA), litter weight (LW), farrowing interval (FI), pre-weaning mortality % (PM), and piglet birth weight (BW). One way ANOVA procedure was used for each trait treating breed as the fixed effect and Duncan's Multiple Range Test was used for mean comparison (p=0.05). Heritability of each trait was estimated using sire model. The results showed that Duroc breed had significantly low mean for LS (7.38 ± 0.41 piglings/litter) than Large White (8.44 ± 0.28 piglings/litter) and Landrace (8.78 ± 0.27 piglings/litter) breeds. Means of NBA of Duroc, Large White and Landrace breeds were 6.08, 6.94 and 7.72 piglings/litter, where Duroc mean was significantly lower than that of Landrace. The Duroc breed also exhibited significantly inferior performance with respect to LW (10.51 ± 0.59 kg) and FI (173.52 ± 5.16 days) than those of Large White (11.95 ± 0.38 kg and 158.26 ± 2.58 days, respectively) and Landrace (12.69 ± 0.41 kg and 158.51 ±2.69 days, respectively). The three breeds were not significantly different with respect to means of BW and PM, where the respective overall means were 1.43 ± 0.08 kg and 15.24 ± 0.82%. The heritability estimates for LS, NBA, LW, FI, PM, and BW were 0.44, 0.48, 0.51, 0.42, 0.10, and 0.28, respectively showing presence of sufficient additive genetic variability for genetic selection for the reproductive traits except for PM.

Keywords: Breed comparison, Genetic parameters, Litter size, Performance evaluation, Variance components.

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Development of a Micropropagation Protocol for *Aglaonema commutatum* 'Lipstick'

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Aglaonema commutatum 'Lipstick' belongs to the Araceae family and is one of the most commonly used indoor ornamental plants. The large-scale commercial production is limited by slow conventional propagation. This study investigates the possibility of establishing an effective *in-vitro* micropropagation protocol for *Aglaonema commutatum* 'Lipstick' through indirect organogenesis from leaf explants and shoot proliferation from nodal explants. The first experiment evaluated callus induction using two MS strengths (full and half), three benzylaminopurine (BAP) concentrations (0, 1, and 2 mg/L), and two auxins [2,4-dichlorophenoxyacetic acid (2,4-D) and indole-3-butyric acid (IBA) at 0.1 and 0.5 mg/L]. The highest callus formation rate (75%) was observed in half-strength MS supplemented with 1 mg/L BAP and 0.5 mg/L 2,4-D ($p < 0.05$). The second experiment evaluated shoot proliferation using eight treatment combinations of two BAP (2 and 5 mg/L) concentrations, and four IBA (0,0.1,0.5, and mg/L) concentrations. The medium containing 5 mg/L BAP without IBA yielded the best results, producing the highest survival rate (100%), the earliest shoot initiation (19 days), and the longest shoot length (9.14 ± 0.86 mm), showing significant effects of BAP and IBA concentrations ($p < 0.05$). The study concludes that half-strength MS medium with 1 mg/L BAP and 0.5 mg/L 2,4-D is optimal for callus induction, while full-strength MS medium with 5 mg/L BAP without IBA is most suitable for shoot proliferation. The developed protocol provides an efficient basis for large-scale micropropagation of *Aglaonema commutatum* 'Lipstick' for commercial ornamental plant production.

Keywords: *Aglaonema commutatum*, Callus induction, 'Lipstick', Micropropagation, Plant growth regulators, Shoot proliferation,

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Dietary Enzyme Supplementation on Growth Performance and Nutrient Digestibility in Broiler Chickens Fed with Rice Bran-Based Diet

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This study evaluated the impact of dietary supplementation with xylanase, combined with protease and phytase super-doses, on growth performance, nutrient digestibility, and intestinal health in broiler chicken fed rice bran-based diets. Five iso-energetic and iso-nitrogenous diets were formulated: Diet 1: corn-soybean based diet containing rice bran (control), Diet 2: control with phytase (500 FTU/kg) and xylanase, Diet 3: control with xylanase, protease, and phytase (500 FTU/kg), Diet 4: control with xylanase and phytase super-dose (1000 FTU/kg), and Diet 5: control with xylanase and phytase super-dose (1500 FTU/kg). One hundred and twenty Ross 308, one-day-old chicks were randomly assigned to the five dietary treatments (n=4 replicates of 6 birds each) and fed for 35 days. Growth performance, relative organ weights, nutrient digestibility, and occurrence of intestinal lesions were assessed at the end of the feeding period. No significant differences ($P > 0.05$) were observed among dietary treatments in body weight gain, feed intake, feed conversion ratio, relative organ weights, or intestinal lesions. All enzyme-supplemented diets improved ileal protein and phosphorus digestibility, while fiber digestibility was lower in protease-supplemented diets compared to diets with phosphorus super-doses. Apparent ileal dry matter digestibility was higher ($P < 0.05$) in the two diets containing xylanase and phosphorus super-doses (Diets 4 and 5). The combination of xylanase and phytase super-doses likely enhanced the degradation of anti-nutritional factors such as phytate and non-starch polysaccharides, improving nutrient availability. In conclusion, supplementation of rice bran-based broiler diets with xylanase and phytase, particularly at super-dose levels, effectively improved nutrient digestibility without negatively affecting growth performance or intestinal health, suggesting that these enzyme combinations can enhance the nutritional efficiency of rice-bran based broiler chicken diets.

Keywords: Rice bran, Broiler chicken, Phytase super-dose, Protease, Nutrient digestibility

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Early Growth and Nodule Formation of Alfalfa and *Stylosanthes* in the Mid-country Wet Zone Conditions

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This study investigated the early growth performance of Alfalfa *(Medicago sativa)* and Stylo *(Stylosanthes guianensis)* during eight weeks after sowing. The experiment was conducted at the Animal Experimental Farm of the Veterinary Research Institute (VRI), Gannoruwa. The experiment followed a Completely Randomized Design. Seeds of legume species were sown on three randomly selected raised beds (2.5 m^2) in rows spaced 25 cm apart, at 20 kg/ha seed rate. At five weeks after sowing, a fertilizer mixture of urea, TSP, and MOP was applied 20:30:15 kg/ha rate. Until eight weeks after sowing, five plants were randomly uprooted from each replicate weekly, and growth parameters (shoot and root length, fresh weight, and nodule formation) were recorded. At eight weeks, shoots harvested from 1 m^2 of each bed were oven-dried at 65° C to determine dry matter accumulation. Throughout the study, all measured growth parameters were significantly ($p<0.05$) greater in Alfalfa compared to Stylo. At eight weeks, Alfalfa recorded significantly ($p<0.05$) higher shoot height (94.9 vs. 44.8 cm), root length (19.0 vs. 16.6 cm), shoot weight (31.2 vs. 15.7 g), and root weight (2.7 vs. 1.2 g), resulting in greater biomass accumulation (33.9 vs. 19.6 g/plant). The study also revealed significantly ($p<0.05$) greater shoot dry matter accumulation in Alfalfa compared to Stylo (2.51 vs. 1.20 MT/ha) at eight weeks of growth. Both species produced trifoliate compound leaves. Stylo initiated nodule formation as early as three weeks after sowing and reached a peak of 37.3 nodules/plant at seven weeks, while Alfalfa did not form nodules. The results demonstrate that Alfalfa exhibited superior early growth and shoot biomass accumulation compared to Stylo. However, the absence of nodule formation in Alfalfa suggests a lack of compatible rhizobial strains such as *Sinorhizobium meliloti* in the soil, whereas the presence of nodules in Stylo confirms successful symbiosis with *Bradyrhizobium* species (e.g., *B. japonicum*) naturally present in mid-country wet zone soils. Inoculation of Alfalfa with effective *Sinorhizobium* species is recommended to enhance nitrogen fixation and establish productive stands in this region.

Keywords: Biomass accumulation, *Medicago sativa*, Rhizobial association, *Stylosanthes guianensis*

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Effect of Dietary Supplementation of Biogaia™ (*Limosilactobacillus reuteri* DSM 17938) on Growth Performance, Survival Rate, in Catla (*Catla catla*) Post-Larvae and Water Quality

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The main objective of the study was to assess the effect of dietary supplementation of BioGaia™ (*Limosilactobacillus reuteri* DSM 17938) on growth performance, survival rate, and water quality in *Catla catla* post-larvae. A field trial was conducted over 21 days. Approximately 24,000 post-larvae (0.76 ± 0.79 mg) were randomly distributed into 12 cement tanks, arranged in a quadruplicate design, with each tank containing 2,000 fish in 0.28 m^3 of water. The control group received no probiotics, while the treatment groups were supplemented with 0.5%, 0.7%, and 0.9% g/kg of probiotics incorporated into the fish feed incorporated into the fish feed. The effect of the supplement on the growth performance, survival rate of Catla, and water quality was evaluated. Proximate analysis was conducted for soya feed and Tropical Fish Feed No 00. One-way ANOVA followed by Tukey's post hoc test was used to determine statistical differences among treatments. During the first week, weight and weight gain rate (WGR) were not significantly different among treatments. However, specific growth rate (SGR) was significantly lower in the control group ($p < 0.05$), while no significant difference was observed among the three probiotic treatments. After the third week, Treatments 1 (0.028 ± 0.04 g) and 2 (0.05 ± 0.07 g) were most effective in improving weight. All treatments showed improved WGR compared to the control. SGR was significantly higher in Treatments 1 (16.86 ± 0.91) and 2 (20.4 ± 0.5). The highest survival rate (60.83 ± 1.55%) was observed in the Treatments 2 ($p < 0.05$). Water quality parameters (temperature, dissolved oxygen, pH, and electrical conductivity) showed no significant differences among treatments. These results suggest that 0.7% probiotic supplementation enhances growth and survival in Catla post-larvae without negatively affecting water quality.

Keywords*:* *Catla catla*, Probiotics, Growth performance, Survival rate, Biogaia™

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Effect of Different Growth Media and Fertilizer Combinations on Growth and Biomass Production of Henna (*Lawsonia inermis* L.)

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Henna (*Lawsonia inermis L.),* commonly called as Mehendi plant, is widely valued for its cosmetic and medicinal uses and as a guard crop in mixed cultivation systems. The henna paste prepared from powdered leaves is applied to dye the nails, fingers and hair. However, limited scientific information on suitable growth media and fertilizer management poses challenges for commercial cultivation of henna. This study was carried out as a replicated pot experiment to investigate the effect of different growth media and fertilizer combination on growth and biomass production of henna plant. The experiment was arranged in a two-factor factorial Completely Randomized Design (CRD) under greenhouse conditions at the University of Peradeniya. Different growing media mixtures containing cocopeat, sand and compost, and three fertilizer sources (Urea, TSP, MOP) were selected. The treatments consisted of four combinations: T1 [Cocopeat + 100: 50: 50 N: P: K $kgha^{-1}$], T2 [Cocopeat + 200: 100: 100 N: P: K $kgha^{-1}$], T3 [Cocopeat: Sand: Compost (2: 1: 1) + 100: 50: 50 N:P:K $kgha^{-1}$], and T4 [Cocopeat: Sand: Compost (2: 1: 1) + 200: 100: 100 N: P: K $kgha^{-1}$]. Number of leaves/plant, number of main branches/plant, plant height, leaf area/plant, chlorophyll fluorescence, SPAD reading, plant fresh weight and plant dry weight, media N, P, K, pH, electrical conductivity (EC) were measured after transplanting in weekly intervals. Number of leaves/plant was significantly higher in T2 and T1 whereas number of main branches/plant was significantly higher in T1 and T4. A significant difference ($p < 0.05$) was observed in chlorophyll fluorescence parameters at the 6th week after transplanting. The results revealed that cocopeat alone with the 100: 50: 50 N: P: K fertilizer ratio was more effective for promoting growth and biomass production of henna plant under greenhouse conditions.

Keywords: Henna (*Lawsonia inermis* L.*)*, Growth media, Fertilizer, plant growth

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Effect of Moringa (*Moringa oleifera*) Leaf Extract as a Natural Bio-Stimulant on Tomato (*Solanum lycopersicum* L.) under Organic and Inorganic Fertilizer Application

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The intensification of crop production using synthetic agrochemicals has raised concerns regarding long-term soil health and environmental sustainability. Moringa leaf extract (MLE), a plant-based bio-stimulant rich in phytohormones, antioxidants, and micronutrients, offers potential to enhance crop performance naturally. However, optimal concentration and integration with different fertilizer types for tomato growth are not well established. A pot experiment was conducted at the University Experimental Station, Dodangolla, Kundasale. This study assessed the effect of MLE on vegetative and early reproductive growth of tomato under two fertilizer types (organic, inorganic), three MLE concentrations (0%,3%,20% v/v), and two foliar spray intervals (7-day,14-day) using a three-factor factorial arrangement in a completely Randomized Design with 12 treatment combinations and six replicates. Results revealed that MLE concentration significantly ($p<0.05$) affected plant height, leaf number, and leaf area, with the highest values recorded under 3% MLE, while fertilizer type and application frequency had no significant effect ($p>0.05$). T2 (organic+3% MLE+7-day interval) produced the greatest number of fruits. Shoot and root fresh weights were significantly affected by fertilizer type into MLE concentration interaction ($p<0,05$), with the highest values under organic+3% MLE application. Chlorophyll a, b, and total chlorophyll contents were significantly ($p<0.0001$) enhanced under organic+20% MLE+7-day interval. Plant nutrient accumulation showed significant ($p<0.05$) increase in nitrogen under inorganic fertilizer, potassium under inorganic+3% MLE, and phosphorus under inorganic+3% MLE+14-day interval application. Root length and flowering time were not significantly affected ($p>0.05$), but MLE-treated plants showed better numerical trends. Results suggest that MLE-treated plants, particularly those receiving 3% MLE with organic fertilizer, exhibited markedly superior growth, physiological responses, and fruit productivity, compared to 0% MLE controls. These results confirm the practical value of MLE as an effective and sustainable bio-stimulant in tomato cultivation, with potential for eco-friendly integration into nutrient management strategies.

Keywords: Application frequency, Bio-stimulant, Moringa leaf extract, Organic Tomato

Acknowledgement: Authors acknowledge the collaborative support of the farm staff of the University Experimental Station, Dodangolla.

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Effect of Organic and Inorganic Liquid Fertilizer Applied as Soil and Foliar Treatments on Growth and Yield of Radish (*Raphanus sativus* L.)

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The present study was conducted to evaluate the effects of organic and inorganic liquid fertilizer applied as foliar and soil treatments on the growth and yield of radish (*Raphanus sativus* L.). The experiment was carried out at the University Experimental Station in Dodangolla. The treatments included different types of liquid fertilizers: Albert's solution, fish tonic, plant tonic and no fertilizer treatment. Each liquid fertilizer type was applied using both soil and foliar methods, along with two control treatments receiving only water as soil and foliar applications. The experiment was arranged in a Completely Randomized Design with three replicates for each treatment. The growth and yield of plants were measured using several parameters including total number of leaves, fresh weight of leaves, dry weight of leaves, root length, root weight, root girth, chlorophyll content of leaves, and plant nutrients. The results showed that there was a significant effect of fertilizer type and application method on the growth and yield of radish. According to the results, root weight is significantly higher ($P<0.05$) in plants grown in soil treated with fish tonic. The control treatment recorded the lowest root weight. Differences were also significant with the fresh and dry weight of leaves. The highest fresh and dry weight of leaves was observed from the soil applied fish tonic treatment and foliar applied Albert's treatment. Overall, the findings of this study suggest that fish tonic can enhance the yield of radish when applied to the soil. The results indicate that the potential use of fish tonic fertilizer as a sustainable and ecofriendly organic liquid fertilizer.

Keywords: Fish tonic, Foliar application, Organic and Inorganic liquid fertilizer, Radish, Soil application

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Effect of *Pontederia crassipes*-derived Biochar on the Growth of Rice (*Oryza sativa* L.) under Salinity Conditions

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Soil salinity severely limits rice productivity by reducing plant growth and yield. Biochar, a carbon-rich soil amendment, has shown potential to alleviate salinity stress and improve plant performance. *Pontederia crassipes* (water hyacinth) is a rapidly growing aquatic plant recognized as one of the most invasive species worldwide. Despite its negative ecological impact, its high biomass and carbon content make it an excellent raw material for biochar production. This study evaluated the effect of biochar derived from *P. crassipes* on the growth of rice (*Oryza sativa* L. variety *Bg*-300) under saline conditions, focusing on plant growth and soil properties. The experiment consisted of four treatments: T1 (control), T2 (salinity only (3.5 ds/m)), T3 (biochar only(1%w/w), and T4 (salinity (3.5 ds/m)+biochar(1% w/w)). Salinity stress (T2(3.5ds/m)) significantly reduced plant height by 26.3% and shoot biomass by 21.9% compared with the control ($p < 0.05$). Biochar application alone (T3(1%w/w) significantly increased plant height by 25.6% ($p < 0.05$). Under saline conditions, biochar amendment (T4) markedly improved growth, producing taller plants (53.4%) and greater shoot biomass (40.5%) than the salinity-only treatment (T2). Root biomass also increased by 44.1% in T4 compared to T2. Biochar enhanced nutrient retention and reduced soil electrical conductivity, thereby mitigating the effects of salinity. Overall, biochar derived from *P. crassipes* effectively improved rice-plant growth and soil health under salinity stress, demonstrating its potential as a sustainable solution for salt-affected soils.

Keywords: Biochar, invasive species, Rice, Salinity stress, Soil properties,

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Effect of Some Selected Natural Substances on Seed Germination and Seedling Vigor of Snake Gourd (*Trichosanthes cucumerina*)

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The study was carried out to assess the impact of some selected natural plant substances on seed germination and seedling vigor of snake gourd (*Trichosanthes cucumerina*) through seed coating. The experiment was conducted at the University Experimental Station Dodangolla, Kundasale. There were six treatments which were arranged in a Completely Randomized Design with four replicates. The experiment involved seed treatment with various botanical powders including neem (*Azadirachta indica*) leaf powder, Moringa (*Moringa olerifera*) leaf powder, Turmeric (*Curcuma longa*) powder and cinnamon (*Cinnamomum verum*) leaf powder with a carbohydrate solution as a binding agent in addition to untreated and control groups. The seeds were stored under ambient conditions and data were collected as germination percentage, seedling fresh weight and dry weight, root length and shoot length, chlorophyll content of leaves. Vigor index of the seedlings were calculated. Results showed that the germination percentage of snake gourd seeds in different coating materials was significantly ($p<0.05$) higher than control. Moringa coated seeds were shown significantly ($p<0.05$) higher germination percentage and higher seedling growth concerning fresh and dry weight of shoots. compared to other coating materials. The findings of the study provide valuable insight for application of specific natural substances especially moringa leaf powder to improve the germination percentage and quality of snake gourd seeds through environmentally friendly and sustainable methods.

Keywords: Snake Guard Germination, Seedling Vigor Index, Bio-Stimulant, Seed Coating, Botanical powders

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Effect of Varietal Differences and Calcium Treatments on Growth, Yield, and Physiological Attributes of Gherkin (*Cucumis anguria* L.)

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The study evaluated the impact of varietal differences and calcium (Ca) fertilizer levels on the growth, yield, and selected physiological parameters of gherkin (*Cucumis sativus* subsp. A*nguria*) under field conditions in the *Yala* season. Two varieties, Chandani and Keerthi, were subjected to three calcium treatments (50, 75, and 80 kg/acre) arranged in a two-factor Factorial RCBD with three replicates. Growth and yield attributes, including plant height, stem diameter, number of nodes, intermodal length, crop yield, leaf Ca, K, P content, fruit calcium concentration, and stomatal density, were measured to determine the varietal response and the influence of different calcium treatments on gherkin growth and productivity. Results revealed that varietal differences and calcium levels significantly ($p < 0.05$) influenced most of the evaluated traits. The variety Keerthi recorded a greater plant height, stem diameter, and yield per vine compared to Chandani. However, Chandani exhibited higher mean fruit calcium content and stomatal density, indicating a superior capacity for calcium accumulation and physiological adaptation. Calcium fertilization had a pronounced effect on growth and yield, with 75 kg/acre treatment showing optimal performance in terms of vegetative growth and fruit yield, while the 80 kg/acre treatment enhanced tissue calcium concentration. Overall, interaction effects between variety and calcium level highlighted that varietal response to calcium nutrition is genotype-dependent. The findings suggest that optimizing calcium application can improve gherkin productivity and fruit mineral composition, particularly when variety-specific nutrient uptake characteristics are considered.

Keywords: Chandani, Firmness, Keerthi, Pickling, Stomatal density

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Effect of Watering Interval on Pseudobulb Growth and Development in Dendrobium Orchids

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Pseudobulbs are succulent stem structures that serve as reservoirs for water and carbohydrates in orchids. Water availability strongly influences orchid growth and productivity, as both excessive watering and prolonged drought can alter vegetative development and physiological performance. However, information on how watering frequency affects the growth and development of pseudobulbs at different developmental stages remains limited, particularly under tropical environmental conditions. The experiment was conducted at the Royal Botanic Gardens, Peradeniya, using small (1.5-year-old) and large (2.5-year-old) plants subjected to five watering intervals as daily (T_0), every 3 days (T_1), every 5 days (T_2), every 7 days (T_3), and every 9 days (T_4). Each treatment consisted of three replicates. Growth parameters, including plant height, pseudobulb circumference, number of leaves, and number of pseudobulbs, were measured monthly, while parameters such as leaf area, chlorophyll content, and relative water content (RWC) were recorded at the end of the study. Plant age significantly influenced most traits ($p < 0.05$), with larger plants exhibiting greater chlorophyll content and performance index, reflecting enhanced photosynthetic capacity. Frequent watering (T_0 and T_1) resulted in higher pseudobulb circumference and overall vegetative vigor in plants, whereas extended watering intervals reduced chlorophyll content and RWC. In contrast, the number of leaves, pseudobulb height, number of pseudobulbs, and leaf area were not significantly affected by watering interval, indicating the ability of the species to maintain basic structural growth under limited water supply. Overall, the findings demonstrate that *Dendrobium* orchids exhibit strong drought resilience and efficient water use regulation, and that frequent watering promotes vigorous vegetative growth. These results provide valuable insights for developing age-based watering practices to enhance sustainable tropical orchid cultivation.

Keywords: Pseudobulb, Watering interval, Plant age, Drought resilience, Circumference

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Effectiveness of Groundnut (*Arachis Hypogaea* L.) and Finger Millet (*Eleusine Coracana* Gaertn.) under Sole-, Inter-, and Mixed-Cropping Systems in the Dry Zone of Sri Lanka

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A field study was conducted during the *yala* season of 2025 at the research farm, university sub-campus, Mahailluppallama, Faculty of Agriculture, University of Peradeniya, to evaluate the effectiveness of different cropping patterns/systems for groundnut (*Arachis hypogaea* L.) and finger millet (*Eleusine coracana* Gaertn.) in the dry zone of Sri Lanka. The primary objective of the study was to compare the growth, yield, and productivity of these crops under sole-cropping, inter-cropping, and mixed-cropping systems. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replicates. Treatments consisted of five cropping systems: T1 – Groundnut sole-cropping, T2 – Finger Millet sole-cropping, T3 – Groundnut + Finger Millet mixed cropping, T4 – Groundnut + Finger Millet single (1:1) row intercropping, and T5 – Groundnut + Finger Millet double (1:2) row intercropping. Growth and yield performances, root nodule characteristics, Land Equivalent Ratio (LER), and Relative Value Total (RVT) were used as parameters to assess the productivity of the five treatments. The sole-cropping of groundnut showed significantly higher ($p<0.05$) yield compared to the groundnut yield in other systems while all finger millet treatments gave statistically similar ($p=0.05$) yields. However, all intercropping systems recorded LER and RVT values above 1.0, indicating a yield advantage and improved land-use efficiency. The highest LER (1.15) and RVT (1.25) were both found in T4 while the second highest was in T5 with values of 1.14 and 1.14 respectively. Therefore, the results reveal that intercropping groundnut with finger millet can enhance overall productivity and economic returns. Additionally, having two crops providing above-ground and below-ground yields together in the same land will reduce the risk for farmers of possible yield loss. Therefore, Groundnut + Finger Millet single row intercropping can be recommended for the dry zone of Sri Lanka for achieving better productivity.

Keywords: Intercropping, Land Equivalent Ratio, Land Use Efficiency, Relative Value Total.

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Effects of Mowing and Stem Shorteners on the Growth and Photosynthesis of Winter Wheat

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Wheat (*Triticum aestivum* L. cv. Graham) is one of the main cash crops in the world. However, it is prone to lodging due to its heavy biomass accumulation under the growth and environmental conditions in New Zealand. The risk of lodging can be reduced by the application of stem shorteners or canopy defoliation. This study aimed to assess the impact of stem shorteners (SS), applied as a plant growth regulator (PGR), and mowing on the subsequent vegetative growth and photosynthesis of winter wheat. This was done in a Randomized Complete Block design at the Field Research Center at Lincoln University, New Zealand, from May to September 2025. Net photosynthesis rate and photosystem II efficiency (Φ2) were not affected ($P>0.05$) by treatments or measurement dates. This indicates that instantaneous leaf-level photosynthetic performance was unaffected by PGR or mowing treatments. However, the above-ground dry matter accumulation was higher ($P<0.05$) in mown (T2 and T4) than in unmown (T1 and T3) plots. Leaf nitrogen content was also higher in mown than unmown plots, but leaf nitrogen levels across all treatments were greater than 3.5% and therefore sufficient to maximize photosynthetic rate. Radiation use efficiency was not different across PGR and No-PGR treatments before mowing, but diverged with higher total dry matter and intercepted radiation in the No-PGR plots. These results indicate that PGR application and mowing together do not alter photosynthetic rates, but mowing reduces biomass accumulation, thereby potentially decreases lodging risk without compromising photosynthesis. Appropriate combinations of SS and mowing can be used in optimizing biomass management techniques in winter wheat. The full impact of these treatments will be determined by a final grain harvest in January.

Keywords: Biomass reduction, Lodging, Plant growth regulators

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Effects of Paddy Husk Biochar on Growth Media Properties and Growth Performance of Tomato (*Solanum lycopersicum* L.)

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Biochar is increasingly recognized as a sustainable soil amendment that can enhance soil fertility and plant productivity while improving resource-use efficiency. This study investigated the effects of paddy husk biochar on the properties of the growth media and the growth and reproductive performance of tomato (*Solanum lycopersicum* L.) under greenhouse conditions at University Experimental Station at Dodangolla, Kundasale. The experiment was laid-out as a CRD with nine treatments consisting of different biochar proportions (0%, 10%, 20%, and 30% v/v) with or without compost, and a chemical fertilizer containing N, P and K as the control. Soil pH, electrical conductivity (EC), available N, P, K, and organic carbon were analyzed before and after the experiment. Growth parameters such as plant height, stem girth, leaf area, number of leaves, root volume, and shoot and root biomass, as well as reproductive traits including days to 50% flowering and fruit set, were recorded. Differences ($p < 0.05$) were significant among treatments for all measured parameters excluding reproductive measurements. Compost-amended biochar, particularly at 10–20% levels, significantly enhanced soil nutrient status, organic carbon content and vegetative growth, achieving results that are comparable to the NPK control. Conversely, excessive biochar proportions without compost reduced growth performance. These findings highlight that integrating paddy husk biochar with compost improves soil fertility and supports sustainable tomato cultivation in protected environments.

Keywords: Biochar, compost, growth performance, reproductive traits, soil fertility

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Efficacy of *Tithonia diversifolia* (Mexican Sunflower) and *Bauhinia kockiana* (Orange Bauhinia) Flower Powder as Natural Feed Additive to Enhance Pigmentation, Growth Performance, and Stress Resistance of *Poecilia reticulata* (guppy)

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The study investigated the efficacy of *Tithonia diversifolia* (Mexican sunflower) and *Bauhinia kockiana* (Orange bauhinia) flower powders as natural feed additives to improve pigmentation, growth performance, and stress resistance in *Poecilia reticulata* (guppy) diets. Five experimental diets were formulated: T1 (control diet without flower powder), T2 and T3 (1% and 2% *Bauhinia kockiana* flower powder incorporated diets, respectively), and T4 and T5 (1% and 2% *Tithonia diversifolia* flower powder incorporated diets, respectively). The feeding trial was conducted over 42 days using 450 male golden-yellow guppy juveniles (28 days old) maintained under controlled conditions. Growth, pigmentation, and stress resistance were evaluated. Proximate analysis confirmed increased protein and lipid contents in the 2% *T. diversifolia* diet. The feed conversion ratio (FCR) showed no significant difference ($p>0.05$) among experimental diets; however, numerically higher FCR values were observed in the 1% and 2% *B. kockiana* diets, while the lowest FCR values were recorded in the 1% and 2% *T. diversifolia* diets. No significant difference ($p>0.05$) was observed in specific growth rate (SGR) among treatments. The highest caudal fin color intensity was recorded in fish fed with the 2% *T. diversifolia* diet, while the lowest intensity was observed in fish fed with the 1% and 2% *B. kockiana* diets. Stress resistance differed significantly among treatments ($p<0.05$), with fish fed the control diet and 1% and 2% *T. diversifolia* diets showing higher stress resistance than those fed the 1% and 2% *B. kockiana* diets. These findings demonstrate that *T. diversifolia* flower powder serves as a sustainable, locally available phytogenic feed additive capable of improving coloration, growth performance, and stress resistance in ornamental guppy culture.

Keywords: Guppy, *Tithonia diversifolia*, *Bauhinia kockiana*, Pigmentation, Growth performance

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Enhancing Carbon Sequestration in a Banana Grown Soil through Soil Management Practices

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Enhancing soil carbon sequestration in soils is critical for improving soil health and mitigating climate change. This study evaluated the long-term impacts of applying carbonized rice hull (CRH), cattle manure (CM) and their combination on soil organic carbon (SOC) sequestration and soil fertility in a banana cultivation. Four treatments were implemented: T_1- control, T_2- CRH, T_3- CM and T_4- CRH + CM with a one-time application of amendments to the planting hole. Soil samples were collected inside and outside the planting hole across the four plots and analyzed for key physicochemical properties as well as plant girth to assess crop response. Results showed that the combined application of CRH and CM (T_4) significantly increase the SOC levels ($p \leq 0.05$) compared to other treatments while CRH and CM alone produced moderate increases. The combined treatment also significantly improved soil porosity. Total Nitrogen and available Phosphorus showed no significant differences across treatments. However, available Magnesium and exchangeable Potassium increased marginally in T_2 and T_4, respectively. Soil pH remained slightly acidic with minimal variation across treatments. Among agronomic parameters plant girth was significantly higher ($p \leq 0.05$) in T_2, T_3 and T_4compared to control treatment suggesting a long-term positive impact of treatments on crop growth. Paired comparisons of SOC within and outside planting holes highlighted localized improvements particularly under T_2 and T_4 ($p \leq 0.05$). T_2(CRH) showed the highest carbon stock indicating strong long-term potential of soil carbon sequestration. The study also evaluated the Agrocares soil sensor as an alternative to conventional soil testing. Results indicated a low accuracy ($r<0.5$) and precision (RMSE > 1.0) of soil SOC and plant nutrients measured with the soil sensor. Findings demonstrated that a single application of CRH to the planting hole is an effective practice for enhancing soil carbon sequestration and the combined application led to an added benefit of improving the soil porosity in banana growing soils. The Agrocare soil sensor requires thorough calibration before being recommended for use by farmers in Sri Lanka.

Keywords: Agrocares soil sensor, Banana, Carbonized rice hull, Cattle manure, Soil organic carbon

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Estimation of Genetic Parameters and Breeding Values for Body Weight of a Government Nucleus Herd of Jamunapari Goats

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This study was conducted to determine the factors affecting birth weight (BW) and to estimate the genetic parameters and breeding values (BVs) for live weight (LW) in an intensively managed state nucleus herd of purebred Jamunapari goats in IL_2 Agro-ecological region. Animal ID, sire ID, dam ID, birth date, kidding age, parity, sex of kid, and birth weight (kg) information were extracted from farm records of 973 animals born from the year 2000 to 2023, and transferred to SAS® software for analysis. Additionally, 1057 live weights recorded from March 2023 to June 2025 of animals with ages up to 45 months were also used for the heritability estimation. ANOVA procedure was conducted for BW using birth year, birth month, sex of kids, and parity as fixed effects, and Duncan's Multiple Range Test was used for mean comparison (p=0.05). Half-sib analysis was carried out to estimate heritability for LW of animals at various age categories using sire information. Daughter-dam regression analysis was conducted to estimate heritability using dam records. BW significantly dropped during 2018-2022 period which coincides the social and economic instability prevailed in the country. March-May and September-November seasons showed significantly higher birth weights, most likely due to rainfall pattern related feed and environmental fluctuations. Mean BW of males (2.99 kg) and females (2.96 kg) were not significantly different, so was the pairty of dam. Heritability estimate for BW from half-sib analysis was 0.58, showing the presence of sufficient genetic variation among sires for genetic selection. However, the respective estimate from daughter-dam regression was 0.03, indicating the lack of genetic variability among dams. Breeding value estimates of the 183 sires were ranged from -0.99 kg to + 0.56 kg. The age group of 37-39 months showed the highest heritability estimate (h^2 = 0.66) for LW, being the best age group for genetic selection.

Keywords: Half-sib analysis, Heritability estimation, Genetic selection, Offspring-parent regression, Variance components.

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Evaluating the Effectiveness of Sunburn Protectant to Increase Yield of Banana under Elevated Temperature

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Increasing temperatures cause leaf drying in bananas, thereby significantly reducing fruit yield. The effectiveness of the potassium and silicon-based protectant (*Protecsol SL),* which is expected to reduce the sunburn damage and improve the physiological responses of banana (*Musa spp.*) plants under high solar radiation, was tested at a banana plantation cultivated in Mahiyanganaya. A completely randomised design was employed with two treatments: control (no sunburn protectant application) and foliar application of *Protecsol SL 5* at 14-day intervals. Independent weekly samples were collected from two-week-old bunch-bearing plants over a 12-week period. Sunburn severity index (SSI), leaf chlorophyll content (SPAD value), leaf temperature, and stem (bunch) weight were measured. Data were analyzed using independent-sample *t*-tests and correlation analyses in SAS 9.2. The *Protecsol SL 5* treatment showed transient effects across measured variables. A significant reduction in SSI occurred at the harvesting stage ($p<0.05$), with the application of *Protecsol SL 5,* indicating mitigation of sunburn stress. A significant increase in stem weight, leaf temperature and chlorophyll content was exhibited during the harvesting stage ($p<0.05$), with the application of *Protecsol SL 5*. Overall, *Protecsol SL 5* produced persistent improvements in yield and cholrophyl content. The results imply that potassium and silicon may offer protection during peak radiation stress, while providing additional potassium supplement to increase the fruit yield.

Keywords: Banana, Chlorophyll Dynamics, Potassium Silicate, Solar Radiation Stress, Yield Response

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Evaluation of Avaram Senna *(Cassia auriculata*) Flower Powder as a Natural Feed Supplement for Enhancing Colouration, Growth, and Survival in Guppies (*Poecilia reticulata*)

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Natural plant-based supplements are used to enhance fish health and coloration in a safe and sustainable way. This research study evaluated the effect of adding Avaram Senna *(Cassia auriculata*) flower powder to fish feed on colour enhancement, growth, and survival of guppy fish (*Poecilia reticulata*). The experiment was done for 45 days using five types of diets: the control diet as Treatment 1 without the flower powder, Treatment 2 (0.5%), Treatment 3 (1.0%), Treatment 4 (1.5%) were incorporated with Avaram Senna flower powder, and a commercial feed was used as positive control (Treatment 5). A total of 150 guppies were allocated into 15 tanks, and each treatment had three replicates. The results showed that there was no significant ($p > 0.05$) difference in colour between treatments, however, the fish fed with 0.5% flower powder incorporate diet had slightly higher carotenoid levels (3.1 mg/g) and growth was significantly different ($p < 0.05$). The fish fed with commercial diet showed the highest final weight. Survival of fish among treatments showed a significant ($p < 0.05$) difference, while T4 and the control (T1) showing better survival rates, and T2 and T3 had lower survival. Although Avaram Senna flower powder did not show significant improvement on visible colour, it improved the carotenoid content in the fish. These results showed that Avaram Senna can be used as a natural supplement to support fish health and colour development of guppies.

Keywords: Guppy (*Poecilia reticulata),* Avaram Senna (*Cassia auriculata*), Carotenoid Supplementation, Growth Performance, Survival Rate

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Evaluation of Climate-Smart Dairy Practice Adoption and Enteric Methane Emission Factor in Dairy Farms of Kantale, Trincomalee District, Sri Lanka

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The dairy sector in Sri Lanka plays a vital role in rural livelihoods but is also a significant contributor to greenhouse gas (GHG) emissions, primarily through enteric methane (CH_4) from ruminant digestion. This study evaluated the adoption of Climate-Smart Dairy (CSD) practices, and estimated area-wise enteric methane emission factors (EFs) for different cattle sub-categories in dairy farms of the Kantale Divisional Secretariat, Trincomalee District. A total of 60 dairy farms were selected using a stratified random sampling approach across three *Grama Niladhari* (GN) divisions. Data on herd composition, feed and manure management, milk yield and body weight were collected through data sheet and farm observations. CSD adoption was quantified through a scoring system, and enteric CH_4 emissions were estimated using the IPCC (2006) Tier 2 methodology. Area-wise emission factors ranged from 76.7–103.3 kg CH_4 head^{-1} yr^{-1} for lactating cows, 60.5–86.8 kg CH_4 head^{-1} yr^{-1} for heifers, 60.9–69.8 kg CH_4 head^{-1} yr^{-1} for calves, and 68.9–84.3 kg CH_4 head^{-1} yr^{-1} for bulls. Analysis of variance indicated that there were no significant differences ($p > 0.05$) in emission factors among the three areas, suggesting similar emission patterns across regions. Correlation analysis revealed moderate to strong negative relationships between CH_4 intensity (kg CH_4 kg^{-1} FPCM) and farm productivity ($r = -0.626$), between CH_4 intensity and CSD adoption ($r = -0.574$), and between total CH_4 emissions (kg yr^{-1}) and CSD adoption ($r = -0.794$). These findings indicate that higher milk productivity and greater adoption of climate-smart practices could substantially reduce methane emission intensity at the farm level. The study concludes that promoting Climate-Smart Dairy practices, particularly improved feeding, manure management, and housing systems, can effectively enhance productivity while mitigating enteric methane emissions in smallholder dairy systems in Sri Lanka.

Keywords: Climate-Smart Dairy, Enteric Methane, Emission Factors, IPCC Tier 2, FPCM

Acknowledgement: Milco Milk chilling center Kantale, Trincomalee

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Evaluation of Growth Patterns and Prediction of Body Weight from Morphometric Traits in Four Sheep Genotypes Using the Brody Growth Model Under Semi-Intensive Management in Sri Lanka

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A study was conducted to compare the live weight (LW) and morphometric traits of Jaffna Local (JL), Red Madras (RM), Red Madras×Bannur cross (RM×B), and Red Madras×Australian White cross (RM×AW) genotypes of sheep, and to develop weight prediction formulas for semi-intensive management in North Western Province. Morphometric traits included body length (BL), wither height (WH), rump height (RH), heart girth (HG), abdominal girth (AG), head length (HL) and ear length (EL) of male and female animals up to 87 months of age (n=389 animals). ANOVA procedure was conducted for each trait considering genotype, sex and age category (12 month classes) as fixed effects and means were compared using Duncan's Multiple Range test (p=0.05). Linear regression procedure was performed between LW and each morphometric trait to determine the best LW prediction formula. Nonlinear regression procedure was used to fit the Brody's growth function for the traits with respect to age. Genotype, age and sex effects were significant for all traits. Weight of adults (>60 months) of JL males and females (22.3 kg and 22.1 kg, respectively) were significantly lower than those of RM, RMxB and RMxAW genotypes (33.7 kg and 27.5 kg; 32.6 kg and 28.4 kg; and 36.3 kg and 34.14 kg, respectively). Body lengths of adult males and females of JL (60.4 cm and 59.6 cm, respectively) also were significantly smaller than those of RM, RMxB and RMxAW (67.4 cm and 66.8 cm; 68.5 cm and 67.3 cm; and 70.8 cm and 70.6 cm, respectively) showing the superiority of exotic genotypes. Adult HL and EL were also significantly shorter in JL than others. For the other traits, adults of the four genotypes showed no significant differences. Brody model fitted all traits of all genotypes significantly. The trait HG predicted the LW best for all genotypes (R^2 >0.85).

Keywords: Breed comparison, Crossbreeding, Growth pattern, Performance evaluation, Weight prediction

Acknowledgement: The contributions of the central administration of the NLDB and the staff of Horakelley and Rukattana farms are gratefully acknowledged.

Evaluation of Locally Formulated Alternative Feed on the Growth Performances and Survival Rates of Tilapia (*Oreochromis niloticus*), Common Carp (*Cyprinus carpio*), and Catla (*Catla catla*) During the Rearing Stage in the Cage Culture Systems of Victoria Reservoir, Sri Lanka

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This study evaluated the effect of a locally formulated alternative feed on the growth performance and survival of Tilapia (*Oreochromis niloticus*), Catla (*Catla catla*), and Common Carp (*Cyprinus carpio*) during the rearing stage in the cage culture system of the Victoria Reservoir, Sri Lanka. The experiment was designed as a Completely Randomized Design (CRD) with three treatments (species) and three replicates per treatment. Fishes were fed a locally formulated feed, at 10% of the total biomass per day, divided into three feeding sessions for 45 days. Growth parameters, including weight gain (WG%), specific growth rate (SGR%), feed conversion ratio (FCR), and survival rate (%) were evaluated. Proximate analysis of the formulated feed showed 97.59% dry matter, 8.53% ash (on dry matter basis), 28.15% crude protein, 12.08% crude fat, and 17.98 MJ/kg gross energy. Growth data were analyzed using one-way ANOVA (SAS software), with fish species as the fixed factor. Results indicated a significant ($p < 0.05$) effect of diet on growth performances, while no effect on survival rate. The logistic model revealed a highly significant ($p < 0.01$) effect of diet on the growth and survival of Tilapia. Tilapia recorded the highest final weight (2.3585g), specific growth rate (5.38%), and survival rate (90.07%) compared to Catla and Common Carp. Hence, the locally formulated feed is most suitable for Tilapia post larvae grown under a cage culture system during their rearing period in reservoirs.

Keywords: Locally formulated feed, Tilapia, Catla, Common carp, Growth performance, Cage culture

Acknowledgement: National Aquaculture Development Authority of Sri Lanka.

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Evaluation of Morpho-Physiological Traits and Their Relationship with Grain Yield in Selected Rice (*Oryza sativa* L.) Varieties

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Identifying physiological traits that sustain rice productivity under nutrient-limited conditions is crucial for developing low-input cropping systems. This study evaluated ten *Oryza sativa* L. varieties cultivated under long-term no-fertiliser conditions at the Rice Research and Development Institute at Bathalagoda, Sri Lanka to investigate the morpho-physiological basis of yield formation. The experiment followed a Randomized Complete Block Design (RCBD) with three replicates, and data were analysed using ANOVA, correlation and regression procedures. Regression analysis at flowering identified total leaf dry weight as the most influential factor determining above-ground biomass accumulation (R^2=0.65, $p<0.001$), indicating that varieties with greater leaf development at flowering possessed stronger assimilatory capacity and higher potential for sustained growth. Variation in total plant nitrogen concentration at flowering ($p<0.001$) supported differences in assimilatory capacity among varieties, although its contribution to biomass prediction was comparatively low (R^2=0.08). Post-flowering biomass increment was not statistically significant among varieties; however, it showed a positive correlation with grain yield (r=0.61, $p<0.001$), suggesting that continued growth after flowering contributed to higher yield formation. Straw dry weight at maturity was further identified as the key determinant of final grain yield (R^2=0.61, $p<0.001$). Varieties Bg 357 and At 362 exhibited superior source-sink coordination, maintaining higher post-flowering growth and efficient nutrient remobilization under nutrient stress. These findings demonstrate that morpho-physiological plasticity, particularly enhanced leaf development, delayed senescence and sustained post-flowering activity, is central to resource-use efficiency and yield stability of rice in nutrient-limited soils.

Keywords: Low-input systems rice, Morpho-physiology, Nutrient-use efficiency, Source-sink dynamics

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Evaluation of the Individual or Combined Efficacy of a Commercial Probiotic (ENTEROSURE™) and Prebiotic (Actigen) as an Alternative to Antibiotic Growth Promoters in Broiler Chicken Diets

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The extensive use of Antibiotic Growth Promoters (AGPs) in poultry production raises concerns about antimicrobial resistance and food safety. This study aimed to evaluate the individual and combined efficacy of a commercial probiotic (Enterosure™; *Bacillus spp*.) and a prebiotic (Actigen®) as alternatives to AGPs in broiler chickens. A total of 500 Cobb 500 broilers were randomly allocated to five dietary treatments: control, chlortetracycline as an AGP, Actigen® alone, Enterosure™ alone, and a combination of Actigen® + Enterosure™. The performance parameters, including body weight gain, feed intake, and feed conversion ratio, were evaluated over a 34-day period. Relative lengths and weights of organs and gut segments were also evaluated. Microbiological analysis was performed to assess the levels of *coliforms* and total anaerobic bacteria in ileal digesta. Intestinal histology was evaluated by measuring ileal villus height. Results showed no significant difference in growth performance and gut morphology (relative organ lengths and weights) between the treatment groups ($p > 0.05$). However, the combination of Actigen® + Enterosure™ significantly improved ileal villus height ($p < 0.05$) compared to the AGP, but no significant difference was found between Actigen® and the control treatments. Actigen® + Enterosure™ and Enterosure™ treatments significantly reduced *coliform* levels ($p < 0.05$) compared to the AGP, Actigen®, and control treatments, whereas all treatments except Actigen® reduced *coliform* levels compared to the control, showing that supplementation of probiotics was more effective than the prebiotic individually or in combination in reducing *coliforms*. The total anaerobic bacteria, however, were not affected by the treatments ($p>0.05$). These findings suggest that, although Actigen® and Enterosure™ alone did not significantly improve growth parameters or gut morphology, their combination effectively enhances ileal villus height and reduces *coliforms*, suggesting potential as an alternative to AGPs in broiler nutrition.

Keywords: Probiotic, Prebiotic, Actigen®, Enterosure™, Broilers, Symbiotic

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Evaluation of Water Hyacinth (*Pontederia crassipes*) as an Alternative Substrate Component to Improve Rooting of Carnation (*Dianthus caryophyllus* L.) Stem Cuttings

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The study investigated the effectiveness of water hyacinth (*Pontederia crassipes* formally named *Eichhornia crassipes*), a common weed, as a partial substitute for cocopeat in rooting media to improve plug quality and root development in carnation (*Dianthus caryophyllus* L.) stem cuttings. Six media formulations were evaluated under a Completely Randomized Design at Ceylon Foliage (Pvt) Ltd, Boralanda, Sri Lanka. 100% cocopeat (T1), 90% cocopeat + 10% water hyacinth (T2), 80% + 20% (T3), 70% + 30% (T4), 60% + 40% (T5), and 50% + 50% (T6). Total root length, root dry weight and number of roots per cutting were significantly higher in T3 and T4 ($p < 0.01$), indicating that 20–30% incorporation enhanced root proliferation more effectively than pure cocopeat. Root: shoot and root: leaves ratios also differed significantly ($p < 0.05$), with greater biomass allocation to roots in T3 and T4. Survival percentage after cold room storage remained above 86% in all treatments without a significant difference ($p > 0.05$) among treatments. Shoot dry weight did not differ significantly ($p > 0.05$), but number of leaves showed a significant difference among treatments ($p < 0.05$), with reduced leaf production in higher water hyacinth levels indicating controlled shoot elongation. Electrical conductivity increased with greater water hyacinth incorporation, while excessively high EC in T6 corresponded with reduced rooting and leaf development. Media pH, total porosity and water holding capacity remained within acceptable ranges across all treatments. Despite the superior rooting percentage observed in T1, it did not correspond with the most vigorous or structurally balanced plug development. Incorporation of 20–30% water hyacinth improved below-ground growth without compromising shoot compactness or survival, demonstrating its suitability as a sustainable media amendment in commercial plug production.

Keywords: Water hyacinth (*Pontederia crassipes*), Cocopeat, Root development, Rooting media, Carnation (*Dianthus caryophyllus* L.)

Acknowledgement: This research was supported by Ceylon Foliage (Pvt) Ltd.

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Exploring the Potential of Tillage Operations and Moisture Conservation Practices for Growth and Nutrient Uptake of Maize under Moisture-Limited Conditions

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Maize (*Zea mays* L.) is one of the most important cereal crops globally and serves as a vital food and feed source in Sri Lanka. However, maize productivity in Dry and Intermediate zones of Sri Lanka is often limited by soil moisture deficits and low nutrient-use efficiency during the *Yala* season, when irrigation water is prioritized for paddy cultivation. Although conservation tillage and mulching are widely recognized for improving crop growth and yield under water-deficit conditions, their combined effects under Sri Lankan Dry zone conditions remain insufficiently studied. This study was conducted to evaluate the influence of different tillage operations and mulching practices on maize growth, nutrient uptake, and nutrient-use efficiency of maize cultivated in *Welikanda*, *Polonnaruwa*. The field experiment was carried out during the 2025 *Yala* season using a split-plot design with three replications. Tillage practices: zero, minimum, and conventional tillage were assigned to main plots, while mulching treatments including paddy straw, half-burnt paddy husk, live mulch with mung bean, and no mulch as the control were allocated to subplots. Plant growth, nutrient uptake and use efficiency were measured at the tasseling stage. Results showed that most measured parameters were not significantly influenced by tillage and mulching treatments, indicating that short-term implementation of conservation agricultural practices did not considerably affect maize growth and nutrient dynamics within a single season. However, potassium accumulation in leaves showed significant effects ($p<0.05$), where both tillage and mulching individually influenced K accumulation, despite their interaction being non-significant. These findings emphasize that while short-term impacts were limited, conservation-based soil management practices might have potential long-term benefits for improving crop growth, nutrient uptake, and nutrient-use efficiency and sustaining maize productivity under Dry zone conditions in Sri Lanka.

Keywords: Maize, Mulching, Nutrient Uptake, Nutrient-Use Efficiency, Tillage

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Formulation of a Nutritional Bar Incorporating Horse Gram (*Macrotyloma uniflorum*) Protein Isolate and Evaluation of Its Nutritional and Quality Characteristics

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The requirement for alternative protein sources to increase the protein availability in the community can be addressed by unexploited horse gram (*Macrotyloma uniflorum*), which has a high protein content. The objective of this research was to develop a nutritional bar incorporating extracted protein isolates from horse gram and determine its properties. Extraction of horse gram protein isolate (HGPI) was carried out through pre-treatment of the seed, followed by flour preparation, alkaline extraction, isoelectric precipitation and freeze-drying. The obtained HGPI and soy protein isolate were analysed using FTIR spectroscopy. Three formulations (F1-F3) were developed and tested for proximate composition, water activity, gross energy value, texture profile, colour and sensory properties. Results indicated that there was a significant difference ($p<0.05$) in crude protein content among three samples, where F1, F2 and F3 contained 11.50±0.23%, 14.92±0.18% and 16.58±0.31%, respectively. Carbohydrate, crude fat, crude fibre and ash contents showed a decrease from F1 to F3, emphasising that HGPI increased protein content while other nutrients decreased. Gross energy values of F1, F2 and F3 were 18.54±0.11 kJ/g, 18.75±0.16 kJ/g and 19.43±0.72 kJ/g, respectively revealing that F3 had the highest value. The highest hardness was observed by F1 compared to F2 and F3, indicating that HGPI contributed to the softness of the bars. The colour of the three bars ranged from golden brown to light brown; however, uniformity varied due to heterogenous structure of the product. Water activity showed no significant difference ($p>0.05$) among formulations, and all three were below 0.6, showing good preservative qualities. Sensory evaluation also indicated no significance difference ($p>0.005$) among formulations, suggesting that consumers equally preferred all the formulated nutritional bars. This study showed that, HGPI can be incorporated into nutritional bars to obtain improved nutritional and quality characteristics.

Keywords: Nutritional bars, Protein isolate, Horse gram, Sensory properties

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

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In organic agriculture, suitable nutrient sources for cash crop cultivation are limited and green manure is one of the few available options. Green manure crops fall into several categories, such as annuals, perennials, legumes, and non-legumes. Growing an annual green manure in the same field as the cash crop is straightforward; however, it occupies the land for a few weeks. In contrast, incorporating green manure from a perennial crop keeps the land available for cash crops at any time. Therefore, this study aims to compare the benefits a cash crop (okra) can gain by using Sunn hemp (*Crotalaria juncea L.*) and Gliricidia (*Gliricidia sepium*) as green manures and nutrient sources. The experiment was conducted at the organic research unit, Mahaillupallama Sub-campus, Faculty of Agriculture, University of Peradeniya, in a Randomized Complete Block Design (RCBD) with three treatments and four replicates. The treatments were: T1 - Sunn hemp as green manure, T2 - Gliricidia as green manure, and T3 - No green manure. Sunn hemp was planted at a rate of 150 kg ha^{-1} and incorporated into the soil at the 50% flowering stage, whilst six-month-old Gliricidia leaves were incorporated at a biomass rate equivalent to that of Sunn hemp. After 10 days of incorporating green manure into the soil, okra seeds were planted. Soil properties were measured weekly for up to one month after green manure incorporation, and okra growth parameters were assessed at weekly intervals. Yields were measured from three weeks until the end of the experiment. The mixed model analysis with repeated measures indicated variability, with T1 producing greater ($p < 0.05$) yields and dry weights in okra plants. Additionally, T1 demonstrated superior weed suppression compared to T2 over time. The study's overall results suggest that using Sunn hemp as green manure offers greater benefits to okra farmers.

Keywords: Cash crop cultivation, Nutrient sources, Organic agriculture, Sustainable crop production, Weed suppression

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Greenhouse Modifications: Strategies for Mitigating Heat Stress Effects on Tomato and Capsicum Growth

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A greenhouse is a controlled environment structure that enables optimal crop growth by regulating temperature, humidity, and light like factors, especially important in tropical countries like Sri Lanka to reduce climate-related stress, improve yield quality, and support year-round cultivation. This study evaluated the performance of a modified greenhouse design aimed at mitigating heat stress and enhancing the growth of capsicum and tomato. The treatment greenhouse was modified with an aluminum foil roof covering and misting system, while the control greenhouse remained unmodified. Two tomato varieties (Thilina and HTHY3) and two capsicum varieties (HYW and CA-8) were cultivated. Environmental, physiological, growth, and yield parameters were recorded throughout the study period. The modified greenhouse maintained significantly lower temperature and light intensity, whereas higher relative humidity compared with the control ($P<0.05$). Analysis of variance (ANOVA) revealed that under the control greenhouse conditions, significant differences were observed in the total yield per plant and plant height between capsicum varieties ($P < 0.05$). In the treatment greenhouse, leaf temperature, number of leaves, number of flowers, and total yield per plant differed significantly among capsicum varieties, while leaf temperature and total yield per plant differed significantly between tomato varieties ($P < 0.05$). Regression based optimization revealed a significant relationship between plant height and the number of flowers with the temperature. Plant height increased with temperature up to the optimum (34.5 °C for capsicum and 34.3 °C for tomato) but declined beyond 35.5 °C, indicating that excessive heat negatively affects growth. Similarly, flower production in capsicum and tomato increased up to the optimum temperatures (34.6 °C and 34.2 °C, respectively) but decreased beyond 35.4 °C and 35.5 °C, showing that temperatures above the optimum adversely affect flowering. This preliminary study highlights the potential of greenhouse modifications to regulate temperature and enhance crop performance, guiding future optimization research.

Keywords: Capsicum, Greenhouse modification, Heat stress, Microclimate, Tomato.

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Growth and Yield Performance of Maize Production System in Response to Alternative Nutrient Management Packages

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Maize (*Zea mays* L.) is the second most important crop in Sri Lanka, which plays a large role in food security and as a source of feed for livestock. However, the yield gap and use of large-scale inorganic fertilizers raise concerns for soil degradation and long-term sustainability. This study looked at the effects of bio-carbon and biofilm bio-fertilizers on maize growth, nutrient uptake, yield, and soil fertility, comparing them with the fertilizer recommendation of the Department of Agriculture (DoA)-Sri Lanka. A field experiment was conducted at the University Experimental Station-Dodangolla using a Randomized Complete Block Design (RCBD) with four treatments; T1-DoA fertilizer recommendation (control), T2-Biocarbon-based fertilizer package 1, T3-Biocarbon-based fertilizer package 2, and T4-50% DoA recommendation combined with biofilm bio fertilizers. Plant growth parameters, yield attributes, and soil nutrient levels were analyzed following standard protocols, and treatment means were compared using Duncan's Multiple Range Test. Results showed no significant differences ($p>0.05$) in maize yield and yield components (cob length and diameter, grain number per cob, and grain weight per cob), and nutrient uptake across three alternative nutrient management techniques and the control. Fertilizer recommendation from the DoA significantly enhanced shoot biomass and potassium uptake, but did not result in a yield increase compared to other treatments. Soil nitrogen, phosphorus, potassium, and organic matter remained stable across treatments. The results confirm that all three alternative nutrient management techniques used in this study perform similar to the fertilizer recommendation from the DoA.

Keywords: Maize, Nutrient Management, Nutrient Uptake, Yield Component

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Growth Curve Modeling and Determining Relationships Among Morphometric Traits and Live Weight in Jamunapari Goats

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This study focused on statistical modeling of growth patterns and determining the statistical relationships between morphometric traits (cm) and live weight (kg) in pure Jamunapari goats. A state owned nucleus herd of purebred Jamunapari goats, intensively managed in IL_2 Agro-ecological region of North Western Province was used for the study. Animal ID, age, live weight (WT), body length (BL), chest girth (CG), heart girth (HG), abdomen girth (AG), rump height (RH) and wither height (WH) of 302 animals with ages ranging from day 1 to 103 months were recorded. Growth curves of Brody, Von Bertalanffy, and Logistic models were fitted to the data using nonlinear regression procedure in SAS® software. The Logistic model best described age-WT, age BL, age-CG, and age-AG relationships while the Brody model provided the best fit for age-HG, age-RH, and age-WH data, with the smallest mean square error values. Significant positive correlations were observed between WT and all morphometric traits with 0.788, 0.845, 0.808, 0.800, 0.747, 0.751 for BL, CG, HG, AG, RH and WH, respectively. CG was the strongest predictor of live weight (R^2 = 0.714), followed by BL (R^2 = 0.621). Quadratic models fitted between WT and morphometric traits only slightly increased (<0.07) R^2 values. A multiple linear regression model incorporating all morphometric traits explained only 73% of the variation of WT. Those findings suggest CG can be used as the best predictor of WT under field conditions. The $WT = -14.639+ 0.237*CG + 0.006*CG^2$ formula could be used to develop weigh bands for pure Jamunapari goats reared under intensive management of IL_2 region or similar non genetic conditions.

Keywords: Brody model, Logistic model, Nonlinear modelling, Von-Bertalanffy model, Weight prediction.

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Impact of Different Nitrogen Fertilizer Combinations on the Physicochemical, Functional, and Sensory Properties of Green Tea: A Comparative Study

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Green tea (*Camellia sinensis* L.) is a globally popular beverage due to its unique flavor and proven functional properties. The application of nitrogen fertilizer is important to influence both the yield of the crop and the quality of green tea. This study was conducted to evaluate the impact of ten nitrogen fertilizer treatments, including Granular Urea, Coated Granular Urea, Sulphate of Ammonia (SOA), U-709, UT-1625, and their combinations with Super Absorbent Polymer (SAP), on the physicochemical, functional, and sensory properties of green tea. Green tea processed from experimental plots consisting of 150 mature tea bushes were assessed at 1st, 4th, and 5th plucking cycles. Physicochemical parameters, including total polyphenol, caffeine, chlorophyll, catechin content, and antioxidant capacity, were analyzed, and yields were measured during the plucking cycle. Consumer panel and professional tea tasting were performed for sensory evaluation of green tea. Results showed that the combination of 50% SOA and 50% Granular Urea (T5) produced the best outcomes in the 5th plucking cycle, with the highest mean chlorophyll content (1.57 mg/g ± 0.2) and stable yield performance in the plucking cycle. Catechin content was also highest in T5 fertilizer combination (19.80%) among the selected treatments. Other quality parameters, including total polyphenol content (25.56% ± 0.2) and caffeine content (5.4% ± 0.1) were favorable. Sensory evaluation across three selected treatments showed that T5 achieved the highest overall acceptability. In conclusion, the T5 combination optimizes both physicochemical and sensory attributes of green tea while maintaining stable yield.

Keywords: Green Tea, Nitrogen Fertilizer, Sensory Attributes, Polyphenol, Catechin

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Impact of Glyphosate Residues and Metabolites on Soil Fertility of a Mid- Grown Tea Plantation in Sri Lanka

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Glyphosate is the most widely used herbicide in tea plantations. Frequent and excessive application of glyphosate lead to accumulation of residues of active ingredient and its metabolites, and surfactants such as nonylphenol ethoxylate and polyethoxylated tallow amine, potentially affecting soil fertility. This study examined how the different residue levels of glyphosate and its metabolites would influence selected soil fertility parameters over a two-months period in a mid-grown tea plantation in Kandy District, Sri Lanka. Two field lots were selected, and three treatments were established: T1-glyphosate applied at the beginning of the experiment; T2-glyphosate application ceased three months before the experiment; and T3-manual weeding practiced for over ten months without glyphosate. The treatments facilitated different levels of glyphosate residues in the order of T1>T2>T3. Each treatment was applied over a 0.5 ha plot, and six soil samples (0–15 cm depth) were collected at 0, 15, 30, and 60 days and analyzed for soil pH, electrical conductivity (EC), organic carbon (OC), bulk density (BD), wet aggregate stability (WAS), microbial biomass carbon (MBC), and soil respiration. Leaf litter decomposition was assessed *In*-situ using a litter bag study. Results indicated that EC, and OC were significantly affected ($p<0.05$) by glyphosate treatments differently with time. However, pH, BD, WAS and litter decomposition were not significantly affected ($p>0.05$) by glyphosate treatment. In one field, T1 and T2 resulted in comparable and significantly higher MBC than that of T3 by 30 days, while MBC remained insensitive to glyphosate treatment in the other field. Increase in glyphosate residues significantly reduced ($p<0.05$) both soil respiration and respiration quotient by 30 days in both fields. In conclusion, only the biological soil fertility and not the physical and chemical soil fertility of the tea plantation was negatively affected in short-term by the increase of glyphosate residues in soil.

Keywords: Glyphosate, Residues, Soil fertility, Tea

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Impact of Nitrogen Fertilization on Physicochemical, Nutritional and Functional Properties of Selected Rice (*Oryza sativa* L.) Varieties Grown in Sri Lanka

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Rice quality is increasingly recognized as a vital criterion alongside yield in achieving sustainable rice production, particularly as consumer demand in Sri Lanka and globally shifts toward improved eating quality characteristics, nutritional composition, and functional properties. As the most yield-responsive macronutrient in rice, nitrogen (N) plays a central role not only in plant growth and grain filling but also in determining the physicochemical and bioactive characteristics that define market and consumer value. However, excessive N fertilisation exacerbates greenhouse gas emissions, eutrophication, and production costs, highlighting the need for evidence-based optimisation to balance productivity with environmental and nutritional outcomes. This multidisciplinary investigation integrating agronomy and food science examined the effects of five N levels (0, 35, 70, 105, and 140 $kgha^{-1}$) on the physicochemical, nutritional, and functional attributes of polished grains from three Sri Lankan rice varieties. Field trials were conducted at the Rice Research and Development Institute (RRDI), Bathalegoda, and samples were analysed for apparent amylose content (AAC), swelling power (SP), grain length (GL), chalkiness rate (CR), protein content (PC), antioxidant potential (total phenolic content; DPPH, $ABTS^+$, FRAP assays), and α-amylase inhibitory activity using standard analytical procedures. Nitrogen significantly influenced all traits except α-amylase inhibition and SP ($p < 0.05$). Increasing N rates were strongly associated with higher PC and CR, while AAC and SP decreased, suggesting softer texture and reduced appearance quality. Antioxidant activity exhibited moderate improvement with N enrichment, indicating enhanced functional potential. Significant ($p<0.05$) variety × nitrogen interactions underscored genotype-specific responsiveness, reinforcing the need for varietal fertiliser guidelines. Overall, results demonstrate that while nitrogen application enhances the nutritional and antioxidant qualities of rice, over-application undermines grain integrity and consumer acceptability. Balanced N management is therefore critical for sustaining nutritional security, environmental stewardship, and the economic resilience of Sri Lanka's rice sector in a health-conscious agri-food economy.

Keywords: Nitrogen fertilisation, Rice grain quality, Antioxidant activity, Sustainable nutrient management

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Improving the Efficiency of Black Soldier Fly Larvae (*Hermetia illucens*) Meal in Guppy (*Poecilia reticulata*) Fry Nutrition through Two Fermentation Techniques: Solid-State Vs Bacillus- Based Approaches

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Despite fishmeal (FM) is the key animal protein source for aquafeeds, soaring price, and more importantly, disturbing the achievement of UN Sustainable Development Goals urge to consider other sustainable alternatives for FM. Furthermore, recent studies have identified that the black soldier fly (*Hermetia illucens*) larvae meal (BSFL) as an insect meal is a promising solution to FM. However, several previous research findings confirmed that BSFL could not totally replace the FM without adversely affecting the fish performance parameters. Therefore, this study sought to evaluate the effects of two fermentation techniques: Solid-State (SS) Vs Bacillus - Based (BB) approaches to explore the efficiency of BSFL in guppy (*Poecilia reticulata*) fry feed**.** A total of four dietary treatments; **T**1 (100% FM-included diet), T2 (100% FM replaced diet with unfermented BSFL), T3 (100% FM replaced diet with SS fermented BSFL), and T4 (100% FM replaced diet with BB fermented BSFL) were tested. Each treatment contained three replicates; thus, the completely randomized design was followed. Further, fish were allocated to 12 fish tanks, with 20 fish in each, for eight weeks experiment, and fish were fed with 3% of the body weight twice daily. Guppy fry fed the SS-fermented BSFL diet (T3) demonstrated the best overall performance, yielding the highest numerical values for daily weight gain (1.90 mg/day), specific growth rate (1.03 %/day), and feed conversion ratio (3.15), alongside a high survival rate (76.67%). While the Bacillus-fermented BSFL diet (T4) did not improve growth over the control (T1), it resulted in the highest survival rate. However, results confirmed that BSFL can totally replace the FM in terms of growth (weight gain, daily weight gain, relative weight gain, specific growth rate, and FCR) significantly ($P<0.05$). However, fermented fish groups (T3 and T4) did not show significantly different ($P<0.05$) results with other groups. Simultaneously, SS-fermented feed fed fish group (T3) exhibited non-significant growth enhancement. Therefore, based on these positive results, further studies, (i.e., inclusion level of yeast is enhancing), are needed to enhance the efficiency BSFL with Solid-State (SS) fermentation.

Keywords: Fermentation with yeast, Bacillus-based fermentation, novel aquafeed ingredient, insect

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Incubation outcomes of Muscovy duck eggs under varying pre-storage periods and water spraying treatments following an incubator malfunction: A case study

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This case study examines the embryonic development of Muscovy duck (*Cairina moschata*) eggs under varying storage durations and water spraying treatments following an unexpected incubator malfunction. A total of 282 eggs from a healthy breeder flock were divided into four storage groups (1-3, 4-6, 7-10, and 11-14 days) and two incubation treatments: water-sprayed and non-sprayed. Eggs were stored at 18-20°C and 50-65% RH, then incubated at 37.5°C and 55% RH for 35 days. In the spraying treatment, clean room-temperature water was applied daily, with eggs kept outside the incubator for 10 minutes during each spraying session. Hatchability was severely affected due to an unexpected incubator malfunction during the study. Despite this, all fertile eggs were examined to determine embryonic death stages. Moisture loss during storage was analyzed using Kruskal–Wallis and Wilcoxon tests, while incubation moisture loss was evaluated using the Aligned Rank Transform (ART) model. Relationships between storage duration and embryonic mortality were tested using Spearman correlation, and the association between water spraying and embryonic death stage was assessed using Chi-square analysis (SAS Version 9.4). Storage moisture loss increased significantly with extended storage ($p < 0.05$), while incubation moisture loss did not differ among groups ($p > 0.05$). A significant negative correlation was found between storage duration and embryonic survival ($\rho = -0.151$, $p < 0.05$), indicating higher early deaths with extended storage. Water spraying significantly influenced embryonic death patterns ($p < 0.05$), reducing late-stage mortalities. In conclusion, longer storage increased moisture loss and early embryonic deaths, while spraying influenced embryonic death patterns without affecting incubation moisture loss. These observations, though exploratory, provide useful insights for designing future incubation studies and highlight the importance of monitoring incubator performance.

Keywords: Muscovy duck, storage duration, water spraying, moisture loss, embryonic mortality, hatchability

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Influence of Carbon to Nitrogen Ratio and Paclobutrazol Concentrationon the Growth and Morphologyof Binara (*Exacum Trinervium*)

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Exacum trinervium (Binara) is an endemic and near-threatened ornamental plant species in Sri Lanka with high potential for conservation and commercial propagation. This study aimed to develop an in vitro flowering protocol and to evaluate the effects of carbontonitrogen (C: N) ratio and paclobutrazol (PBZ) concentration on the physiological and morphological performances of Binara plantlets. Two experiments were conducted using Murashige and Skoog (MS) media in a Completely Randomized Design. In Experiment 1, plantlets were grown on media containing four sucrose concentrations (0, 3, 6, and 9%) combined with four MS nitrogen strengths (1650, 825, 412.5, 206.25 mg/L). In Experiment 2, full-strength (N-1650 mg/L) MS medium was supplemented with four PBZ concentrations (0.1, 0.2, 0.5, and 1.0mg/L). Even though no flowering occurred in any treatments, sucrose, nitrogen, and PBZ significantly ($p < 0.05$) affected shoot height, fresh weight, and total chlorophyll content. Increasing sucrose concentration and decreasing nitrogen strength reduced shoot height. However, increased fresh weight and chlorophyll accumulation ($R^2 = 0.97$-0.98). Further, chlorophyll content increased with sucrose from 0 to 6% however declined at 9%, suggesting osmotic inhibition at excessive sugar levels. The highest fresh weight (0.884 g) and chlorophyll content (0.903 mg/g) were obtained at 6% sucrose with MS containing 412.5 mg/L nitrogen strength. PBZ also significantly influenced plant morphology ($R^2 = 0.94$), where increasing PBZ concentrations reduced shoot elongation but enhanced compactness and chlorophyll levels, with 1.0 mg/L PBZ being the most effective. These findings suggest that 6% sucrose, 0.25MS nitrogen, and 1.0 mg/L PBZ provide the most suitable physiological conditions for potential in vitro flowering induction in Binara under improved culture conditions.

Keywords: Chlorophyll content, *Exacum trinervium*, in vitro flowering, sucrose concentration, nitrogen level, paclobutrazol,

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Influence of Hibiscus Flower (*Hibiscus rosasinensis*) as a Carotenoid Source on Growth Performance and Coloration in Golden Tuxedo Guppy (*Poecilia reticulata*)

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The ornamental fish industry urgently needs natural carotenoid sources due to the undesirable effects of synthetic additives. This study examines the effects of an untapped carotenoid source, Hibiscus flower (*Hibiscus rosasinensis*), on growth performance and coloration in Golden Tuxedo Guppy (*Poecilia reticulata*). Experimental diets containing 40% crude protein were formulated with varying carotenoid sources at T1- 0%, T2- 0.5%, T3- 1%, T4-1.5% and a commercial diet (T5) was used as a positive control, while a diet without a carotenoid source was a negative control. Two-week-old Golden Tuxedo Guppy (n=300) was randomly allocated into 15 groups for five treatments, and all were kept under the same conditions. The experiment lasted 60 days for the Golden Tuxedo Guppy. The findings show that the 1 % (T3) carotenoid source diet led to a significant ($p < 0.05$) increase in the skin colour of fish compared to the other treatments. The T3 (1%) recorded a significantly ($p< 0.05$) higher mean weight gain than T1 (0%) and T2 (0.5%), and the commercial feed (T5) given fish achieved the highest net gain. All treated groups had survival rates over 86%, and there was no significant difference ($p> 0.05$) in survival rate between treatments. The highest pigmentation (5.22 mg /g) was observed in 1 % (T3), followed by 1.5 % (4.66 mg /g), 0.5 % (4.18 mg /g), while the Commercial feed (3.98 mg /g), and the lowest (2.62 mg /g) pigmentation was with zero % (T1). Furthermore, these diets enhanced the growth of Golden Tuxedo Guppy. Hence, 1% carotenoid inclusion diet can be adequately, cost effectively substituted for the commercial fish feeds in the ornamental fish industry.

Keywords: Aqua feed, Hibiscus flower, Natural carotenoid, Ornamental fish

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Investigating the Effect of Different New Generation Fertilizers on the Growth and Yield of Maize (*Zea mays* L.)

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Maize (*Zea mays* L.) is an important cereal crop in Sri Lanka. However, inefficient nitrogen (N) fertilizer use has led to decline the productivity and degrade soil. This study evaluated the efficiency of "new-generation N fertilizers" on maize growth, yield, and nitrogen dynamics under field conditions. Experiment was conducted at the University Experimental Station, Dodangolla (IM3a) from July to October 2025. The experiment was arranged in a Randomized Complete Block Design (RCBD) with six treatments and four replicates. The treatments included Baurs Super Urea containing dicyandiamide (DCD) and N-(n-butyl) thiophosphoric triamide (NBPT) at 70% and 100% levels, CIC Vibelsol (70% of DOA recommendation) containing 3,4-dimethylpyrazole phosphate (DMPP) and NBPT, CIC Yara Mila - a blended fertilizer, Conventional urea at 100% of the Department of Agriculture (DOA) recommendation, and a no-nitrogen control. Super Urea (100%) produced the tallest plants (279.5±2.6 cm) and the largest stem girth (8.1±0.7 cm), which were significantly different from those of other treatments ($p<0.05$). Vibelsol recorded significantly higher grain yield (100.1±1.6 g plant^{-1}) and harvest index (25.3%±0.7%). Yaramila maintained the highest soil N at 10 cm (1.36±0.4 mg kg^{-1}) and 20 cm (0.69±0.03 mg kg^{-1}) depths, indicating the reduced N losses. Plant nitrogen content was highest in Super Urea (100%) in 6 weeks after planting (41.3±6.0%). Vibelsol produced the longest cob (18.03±0.48 cm) and the highest number of seed rows per cob (18.6±0.3). Overall, Stabilized fertilizers (vibelsol, superurea) and blended (Yaramila) fertilizers significantly improved maize growth, yield attributes, and soil N retention compared with conventional urea. These findings prove that enhanced-efficiency nitrogen fertilizers can improve productivity and nitrogen use efficiency, ensuring sustainable maize production in Sri Lanka.

Keywords: Maize (*Zea mays* L.), Nitrogen, Stabilized and Blended Fertilizers, Urease and Nitrification Inhibitors

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Isolation and Characterization of *Escherichia coli* and *Salmonella* Species from Cloacal Swabs Samples of Small Scale and Medium Scale Commercial Layer Farms in Kurunegala District

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This study investigated the prevalence of *Escherichia coli* and *Salmonella* and characterized the species of cloacal swab samples collected from commercial layer farms in Kurunegala district of Sri Lanka. Seventy-two pooled samples were collected from ten farms and cultured in selective media (MacConkey, Blood and Xylose Lysine Deoxycholate agar). Phenotypic and biochemical identifications namely, Gram staining, catalase test, oxidase test, indole test and other metabolic assays were carried out. From 32 composite cloacal swabs samples, *E. coli* (n=16; 50%), *Salmonella spp*. (n=2; 6.25%), others (n=10; 31.25%) and un-classified (n=4; 12.5%) were identified. These findings highlighted the dominance of *E. coli* in poultry gut microbiota population and emphasizes the need for continuous surveillance and improved farm management. Although *Salmonella* was less prevalent, its presence poses a serious zoonotic and food safety risk. Targeted interventions such as improved sanitation, strict biosecurity and vaccination are essential. This research reinforces the importance of microbiological monitoring in reducing contamination risks and promoting sustainable poultry production in Sri Lanka.

Keywords: Poultry production, *Escherichia coli, Salmonella* spp., Isolation, Characterization

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Isolation and Identification of Fungal Bio control Agents from Traditional Sri Lankan Rice Varieties against Rice Brown Spot Pathogen (*Bipolaris oryzae*)

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Brown spot disease in rice caused by *Bipolaris oryzae* is one of the most destructive diseases in Sri Lankan rice cultivation that reduces the yield and grain quality. As effective fungicides or resistant varieties are not available, this study investigated the fungal antagonists associated with traditional Sri Lankan rice varieties as potential biocontrol agents of *B. oryzae*. *B. oryzae* was isolated from symptomatic leaves at several locations, and an isolate from Bombuwela which resulted in the highest *in vitro* growth rate was selected for further studies. Sporulation of the pathogen under *in vitro* conditions was induced by UV light and alternative dark and light cycles in water agar medium. A total of 41 epiphytic and endophytic fungal isolates were obtained from leaves and grains of five traditional rice varieties (*Suwadal, Kaluheenati, Madathawalu, Suduheenati,* and *Kahawanu*) by leaf and grain imprinting and tissue crushing techniques. All the isolates were *in vitro* screened by dual-culture method and identified 8 antagonists against *B. oryzae* which showed more than 44% colony growth inhibition. Isolates M6 and KH8 demonstrated a superior performance than the other isolates, reducing brown spot disease severity *in vivo.* Results revealed that application of antagonists before and after the inoculation of the pathogen produced similar levels of reduction of the disease severity. The fungal isolates exhibited production of amylase, lipase, cellulase, and protease enzymes and antifungal volatile and non-volatile metabolites, suggesting that both mycoparasitism and antibiosis mechanisms are possible for pathogen suppression. Based on spore morphology, Isolate M6, from *Madathawalu* was identified as *Aspergillus* spp., and Isolate KH8 obtained from *Kaluheenati* was identified as *Penicillium* spp. This study highlights the potential of fungal antagonists dwelling on traditional rice varieties as potential biocontrol agents that can be used for the management of brown spot disease of rice.

Keywords: Endophytes, Epiphytes, Dual culture, Inhibition, Mycoparasitism

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Isolation and Identification of Fungal Pathogen/s Causing a Newly Reported Leaf Spot Disease of Tea (*Camellia sinensis* (L) O. Kuntze) in Sri Lanka

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A new leaf spot disease was reported in Tea (*Camellia sinensis* (L)) grown in low country, Sri Lanka. The symptoms on the leaves are different to the already identified leaf diseases of tea. The present study aimed isolation, identification and evaluation of possible management measures using chemical and biocontrol agents. Symptomatic leaves were collected from TRI 4049 cultivar in low country tea nurseries, Rathnapura and isolated the causal pathogens using standard techniques. As the symptoms resembled a fungal infection, isolated fungi were used for further studies. Pathogenicity test was performed for three fungal isolates which showed a higher isolation frequency, using cultivars, TRI 2025, TRI 4049 and TRI 2043. Molecular identification was performed with ITS1 and ITS4 primers, DNA sequencing, NCBI BLAST analysis and phylogenetic analysis. *In vitro* colony growth inhibition was assayed by Poisoned Food Technique using CuO, $CuSO_4$ and $Cu(OH)_2$ fungicides as well as 12 isolates of *Trichoderma* by dual culture plate method. Two fungal isolates (Isolate 01 and 02) were confirmed for their pathogenicity and identified morphologically as *Colletotrichum* spp.. For both fungal isolates, immature leaf stage is more susceptible irrespective of the cultivar used. Colony growth rate of the two isolates was optimum at 25 ^{o}C. Isolate 01 gave the highest homology with *Colletotrichum aenigma* and the Isolate 02 had the highest match with *Colletotrichum guiyangense, C. tropicale, C. cobbitiense* and *C. ti*. Phylogenetic analysis further confirmed the genetic distance of Isolates 01 and 02 and demonstrated their genetic closeness with several other *Colletotrichum* spp. CuO (0.1%) achieved the highest *in vitro* colony growth inhibition of Isolate 01 (77.73%) and $CuSO_4$ (0.1%) for Isolate 02 (87.03%). All the *Trichoderma* isolates resulted in more than 55% colony growth inhibition of both isolates, *in vitro*. The research findings provide an insight to design effective management measures for the newly-reported leaf spot disease.

Keywords: ITS region, *Colletotrichum* sp., *Trichoderma*, Copper based fungicides, Phylogenetic analysis.

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Isolation and Identification of Lactic Acid Bacteria from Natural Inoculum for Potential Use as a Probiotic Supplement

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The objective of the current study was to isolate, identify and biochemical characterization of lactic acid bacteria (LAB) from a natural inoculum to assess its potential application to use as a probiotic supplement for poultry. Molasses and natural minerals were used to prepare the inoculum, which was then fermented for five days. Three biological replicates were used for the isolation of LAB. After the primary isolation on de Man, Rogosa, and Sharpe (MRS) agar in anaerobic conditions, presumptive isolates were first phenotypically characterized by colony morphology, physiological and biochemical tests. The catalase test, Gram staining, the production of hydrogen sulphide, the production of gas from glucose, tolerance to temperature and salt, tolerance to bile salt, and the ability to coagulate milk were carried out as preliminary tests and identified 28 isolates as presumptive LAB. Based on colony morphology isolates were classified into 4 distinguish groups. All four groups were non-motile, catalase-negative, and Gram-positive rods. One group met the threshold for effective probiotic dosing with bacterial counts above 1×10^8 CFU/mL, while other groups showed promising probiotic traits at lower counts namely high acidification ability, bile salt tolerance, moderate NaCl tolerance up to 4%, and optimal growth at mesophilic temperatures around 37°C. Additionally, none of them generated hydrogen sulphide, and the main metabolic pathway was homofermentative, which produces lactic acid without gas which is favorable for gut health. The findings of the study revealed that the LAB isolated from natural inoculum exhibited strong probiotic potential characteristics with high viability, acid and bile tolerance, and optimal growth at 37°C, indicating its potential to use as a natural probiotic supplement. Further investigations of molecular identifications are vital for exact identification of the isolates.

Keywords: Lactic acid bacteria, Isolation, Identification, Inoculum, Probiotic supplements, Biochemical characterization

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Litter management practices and effect on welfare of broiler chicken in Kandy district

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The study was aimed to identify the relationship between litter management practices and welfare indicators such as foot pad dermatitis, hock burns, lameness and plumage quality of broiler chicken in Kandy district. Data were collected from 35 broiler farms through a questionnaire and on-farm assessments. Most farmers were aged 35–50 years (47.1%) and 58.8% had over five years of farming experience. From each farm, 15 birds were examined and litter condition was evaluated using five representative litter samples per farm, in addition continuous assessments were conducted for three weeks in five selected farms. Results showed that 51.4% of farmers turned the litter daily. Foot pad score and lameness showed significant correlations with litter score, and there was a highly significant difference ($p < 0.001$) among footpad and lameness scores over three weeks. Litter score and foot pad score showed significant correlation with litter management practices ($p < 0.001$). Regular litter turning was found to improve litter quality and overall bird welfare.

Keywords: Broiler welfare, Litter management, Footpad dermatitis, Hock burns, Lameness

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Management Factors Affecting Welfare of Dairy Buffaloes in a Large-scale Farm: A Case Study

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In Sri Lanka, a limited number of research had been conducted on dairy buffalo welfare. In this study, a total of 253 buffaloes (Milking-65, Dry-19, Heifers-101, Calves-68) were observed to assess their welfare status. Data related to farm, animal and stock-person attitude factors were collected to identify the welfare issues. Descriptive statistical analyses were performed using MS Excel (2024). According to the results, limb cleanliness was considerably low (38.5%) in milking herd and claves (26.5%) compared with dry cows (52.6%) and Heifers (71.3%). Prevalence of mastitis was 20% and a considerable percentage were in stage 1 (score 1: 53.9%; score 2: 46.2%). Several positive welfare indicators were identified including maintaining of proper body condition score [Milking: 3.0–3.5 (75.4%); Dry: 3.0–3.5 (68.1%)], udder cleanliness (Milking: 75.4%; Dry: 89.5%) and flank cleanliness (Milking: 58.5%; Dry: 78.9%; Heifer: 84.2%; calf: 51.5%). Additionally low percentages were recorded for skin lesions (Milking: 18.5%; Dry: 15.8%; Heifer: 16.8%), hock wounds (Milking: 7.7 %; Dry: 5.3%; Heifer: 2.9%; calf: 4.4%), overgrown claws (Milking: 9.2%; Dry: 0%; Heifer: 6.9%), lameness (Milking: 1.5%; Dry: 0%; Heifer: 0.9%) and swollen hocks (Milking: 6.2%; Dry: 0%; Heifer: 0%). All calves (100%) were managed through early calf-dam separation, bottle feeding of colostrum, weaning at three months of age, naval disinfection, use of calving pens and calf pens. However, improper handling practices were observed among stockpersons including flinch, steps and kicks (12.3%), flinch and steps (21.34%), moderate slaps, pushes and hits (36.9%), forceful slaps, pushes and hits (20%), and hand resting on the back (20%). A majority of stockpersons lacked adequate knowledge of buffalo welfare (75%), nutrition (66.7%) and a considerable percentage of farmers handled animals by shouting (75%), hitting (50%) and kicking (33%). This study revealed both positive and negative welfare aspects in Sri Lankan dairy buffalo management, emphasizing the need for improved farmer knowledge, handling practices, and hygiene to enhance overall buffalo welfare and sustainable dairy production.

Keywords: Dairy buffalo, Animal welfare, BCS, Mastitis, Stockperson behavior

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Molecular Characterization of an *In-situ* Collection of Sri Lankan *Coffea* (Coffee) Germplasm

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Coffee (*Coffea* spp.) is a crop of major global economic and cultural importance. Its re-emergence as a promising plantation crop in Sri Lanka underscores the need to characterize and conserve existing germplasm resources. This study aimed to assess the genetic diversity and relationships among *in-situ Coffea* accessions collected from major coffee-growing regions of Sri Lanka using simple sequence repeat (SSR) markers. A total of 50 representative accessions, including known reference varieties of *Coffea arabica* and *C. canephora* collected from the Export Agriculture Research Station, were genotyped at seven SSR marker loci. Allelic data were analyzed using PowerMarker, MEGA, and STRUCTURE software to determine diversity parameters, phylogenetic clustering, and population structure. Across all loci, the mean gene diversity was 0.67, and the polymorphic information content (PIC) averaged 0.61, confirming polymorphism and the high informativeness of the selected SSR panel. UPGMA dendrogram revealed clear genetic differentiation, forming five main clusters (C1–C5) that corresponded to species identity and geographic origin. Reference accessions of *C. arabica* and *C. canephora* grouped distinctly, validating marker efficiency and confirming the successful resolution of varietal and interspecific relationships. Accessions from different districts were distributed across clusters, showing high inter-district genetic diversity with no strict district-wise grouping. Overall, the dendrogram reveals broad genetic diversity among Sri Lankan coffee-germplasm, highlighting rich local germplasm variation. Population structure was further examined using STRUCTURE and Structure Selector software with datasets comprising 7, 6, and 5 SSR markers to evaluate marker sufficiency. Clustering patterns showed low resolution and inconsistent grouping, indicating that the limited number of loci was insufficient for robust population structure inference. This study provides a valuable baseline for future molecular characterization and genetic improvement of coffee, aiding in the long-term conservation and utilization of local coffee genetic resources.

Keywords: Genetic diversity, Germplasm conservation, Polymorphism, Population structure, SSR markers

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Morphological Characterization of 20 *Theobroma cocoa* L. Germplasms in Field Gene Bank, Kundasale

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Theobroma cacao L. (cocoa) remains a globally important tropical crop valued for its economic and nutritional significance. In Sri Lanka, cocoa once held a prominent place in plantation agriculture, particularly for its high-quality varieties. However, genetic erosion caused by land fragmentation, pest and disease pressures, and limited research driven interventions has led to reduced diversity within local germplasm. Revitalizing the crop requires a clear understanding of its existing genetic and phenotypic variation. This study aimed to characterize the morphological diversity of 20 *T. cacao* accessions maintained at the Kundasale field gene bank to support conservation and selection of promising genotypes for breeding. Morphological evaluation was conducted using 46 standardized quantitative and qualitative descriptors covering vegetative, floral, fruit, and seed traits. Hierarchical clustering analysis based on Gower's distance and the UPGMA algorithm classified the accessions into six main groups at a 0.28 similarity cutoff, indicating moderate intra-population variability. PCoA showed that the first 3 axes explained 46.54% of total morphological variation, while PCA identified pod size, seed traits, flower morphology, and qualitative features as key contributors to differentiation. Overall, the findings demonstrate substantial morphological diversity among the studied accessions, suggesting the presence of valuable traits for future crop improvement. This provides a crucial baseline for the conservation and utilization of cocoa genetic resources in Sri Lanka and highlights the potential of morphological characterization as a foundation for structured breeding programs.

Keywords: Cluster analysis, *Criollo*, Morphological descriptors, PCA mix, Sri Lanka

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Morphological, Nutritional, and Phytochemical Assessment of *Megathyrsus trichocladus* (wireweed): Implications of Forage Potential and Maturity Related Changes

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Wireweed or *Megathyrsus trichocladus* is a highly invasive tropical grass widely spread in Sri Lanka. Although it produces abundant biomass, grazing animals tend to reject mature plants, indicating its poor palatability. This study aimed to identify the morphological, nutritional and phytochemical determinants that might contribute to the low palatability with the maturity of wireweed plants. Biological replicates of *M. trichocladus* were collected from pre-flowering and flowering stages from 4 different locations at Peradeniya and proximate composition was analyzed by AOAC standard methods following fiber fractionate by Van Soest method. Phytochemicals were tested both qualitatively and quantitatively. Findings of the study revealed that crude protein content is lower ($p < 0.001$), whereas crude fiber content is higher ($p < 0.001$) in flowering stage than in pre flowering stage. Similarly, fiber fractionation was higher ($p < 0.001$) in neutral detergent fiber (65.9 ± 0.8% vs 70.6 ± 0.8%), acid detergent fiber (38.4 ± 0.6% vs 45.5 ± 0.6%), and acid detergent lignin (4.4 ± 0.3% vs 7.9 ± 0.3%) in flowering stage than in pre-flowering stage reflecting enhanced structural rigidity and reduced digestibility with maturity. Microscopic observations revealed dense trichome distribution on leaf surfaces and sheaths, while stems lacked trichomes. Lignin deposition has increased notably in stem tissues at the flowering stage, contributing to stiffness which in turn lower the intake. Phytochemical screening indicated the presence of phenols, saponins, flavonoids, terpenoids, and coumarins in both stages, whereas quinones was present only during the flowering stage. Total phenolic content was significantly higher (2.85 ± 0.09 mg GAE/100 mg DM at flowering stage compared to pre-flowering stage (4.34 ± 0.21 mg GAE/100 mg DM) indicating intensified astringency and bitterness. These results suggested that both structural and chemical changes contribute to the reduced palatability of mature grass. It could be concluded that *M. trichocladus* cannot be recommended to cultivate as a forage, though its inclusion in total mixed rations (TMR) at the pre-flowering stage, which exhibits moderate nutritive value, may be suitable as a supplementary feed component. Further investigations with feeding trials are needed to determine the suitability of inclusion in TMR.

Keywords: *Megathyrsus trichocladus*, invasive grass, maturity stage, fiber composition, phytochemicals

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Nutri-priming Seed Paddy with Selected Essential Micronutrients (Zn, Mn and B): Effects on Germination and Vegetative Growth of Rice Plant

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Micronutrients are essential for ensuring proper metabolic and cellular activities in plants. Effect of nutri-priming seed paddy with three essential micronutrients; zinc (Zn), manganese (Mn) and boron (B), was investigated on seed germination and vegetative growth of rice (*Oryza sativa* L.). Nutri-priming refers to soaking seeds in a nutrient solution before sowing. The study comprised preliminary and main experiments conducted at the Rice Research and Development Institute, Bathalagoda, Sri Lanka. Preliminary experiment using two rice varieties; Bg 300 (3 months age class) and Bg 251 (2½ months age class) with hydro-priming as the control, revealed a varietal difference in response to treatments. Zinc had no significant effect (P>0.05) on seed germination of both varieties, while 2 g L^{-1} $ZnSO_4.H_2O$ increased radicle: plumule ratio in Bg 300. Manganese enhanced seed germination and early seedling growth (*P<0.05*) at 5 g L^{-1} $MnSO_4.4H_2O$ in both varieties. Boron did not significantly affect seed germination of Bg 251 but had a significant effect on Bg 300. However, 1 g L^{-1} H_3BO_3 promoted early radicle elongation (P<0.05) of Bg 251. Selected concentrations (2 g L^{-1} $ZnSO_4.H_2O$; 5 g L^{-1}; $MnSO_4.4H_2O$; 1 g L^{-1} H_3BO_3) and their combinations for nutri-priming were further evaluated in a pot experiment using Bg 300. Treatments significantly affected growth parameters at 7, 14, and 21 days after sowing, but not at 28 days except for root length. The combined B and Zn treatment produced the highest tiller number and a higher SPAD value compared to the control treatment, though differences were not significant (*P>0.05*). Overall, B treatments (single/ combined) had the least impact on growth or seedling vigor. Nutri-priming with $MnSO_4.4H_2O$ or $ZnSO_4.H_2O$ promoted seed germination, and seedling growth and vigor of rice variety Bg 300. Further studies to confirm the results at field level using different rice varieties are recommended.

Keywords: Boron, Manganese, Nutri-priming, Rice, Zinc

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Nutritional Adequacy of Home-prepared Diets for Sri Lankan Indoor Cats Visiting Peradeniya Veterinary Teaching Hospital.

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Home-prepared diets (HPDs) are commonly used for indoor cats in Sri Lanka, influenced by owner preferences and limited access to commercial cat foods. However, the nutritional adequacy of these diets and knowledge of the owners about feline dietary needs remain uncertain, raising potential health concerns for cats reliant on HPDs. This study aimed to assess the nutritional adequacy of HPDs for indoor cats visiting the Veterinary Teaching Hospital (VTH), University of Peradeniya, and to investigate the relationship between the nutritional adequacy of each HPD and owner awareness of feline nutrition. Data on detailed dietary records on HPDs and response to 10 Feline nutrition-related questions were collected from 50 adult owners of mature cats visiting the VTH using a structured questionnaire, and nutrient intakes were evaluated based on a compiled ingredient database using standardized calculation methods using Microsoft Excel. Each calculated nutrient intake for 50 HPDs was compared with established standards (NRC 2006, AAFCO 2015, and FEDIAF 2024). Owner awareness scores derived from their response to structured survey were classified as low, moderate, or high. Statistical analyses were performed in R using descriptive tests and Fisher's Exact test. None of the 50 HPDs quantitatively provided all essential core nutrients in adequate concentrations to meet at least one established nutritional standard. Though the protein and energy intakes generally met or exceeded guidelines, fat, taurine, calcium, and key B vitamins were frequently inadequate. Animal-source foods were crucial for taurine sufficiency. However, inclusion of rice or non-meat items tended to dilute essential nutrient density. Owner awareness was not significantly associated with calculated nutritional adequacy ($p<0.05$), suggesting that high owner awareness alone does not resolve the issue. In conclusion, HPDs for diets for Sri Lankan indoor cats often lack one or more essential nutrients. Professional guidance is needed to improve diet formulation and safeguard the health of indoor cats.

Keywords: Feline nutrition, home-prepared diets, nutritional adequacy, Sri Lanka, owner awareness.

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Optimization of Harvest Maturity for *Ambul* banana (*Musa* spp.) Based on Physicochemical Quality Attributes during Fruit Ripening

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This study evaluated the optimal harvest maturity of *Ambul* banana (*Musa acuminata* AAB) based on physicochemical quality attributes during fruit ripening. Fruits were harvested at five maturity stages; 9, 10, 11, 12, and 13 weeks after flowering (WAF) and assessed for weight loss, peel color, firmness, pulp-to-peel ratio, soluble solid content (SSC), titratable acidity (TA), pH, and sensory evaluation at room temperature (27 ± 2 °C). Harvest maturity significantly affected postharvest shelf life and fruit quality ($p \leq 0.05$). Early-harvested fruits (9-10 WAF) had the longest shelf life (up to 14 days), but underdeveloped flavor, with low SSC and TA and high firmness. Late-harvested fruits (13 WAF) ripened rapidly, showing high SSC, low firmness, and a short shelf life of 8 days. Fruits harvested at 11-12 WAF demonstrated an optimal balance of SSC, acidity, firmness, and sensory acceptability, maintaining a shelf life of 10-12 days. These findings indicate that 11-12 WAF is the most suitable harvest maturity for *Ambul* banana to optimize postharvest quality and marketability under ambient storage conditions.

Keywords: *Ambul* banana, Harvest maturity, Physicochemical attributes, Postharvest quality, Shelf life

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Optimizing Media for Cultivating Indigenous Microorganisms (IMOs) and Evaluating them as Organic Biofertilizers

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Reliance of conventional agriculture on synthetic chemicals is a major driver of global pollution, biodiversity destruction, and soil degradation, necessitating a critical shift toward sustainable practices. This research investigates one such solution, Indigenous Microorganisms (IMOs), which is a central technique in Korean Natural Farming (KNF) that cultivates native beneficial microbes to enhance soil health and fertility. The study was conducted with the primary objectives of identifying the optimal medium for cultivating IMOs and evaluating the effectiveness of IMOs as a biofertilizer in improving soil chemical properties compared to other organic and inorganic fertilizers. For the collection of Indigenous Microorganisms, four different rice-based media were used to determine the most suitable substrate for microbial proliferation. The experimental results for IMO cultivation revealed that medium composition critically affects microbial populations. Among the tested substrates, the Rice with coconut poonac (coconut oil cake) medium produced the most favorable results, consistently supporting the highest bacterial growth and superior microbial colonization in both the IMO 1 and IMO 2 stages. In addition to promoting microbial abundance, the coconut poonac-based medium also contributed positively to soil quality when used as a component of biofertilizer. Differences were significant ($p < 0.05$) among treatments for all measured parameters. Organic treatments, including those with IMO, significantly increased soil pH by neutralizing acidity and reduced soil electrical conductivity (EC), thereby minimizing the salinity buildup associated with the inorganic fertilizer regime. These findings underscore the potential of locally produced IMO technology, particularly coconut poonac-based formulations to provide a sustainable and cost-effective method for fostering superior microbial growth and ensuring favorable, long-term soil health.

Keywords: Indigenous Micro Organisms (IMO), Korean Natural Farming (KNF), Biofertilizer, Rice with coconut oil cake medium, Rice with potato medium

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Optimizing Stress-Mediated Flowering in *Bougainvillea glabra 'variegata'*: Role of Controlled Drought, Nutrient Restriction, and Paclobutrazol

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A study was conducted at a commercial plant nursery in Kuliyapitiya to determine the optimal combination of water stress, nutrient regime and paclobutrazol (PBZ) to enhance growth and flowering of *Bougainvillea glabra 'variegata'*. A three factor factorial experiment was arranged in a completely randomized design evaluated two watering intervals (4 and 8 day), five fertilizer types;- current practice at the nursery (12:11:18 N:P:K), Department of National Botanic Gardens (DNBG) recommendation (6:30:30 N:P:K), low N with high K (3: 14: 21 N:P:K), low N + high K + 2% Mg (3: 14: 21 N:P:K), and no fertilizer, and two PBZ concentrations (0 and 200 ppm). Vegetative growth, flowering response, root development, chlorophyll content and photosynthetic activity were measured. Analysis revealed significant interactions ($p < 0.05$) among all three factors. Treatment T12 - (8- day water interval + current practice + 200 ppm PBZ) produced the highest flower count (13.2) with 70% flowering success while maintaining a good vegetative growth. Maximum leaf production was achieved by T17 (8 day water + low N + high K + 200 ppm PBZ) with 79 leaves, while T13 (8 day water + DNBG + 0 ppm PBZ) produced the most branched architecture (8.9 branches). Root development was maximized by T16 (8 day water + low N + high K + 200 ppm PBZ). The study demonstrates that synergetic application of moderate drought stress with PBZ and standard fertilizer creates an optimal protocol for commercial bougainvillea production, providing growers with scientifically validated strategies to manipulate plant architecture and flowering in response to specific market demands.

Keywords: Bougainvillea, Flowering induction, Nutrient management, Paclobutrazol, Water stress.

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Potential Use of Biofilm Biofertilizer on Green Cucumber (*Cucumis sativus* L.) Production in Protected Culture

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The growing need for sustainable crop production under protected environments has prompted for biological alternatives to chemical fertilizers. Biofilm biofertilizers (BFBFs), composed of beneficial microbial consortia embedded in biofilm matrices, have shown promise in enhancing nutrient uptake, plant growth, and soil health. This study aimed to evaluate the potential use of BFBFs on the growth, yield and fruit quality of greenhouse grown green cucumber (*Cucumis sativus* L.) cultivated under greenhouse conditions. The experiment was conducted using a CRD with 6 treatments and 10 replicates. In the treatments, biofilm biofertilizer (Biofilm veg) (T3), two multifunctional biofertilizers (HB85 and HB95) (T5 and T6) and fish tonic (T4) were tested under 75% Alberts fertilizer, keeping 100% (T1) and 75% (T2) Albert's solutions as the no-biofertilizer controls. Plant growth, yield and quality and microbial activity of the substrate were evaluated to determine the treatment effects. Significant treatment effects ($p<0.05$) on plant growth appeared from the fourth week after emergence. The control (T1) exhibited the highest early vegetative growth. However, HB85 (T6) showed a steady and progressive improvement along with the vegetative growth, ultimately reaching the level of the control by the 8th week. It also showed the highest root fresh weight and also comparable in dry weight to T1. Although fruit number did not differ significantly, HB85 (T6) and Biofilm veg (T3) yielded heavier, well-shaped, and more uniform fruits, surpassing the control with respect to marketable quality. Chlorophyll analysis revealed maximum chlorophyll *a content* in T1, chlorophyll *b* in T3, and total chlorophyll in T1 and T6, indicating enhanced capacity for photosynthesis. Microbial population was the highest in T3, confirming superior microbial survival two weeks after biofertilizer application. Collectively, HB85 demonstrated balanced vegetative growth, improved biomass accumulation, and good fruit quality, underscoring its potential as a sustainable and effective biofertilizer for greenhouse cucumber production.

Keywords: Biofilm biofertilizer, greenhouse cultivation, plant growth, fruit quality, microbial survival

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Preliminary Investigation on the Loading of Antibiotic-Resistant Bacteria and Potentially Toxic Elements in Indoor Dust of Households in an Agricultural Landscape

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Antibiotic resistance and heavy metal contamination have emerged as critical environmental and public health challenges, especially in agricultural landscapes where close interaction between farming and domestic environments occurs. This study aimed to investigate the loading of antibiotic-resistant bacteria (ARB) and lead (Pb) in indoor dust from households within and outside an agricultural landscape in Nuwara-Eliya district. A total of 23 households were sampled, comprising 15 in the agricultural landscape and 8 from non-agricultural landscape. Dust samples were analysed for the loading of bacteria resistant to amoxicillin (10 ppm), sulfamethoxazole (15 ppm), ciprofloxacin (1 ppm) and trimethoprim (10 ppm) in indoor dust using pour-plate and settle-plate techniques. Dust samples were subjected to aqua-regia digestion and analysed for total Pb content. Data were analysed with Mann-Whitney U test and Spearman Correlation. Total culturable bacteria in indoor dust ranged from 7.16 to 7.88 $\log_{10}$ CFU/g dust. Bacteria loading did not differ significantly between household categories. However, the prevalence of bacteria resistant to sulfamethoxazole and ciprofloxacin was significantly higher ($p<0.05$) in agricultural households than in non-agricultural households. Significant positive correlations ($r>0.70$) were observed between prevalence of ARB types. Lead concentrations did not differ significantly ($p>0.05$) between household categories and the values ranged from 15.84 to 64.47 mg/kg. The findings highlight that exposure to agricultural activities elevated the prevalence of ARB in indoor dust, while Pb content was not affected. This study emphasizes the importance of improved manure management, stricter antibiotic regulation, and enhanced indoor hygiene to mitigate cross-transfer of environmental contaminants under the One Health framework.

Keywords: Agricultural activities, Antibiotic resistance, Heavy metals, Indoor air quality, One Health

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Production and Evaluation of Ipil-Ipil and Gliricidia Leaf Meal Pellets as Alternative Protein Supplements for Ruminants

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Limited availability of conventional protein supplements has created the need to develop alternative protein supplements for ruminant feeding. Ipil-Ipil *(Leucaena leucocephala)* and Gliricidia *(Gliricidia sepium)* are leguminous perennial trees widely distributed in the low-country dry zone and up-country wet zone of Sri Lanka. They produce leaves rich in crude protein. This study aimed to produce leaf meal pellets from Ipil-Ipil and Gliricidia leaves as potential protein supplements for ruminant feed. Harvested leaves were dried in a forced-air oven at 65° C and finely ground. The resulting leaf powders were analyzed for proximate composition. Pellets were prepared by mixing varying proportions of leaf powder with wheat flour and molasses to form a dough, which was then pelletized using a laboratory pelletizer and dried at 65° C. The experiments were arranged in a Complete Randomized Design with four replicates. The dried leaf meal pellets were analyzed for composition and physical quality. Pellets containing 79% Ipil-Ipil or 77% Gliricidia leaf powder recorded crude protein contents of 21.7% and 18.9%, respectively. The Pellet Durability Index (PDI) of both types exceeded 97%. Particle size distribution analysis indicated that 97% and 100% of Ipil-Ipil and Gliricidia pellets, respectively, ranged between 1.5 mm and 3.0 mm. The study confirmed the feasibility of producing durable, protein-rich leaf meal pellets by incorporating 79% Ipil-Ipil or 77% Gliricidia leaf powder with molasses and wheat flour as binders for use as protein supplement in ruminant feed.

Keywords: Crude Protein, Particle size, Pellet durability

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Rice Grain Particle Size Does Not Affect the Performance of Rice-Based Diet Fed Broiler Birds

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The Sri Lankan poultry broiler meat industry's profitability is dependent on feed costs, which account for 60-70% of production expenses, and a heavy reliance on imported maize. Rice (*Oryza sativa*), a locally abundant staple, presents a strategic alternative; however, the optimal particle size for rice-based diets is not well established. This study was conducted to evaluate the impact of rice grain particle size in rice-based mash diets on broiler birds' growth performance. A total of 75 one-day-old Cobb 500 broiler chicks were subjected to 3 dietary treatments using a Completely Randomized Design (CRD). Each treatment had 5 replicate cages with 5 birds per cage. The treatments consisted of rice-based mash diets with different rice particle sizes: Whole Grain, 6 mm, and 3 mm. The trial lasted 35 days. Growth performance (feed intake, live weight, FCR), apparent ileal digestibility (crude protein, crude fat), carcass weight, relative intestinal organ weights, and intestinal histomorphology Villus Height (VH), Villus Width (VW), Crypt Depth (CD) were measured. Results showed no significant differences ($p > 0.05$) among treatments for cumulative live weight, feed intake, feed conversion ratio, carcass weight or the apparent ileal digestibility of crude fat. However, particle size had a significant ($p < 0.05$) effect on gastrointestinal morphology. Relative gizzard weight and relative proventriculus weight were significantly different ($p < 0.05$) among the groups. Also, the apparent ileal digestibility of protein values were significantly different ($p < 0.05$) among the treatments. Furthermore, significant differences ($p < 0.05$) were observed in the histomorphology of the jejunum VH and ileum VH. In conclusion, rice grain particle size affects gizzard weight, proventriculus weight, and the villus height of the jejunum and ileum, while particle size had no significant effect on overall growth performance.

Keywords: Broiler, Rice-based diet, Particle size, Broiler performances, Intestinal histomorphology

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Soil Moisture and Nutrient Dynamics in Maize Cropping System under Different Tillage and Moisture Conservation Practices

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Soil moisture and nutrient availability are critical determinants of crop productivity in dryland maize (*Zea mays* L.) cropping systems. This study evaluated the effects of different tillage and soil moisture conservation practices on soil moisture retention and nutrient dynamics in a maize cropping system under dry zone conditions of Sri Lanka. A field experiment was conducted during the *Yala* season at Mahaweli System B using a split-plot design with three replications. The main plots comprised (i) zero tillage, (ii) minimum tillage, and (iii) conventional tillage, while subplots included soil moisture conservation practices, such as (i) paddy straw mulch, (ii) half-burnt paddy husk, (iii) live mulch with mung bean, and (iv) control (no mulch). Soil physical and chemical parameters, including soil moisture content, bulk density, pH, electrical conductivity, organic matter, cation exchange capacity, and available nitrogen (N), phosphorus (P), and potassium (K), were measured at the vegetative stage, while soil moisture and bulk density were again measured at the harvesting stage. The results revealed that most soil properties measured were not significantly affected ($P>0.05$) by tillage and mulching within a single season. However, minimum tillage significantly enhanced ($P<0.05$) available P compared to zero and conventional tillage, suggesting improved nutrient retention through moderated soil disturbance. Soil electrical conductivity was lower under zero tillage with mulching than that without mulch, highlighting the role of mulch in stabilizing soil salinity. Other parameters were not markedly influenced, indicating that the short-term effects of implementing conservation agricultural practices on soil parameters may be limited. It can be concluded that minimum tillage combined with appropriate mulching practices can improve long-term soil P availability in dryland maize cropping systems.

Keywords: Maize, Mulching, Nutrient Dynamics, Soil Moisture, Tillage

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Study on the Life Cycle of *Apis cerana* Worker Bees and Temporal Dynamics of Microclimatic Changes inside the Hive

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The Asian honey bee (*Apis cerana* Fabricius, 1793) is widely distributed across Asia, playing a vital ecological and economic role as a pollinator. While *Apis mellifera* has been extensively studied for its life cycle and thermoregulation, research data on *Apis cerana*, particularly in countries like Sri Lanka, is limited. This study investigates the life cycle of *A. cerana* worker bees and the temporal dynamics of hive microclimatic conditions, focusing on temperature and relative humidity (RH) regulation under varying environmental conditions. The life cycle study was conducted using a natural beehive, with visual observations of 35 worker bees tracked through photographs and videos. Results showed that adult worker bees develop in 19.2 days (SD=0.23), with an egg stage of 3 days, a larval stage of 4.5 days (SD=0.23), and a pupal stage of 11.5 days (SD=0.22). To study hive microclimate, custom sensor units with DS18B20 and DHT22 sensors were installed in colonies with low and high strength. Data were recorded every five minutes over one month and stored using Arduino Cloud. Statistical analyses, including Linear Mixed Models and Tukey's test, revealed significant differences (F-value = 6974.45 and 504.95, $p < 0.001$, for temperature and RH, respectively) in temperature and RH between hive types and ambient conditions. Mean hive temperatures were higher than the ambient temperature of 25.52°C (SD=2.154), with low-strength colonies at 30.09°C (SD=1.361) and high-strength colonies at 32.65°C (SD=0.838). RH ranged from 62.4–90.0% (SD=5.52%) in low-strength hives and 60.8–89.7% (SD=4.11%) in high-strength hives. Coefficients of variation decreased from ambient (11.6%) to low-strength (7.0%) and high-strength hives (5.6%), indicating tighter microclimate regulation in stronger colonies. These findings confirm that *A. cerana* effectively maintains stable internal hive conditions, with regulation efficiency closely tied to colony strength.

Keywords: *Apis cerana*, Life cycle, Hive microclimate, Thermoregulation, Relative humidity

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The Influence of Urease Inhibitor (Limus®) on Growth, Yield and Nutritive Composition of Hybrid Fodder Maize in Low Country Dry Zone of Sri Lanka

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This study investigated the effect of applying Limus®-treated nitrogen fertilizer on aboveground biomass accumulation in hybrid fodder maize (*Zea mays* L.). The hybrid fodder maize cultivar 'Commando' was sown at a plant density of 88,888 plants/ha on soils dominated by Reddish Brown Earths, Red-Yellow Podzolic soils, and Low Humic Gley soils in the Low-Country Intermediate Zone 2 (IL2) of Sri Lanka. The experiment was conducted in a Randomized Complete Block Design (RCBD) with two treatments: nitrogen fertilizer treated with Limus® and nitrogen fertilizer without Limus®. A grower fertilizer mixture (15N:8P:20K) was applied at 257 kg/ha and 210 kg/ha at 14 and 25 days after sowing, respectively. Subsequently, a top-dressing fertilizer mixture (27N:3P:20K) was applied at 198 kg/ha and 173 kg/ha at 32 and 45 days after sowing, respectively. Plant height, leaf number, leaf blade length, and first internode stem circumference were measured weekly until 9 weeks after sowing. The crop was harvested at 65 days, and fresh matter yield (FMY) and dry matter yield (DMY) was estimated. The effect of application of Limus®-treated fertilizer was statistically analyzed using analysis of variance (ANOVA), and mean separation was performed by Duncan's Multiple Range Test (DMRT). Indicating enhanced nitrogen fertilizer use efficiency of Limus®, maize fertilized with Limus®-treated nitrogen fertilizer recorded significantly ($p < 0.05$) greater stem circumference and leaf blade length after 3 and 5 weeks, respectively. At harvest, maize fertilized with Limus®-treated nitrogen fertilizer showed significantly ($p < 0.05$) greater plant height (266 cm vs. 261 cm) and crude protein content (7.03% vs. 6.37%). In addition, there was a tendency for Limus®-treated fertilizer to produce a greater FMY (80.32 vs. 74.93 MT/ha) and DMY (17.28 vs. 15.59 MT/ha) compared to untreated fertilizer. The study demonstrated that the application of Limus®-treated fertilizer enhances the nitrogen fertilizer use efficiency and thereby biomass yield of hybrid fodder maize.

Keywords: Nitrogen fertilizer, Plant height, Leaf number, Leaf blade length, First internode stem circumference

Acknowledgement: This research was conducted in collaboration with the Golden Grains (Pvt.) Ltd., Giradurukotte, Sri Lanka.

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Validation of Molecular Markers for Spiny and Spiny-Tip Leaf Margin in Pineapple

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Pineapple (*Ananas comosus* L.) is one of the most valuable tropical fruit crops grown in Sri Lanka. The presence of spiny leaf margins continues to cause serious difficulties during field operations and post-harvest handling. Developing spineless or less spiny varieties has made marker-assisted selection (MAS) an attractive strategy for breeding programs. However, reliable molecular markers linked to leaf margin traits in local varieties remain untested. This study aims to validate Sequence Characterized Amplified Region (SCAR) and Simple Sequence Repeat (SSR) markers associated with spiny and spiny-tip phenotypes in pineapple, using a segregating population derived from a cross between 'Kew' and 'Mauritius'. Field evaluations of 25 spiny and 25 spiny-tip plants revealed notable variation, but the overlap between the two phenotypic classes indicated the need for a standardized, objective scoring system. The current morphological criteria were found to be inadequate for clear classification due to subjective assessments and environmental influences. To achieve more reliable differentiation, 12 molecular markers, including 10 SSRs and 2 SCARs were tested using DNA from both parents and bulked progenies. SCAR markers Pa-01 and Pa-02 did not show polymorphism. Several SSR markers produced clear polymorphic patterns, with *Pa5* showing the highest polymorphism (60%), followed by Pa4, Pa9, and Pa10 (50%). Results confirmed that phenotypic traits alone cannot effectively separate pineapple leaf types. Establishing a clear and reproducible morphological scoring framework, together with robust molecular diagnostics, is crucial for future breeding programs. Among the validated markers, *Pa5* showed strong potential for assisting in the early selection of desired phenotypes. Further validation of high polymorphic markers on individual samples is needed to confirm their effectiveness, reliability, and reproducibility.

Keywords: *Ananas comosus*, SCAR, Spiny, Spiny-tip, SSR

Acknowledgement: This research was supported by the Fruit Research and Development Institute, Horana.

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Varietal Screening and Physiological Response Profiling of Tea (*Camellia sinensis* L.) O. Kuntze) Under the Elevated Temperature Condition in Upcountry-Wet Zone

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Tea (*Camellia sinensis* (L.) O. Kuntze) production is highly influenced by climate change, which can significantly impact physiological processes. With the ongoing impact of climate change, global warming has become a major concern worldwide. This study was conducted at the Tea Research Institute, Talawakelle, Sri Lanka, to evaluate four tea cultivars (TRI 2023, TRI 2025, TRI 4046, and TRI 4071) for their physiological and growth responses to elevated temperature. Potted plants were grown under ambient and elevated temperatures, under well-watered conditions. Elevated temperature treatment is maintained at an average of 3.5 °C above ambient. Heat was provided by using artificial heaters. Elevated temperature significantly ($p<0.05$) increased total dry weight per plant in TRI 4046, while increasing leaf dry weight in all cultivars except TRI 4071. Net photosynthetic rate, transpiration rate, and stomatal conductance were significantly increased under elevated temperature, with TRI 4071 showing the highest increment. Total chlorophyll and carotenoid contents were significantly reduced by elevated temperature, with no significant variation among cultivars in both treatments. Total soluble sugar and proline contents were significantly lower ($p <0.05$) under the elevated temperature. The lowest proline content was observed in TRI 4046 and TRI 4071 under the elevated temperature. Non-photochemical quenching was significantly ($p <0.05$) lower under elevated temperature in all cultivars. Therefore, future temperature increases can positively affect the tea cultivation in the up-country of Sri Lanka by enhancing growth and physiological performance. The two 4000 series cultivars showed greater response to increasing temperatures, while the 2000 series maintained stable growth and physiological performances.

Keywords: Tea, Up country, Temperature, Physiology, Climate change

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Whole-Genome Assembly, Characterization, and Comparative Analysis of Foraging-Related Genes in the Sri Lankan Honeybee (*Apis cerana* Fabr.)

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Genomic assemblies of honeybees (*Apis* spp.) have become indispensable tools for advancing bee breeding, conservation, and evolutionary biology. Despite this, the Sri Lankan honeybee has remained a notable exception, with its genomic architecture largely unexplored. To fill this knowledge gap, this study focuses on the first high-quality whole-genome assembly of the Sri Lankan honeybee and comparative analysis of key foraging genes. Using high-throughput paired-end Illumina sequencing, this study generated both a reference-guided and a *de novo* assembly, achieving very high gene coverage completeness scores of 99.6% and 99.2% BUSCO scores, respectively. The final genome showed 98.8% average nucleotide identity to the Asian honeybee reference genome (GCF_029169275.1), and annotation predicted over 27,000 coding sequences. Utilizing this assembly, a comparative analysis was performed focusing on 42 literature-curated, foraging-related genes across honeybee populations. This comparative genomic approach revealed distinct variations in key protein domains within the Sri Lankan honeybee lineage, providing the first genomic evidence supporting its unique adaptive traits. This work not only offers novel insights into the foraging ecology of the Sri Lankan Honeybee but also establishes a vital genomic resource for future honeybee breeding and conservation efforts.

Keywords: Sri Lankan honeybee, Whole-genome assembly, *De novo* assembly, Reference-based assembly, Foraging-related genes

Acknowledgement: This research was funded by the multidisciplinary research grant (MDRG 351)

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Theme 2

Technological Interventions and Applications in Agriculture

AI-Driven De Novo Molecular Design and Computational Evaluation of Novel Sweeteners Targeting the Human Sweet Taste Receptor Using a Target-Aware Chemical Language Model

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Excessive dietary sugar intake is a leading driver of global non-communicable diseases (NCDs), such as diabetes mellitus and cardiovascular disease. Artificial sweeteners are used as alternatives, but they may pose metabolic risk and potential safety concerns. Here, we present an AI-driven *de novo* molecular design approach for generating novel sweetener molecules targeting the human sweet taste receptor (TAS1R2–TAS1R3). Using the target-aware chemical language model (TamGen), two conditional generation strategies were employed: one conditioned solely on the 3D structure of the Venus Flytrap Domain (VFTD) of the TAS1R2 receptor (PDB ID: 9NOV), and another conditioned on both the VFTD and ten existing sweetener molecules. Together, these approaches produced 19,948 candidate molecules, which were subsequently screened through molecular docking and absorption, distribution, metabolism, excretion, and toxicity (ADMET) profiling. Following multi-stage filtering, sixteen final compounds were identified with higher binding affinities than sucralose, favorable pharmacokinetic and toxicity characteristics, and strong synthetic feasibility. Thermal stability and sweetness intensity predictions further indicated their suitability for applications in the food industry. These findings demonstrate the potential of integrating generative AI with computational screening to accelerate the discovery of safe, potent sugar alternatives and to establish a framework for target-specific design in food and health sciences.

Keywords: Artificial sweeteners, ADMET profiling, Molecular docking, Sweetness prediction, Computational chemistry.

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Application of Micropropagation Techniques for Conservation of Endangered Species, *Rhynchostylis retusa* (L.) Blume

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Rhynchostylis retusa (L.) Blume, commonly known as the foxtail orchid, is an endangered and highly valued ornamental and medicinal species facing severe population decline due to overexploitation, habitat loss, and poor natural regeneration. Conventional propagation through seeds is limited by low germination and dependency on mycorrhizal association, creating a need for alternative conservation approaches. This research aimed to develop an efficient in-vitro propagation protocol through callus induction using root explants of *R. retusa* to support conservation and ex-situ multiplication efforts. The experiment was conducted at the Plant Tissue Culture Laboratory, Department of Crop Science, University of Peradeniya, from July to October 2025. A three-factor factorial experiment in a Completely Randomized Design (CRD) was used to evaluate the effects of light condition (16h light/8h dark and continuous dark), 2,4-Dichlorophenoxyacetic acid (2,4-D; 1.0 and 1.5 mg/L), and kinetin (0.0, 0.5, and 1.0 mg/L) on explant response. Binary logistic regression analysis was performed using SAS software to assess the influence of these factors on survival, browning, and callus formation. The results revealed that 2,4-D concentration had a highly significant effect ($p < 0.01$) on both survival and callus formation, while kinetin showed a moderate influence ($p < 0.05$), and light condition had no direct statistical effect on survival or callus induction but significantly affected browning ($p < 0.05$). The highest callus induction (30%) and survival rates were achieved under continuous dark conditions with 1.5 mg/L 2,4-D and 1.0 mg/L kinetin, whereas browning was more prevalent in prolonged darkness. The study concludes that an optimized hormonal balance of 1.5 mg/L 2,4-D with 1.0 mg/L kinetin under controlled light conditions enhances callus induction and survival, offering a reliable approach for micropropagation and conservation of *R. retusa* through tissue culture.

Keywords: Callus induction, Orchid Conservation, *Rhynchostylis retusa*, Root tissue culture, Survival rate

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Assessing the Suitability of Multispectral Drone Imagery for Estimating Soil Moisture Content in a Selected Coconut Plantation of Low Country Intermediate Zone

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This study aimed to assess whether vegetation indices (VIs) derived from multispectral drone imagery could be used to estimate soil moisture content variability of a selected coconut plantation of low country intermediate zone of Sri Lanka. Multispectral images were captured using a drone equipped with a multispectral sensor, while leaf and soil samples were collected simultaneously from 149 locations. Normalized Difference Vegetation Index (NDVI), Normalized Difference Red Edge Index (NDRE), Green Normalized Difference Vegetation Index (GNDVI), Leaf Chlorophyll Index (LCI), and Optimized Soil Adjusted Vegetation Index (OSAVI) were derived from the imagery. Soil and leaf water contents were determined gravimetrically. The relationships between the VIs and soil and leaf water content were analyzed by linear and non-linear regression methods. None of the VIs showed a statistically significant relationship with leaf moisture content ($R^2 < 0.02$), indicating that the indices were not responsive to changes in leaf water content. Although a statistically significant relationship was found between leaf and soil moisture ($p < 0.05$), the coefficient of determination remained low, showing that leaf moisture explained only a small portion of soil moisture variation. These results suggested that leaf moisture is not an appropriate parameter for linking vegetation indices to soil water status in coconut plantations. The weak correlations are likely due to the unique canopy architecture and physiological characteristics of coconut palms, such as large frond structure, photosynthetic activity, and leaf temperature variation. In conclusion, multispectral VIs derived from visible and near-infrared bands are unsuitable for predicting soil moisture through leaf water content in coconut plantations. Future studies could include different leaf physiological parameters and shortwave infrared or hyperspectral data to improve predictive accuracy.

Keywords: Multispectral Drone Imaging, Precision Agriculture, Remote Sensing, Soil Moisture, Vegetation Indices

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Assessment of Cropping Dynamics and Transformation in Selected Small Irrigation Systems in Kandy District of Sri Lanka Using Remote Sensing, GIS and Field Surveys

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Paddy cultivation has been the backbone of rural livelihoods in Sri Lanka, especially within small-scale anicut-based irrigation systems. In recent years, these systems have faced declining profitability, water shortages, and policy neglect, resulting in substantial transformation of cropping dynamics. This study evaluated three selected minor irrigation command areas: Liyangahamula, Payingamuwa, and Padurugalpoththa in Kandy District using an integrative framework of remote sensing, GIS analysis, and farmer-level surveys. Multi-temporal Landsat satellite imagery from 1978 to 2025 were utilized to assess changes in vegetation cover through NDVI calculations. High-resolution Google Earth images were used to extract field boundaries and map field level cropping practices. Field surveys, institutional records, and cost-benefit analyses provided socio-economic data on crop choices, input costs, and irrigation maintenance. Results showed a marked shift from traditional paddy monoculture to diversified cropping patterns dominated by cassava and vegetables, primarily due to irrigation constraints, lower input and labor costs, and higher market profitability of the main alternative crop of Cassava. Cassava presented higher annual profits (Rs.682,818/ha) compared to paddy (Rs.604,323/ha) with comparatively low fertilizer and maintenance costs when using own labour. NDVI and colour composite imagery analysis revealed considerable spatial heterogeneity and dynamic transformation in land use over multiple decades. High resolution satellite imagery was helpful in plot level mapping of crop details. Most farmers supported community-based canal maintenance. However, maintenance efforts were insufficient downstream, influencing further shifts away from paddy. While adaptive responses have improved economic resilience, the decline in paddy presents risks for long-term soil fertility and biodiversity. This study highlights the usefulness of the integration of remote sensing, GIS, and socio-economic surveys in understanding the system transformations over time for effective management of small-scale wet zone irrigation systems.

Keywords: Cassava, GIS, Irrigation Systems, Paddy, Remote Sensing

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Assessment of the Suitability of *mat*K Region as a Molecular Marker for *Cryptocoryne wendtii* and Identification of Chloroplast Markers from six *Cryptocoryne* Chloroplast Genomes

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Cryptocoryne wendtii de Wit. is an endemic aquatic plant species to Sri Lanka and widely used in the aquarium trade. Species within the genus are highly variable in vegetative morphology, and while accurate identification is possible using floral characteristics, flowers are rarely formed. Consequently, different *Cryptocoryne* species are often mislabeled and sold as *C. wendtii*, and the smuggling of protected species is a common practice. Therefore, it is essential to explore tools to accurately identify the species to ensure conservation and authenticity of the species. This study aimed to evaluate the suitability of the *matK* as a potential chloroplast marker to differentially identify *C. wendtii* from other species within the genus. Samples were collected from a natural population, commercial growers, and tissue-cultured plants. Species status was confirmed using taxonomic keys, herbarium records, and by taxonomists. DNA extraction was done using modified CTAB, followed by PCR amplification with *matK* universal primers. A sample collected from a natural population had a successful PCR and was sent for sequencing. In addition, complete chloroplast genome sequences of six *Cryptocoryne* species were retrieved from NCBI GenBank for comparative analyses. Genome structural parameters were determined using Geneious. Twelve commonly used chloroplast markers were extracted, and nucleotide diversity (π) was estimated. Phylogenetic trees were constructed. Among the 12 analysed genes, *petD* and *matK* showed the first and second highest π across the six *Cryptocoryne s*pecies, indicating high interspecific variability for interspecific identification. Preliminary findings suggest that *matK* is a promising molecular marker for species level identification. The chloroplast genome-based comparative approach also identified an additional potential list. That could enhance the molecular identification framework for the genus.

Keywords: Genome comparison, Molecular marker**,** Nucleotide diversity

Acknowledgement: This research was supported by the National Aquatic Resources Research and Development Agency

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Assessment of Urban Expansion and its Impact on Agriculture in Peri-Urban Areas of Kandy Using Remote Sensing and GIS

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Urbanization has become a major global issue which has led to rapid land use changes affecting agricultural sustainability. This study investigated the effects of urban growth on agricultural lands in the peri-urban areas of Kandy, Sri Lanka. The study utilized Landsat satellite images of 2000, 2011, 2024 and was supported by Google Earth and Sentinel imagery of 2024. Statistical data from Divisional Secretariat (DS) divisions and Agrarian Service Centers were used to identify and quantify land use and land cover (LU/LC) changes over the 24-year period. A 2 km buffer zone was created around the Kandy Municipal Council (KMC) boundary to define the peri-urban region and 46 Grama Niladhari (GN) divisions were selected as peri urban areas considering the building density. Supervised classification of satellite imagery was carried out to analyze spatial changes. Results show a considerable increase in built-up areas and loss of agricultural and forest lands. Between 2000 and 2011, forest/shrub cover decreased by 15.95% and agricultural lands by 8.74%, while from 2011 to 2024, forest/shrub cover declined by an additional 6.35% and agricultural lands by 1.20%. Most of the forest/shrub areas were converted into home garden/Agricultural land in 2000-2011 period than 2011-2024.Overall conversion is high in 2000-2011. The cultivated land area per farmer remained relatively stable. Population in peri-urban DS divisions increased continuously, while farmer population and cultivated land area declined, highlighting the shift from agriculture to non-agricultural livelihoods. Population density has increased across all DS divisions, with Mahanuwara Four Gravets showing the highest concentration. Urban expansion is visible along the major road network, spreading outward from the KMC area. Overall, the results indicate that rapid urban growth has led to substantial agricultural land loss and declining farming activities in the peri-urban region. The study recommends conducting comprehensive field surveys for ground verification and the use of high-resolution satellite imagery for precise identification and mapping of LU/LC.

Keywords: Agriculture, GIS, Land Use/Land Cover, Peri-Urban, Remote Sensing

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Comparative Evaluation of Immune Responses to Vector-Based, Immune Complex, and Live Attenuated Infectious Bursal Disease Vaccines for Broiler Chicken in Sri Lanka: Serology, Bursal Histopathology, and Production Performance

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In Sri Lanka, the comparative efficiency of existing infectious bursal disease (IBD) vaccines and the link between immunogenicity and bursal preservation were poorly understood. This study utilized 200 Ross-308 male broiler chicks randomly assigned to four groups to evaluate different IBD vaccine platforms (vector, immune-complex, and live attenuated) against an unvaccinated control. The research measured IBD virus and concurrent Newcastle Disease (ND) virus antibody titers using ELISA, assessed bursal histopathology, and production performance. The vector vaccine demonstrated superior early immunity, achieving the highest IBDV titers at day 21 ($2.70 \pm 0.07 \log_{10}$, $P<0.001$) and NDV titers ($3.10 \pm 0.05 \log_{10}$, $P<0.001$). It maintained stable antibody responses throughout the period, preserving bursal architecture with minimal lymphoid depletion. The immunocomplex vaccine exhibited delayed IBDV seroconversion, reaching the highest titers by day 35 ($3.41 \pm 0.14 \log_{10}$). However, it caused severe, progressive bursal lymphoid depletion (median 58%), with the lowest bursal index (0.68 ± 0.07, $P<0.001$) and the highest spleen-to-bursa ratio (1.86 ± 0.20, $P<0.001$), indicating bursal atrophy by the 35th day. Live attenuated vaccine showed variable responses, with moderate bursal damage and delayed seroconversion, reflecting maternal antibody interference. Despite immunological differences, production performance remained commercially acceptable across all groups (EPEF >400) with a similar FCR value range. Correlation analysis revealed a positive association between IBDV antibody titers and bursal damage ($r = 0.588$, $P<0.05$), highlighting the trade-off between immunogenicity and tissue preservation. The vector vaccine (rHVT+IBD+ND) demonstrated an optimal balance between the onset of early dual immunity (for both IBD and ND) and bursal preservation under tropical conditions in Sri Lanka.

Keywords: Infectious bursal disease, Recombinant vaccine, Immune complex, Bursal histopathology, Broiler vaccination

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Computational Screening of *Tamarindus indica* Phytochemicals as Potential Inhibitors of LSDV114 Hypothetical Protein in Lumpy Skin Disease

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Lumpy skin disease (LSD) is an emerging transboundary disease caused by the lumpy skin disease virus (LSDV). Although vaccines and treatments are available, current vaccines often fail to provide cross-protective immunity against diverse LSDV strains, highlighting the need to identify novel antiviral compounds. This study targets the hypothetical LSDV114 protein, aiming to inhibit its activity using phytochemicals derived from *Tamarindus indica* L. (tamarind). The target protein was identified via the VaxiJen server based on its high antigenicity score (0.6839). Its three-dimensional structure was predicted using the AlphaFold3 server, refined with the GalaxyRefine server, and validated through a Ramachandran plot. Phytochemicals from *Tamarindus indica* L. were collected through an extensive literature review up to 2025. These compounds were evaluated for their absorption, distribution, metabolism, and excretion (ADME) properties using DataWarrior software. Based on Lipinski's rule of five, non-toxic compounds were identified and subjected to virtual screening using PyRx 0.8. Seven compounds with the highest binding affinity values were selected for further analysis. Subsequently, molecular docking was performed using the CB-Dock2 server, which revealed that β-Amyrone exhibited the highest binding affinity (-8 kcal/mol). Molecular dynamics simulations were then conducted to assess complex stability. The results demonstrated stable interactions, with protein RMSD values of 4–5 Å, ligand RMSD values of 7.5–9 Å, and an average protein RMSF of 1.5–2 Å throughout the simulation. The MM-GBSA analysis yielded a binding free energy of -62.16 kcal/mol, indicating strong thermodynamic stability of the complex. Overall, these findings suggest that β-Amyrone has strong potential to inhibit the LSDV114 protein, and with further investigation, it could be developed as a promising antiviral candidate against LSD.

Keywords: Lumpy Skin Disease**,** *Tamarindus indica* L., LSDV114, Molecular Docking, Molecular Dynamic Simulation.

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Design and Development of a Web Application with an AI-Based Personalized Postprandial Glycemic Response Prediction Model

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Although Glycemic Index (GI) and Glycemic Load (GL) are widely used in dietary planning for metabolic syndrome, these values represent average responses and overlook the significant person-to-person variation in postprandial glycemic response (PPGR). This study aimed to develop and validate an Artificial Intelligence (AI)-based model capable of predicting personalized PPGR using individual and food-related variables. A dataset of 631 records was used to train machine-learning models incorporating personal characteristics (age, gender, body mass index, waist circumference, birthplace, blood group, family history of diabetes, physical activity, and health status) and food attributes (portion size, available carbohydrate, protein, fat, and dietary fiber). Additionally, an in-vivo glycemic index experiment was conducted with 15 healthy participants consuming Savandara rice following standard GI testing protocols to generate validation data. Model validation showed a good association between predicted and observed GI values, confirming predictive accuracy. Among the tested models, Light Gradient Boosting Machine (LightGBM) demonstrated the highest performance ($R^2 = 0.71$; RMSE = 23.59) and was deployed as a web-based application. Usability testing with 30 users showed improved awareness and confidence in selecting low-GL foods. Expert evaluation (n = 20) yielded high ratings for accuracy, usability, visual appeal, usefulness, and overall satisfaction (mean scores 4.30–4.70; $p < 0.01$). This AI-enabled platform offers a practical, scalable and cost-effective solution for personalized glycemic response prediction and supports the advancement of precision nutrition.

Keywords: Glycemic Index, Glycemic Load, Postprandial Glycemic Response, Artificial Intelligence, Machine Learning

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Design Optimization and Performance Evaluation of a Compact Garden Waste Size Reducing Machine for Sustainable Waste Management

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Improper disposal of garden waste through open dumping or burning, driven by inefficient collection systems, causes significant environmental and odor pollution in Sri Lanka. Due to its fibrous nature and physical properties, garden waste decomposes slowly, necessitating methods to accelerate decomposition for value addition. This study aimed to develop a compact, versatile, and energy-efficient dual-mode size-reduction machine integrating both chopping and crushing functions. The system comprised dual-axle chopping and crushing attachments driven via a belt-and-pulley transmission from a 1 HP (746 W) three-phase electric motor with variable-speed control, enabling seamless mode switching. Performance tests using fresh, partially dried, and dried jackfruit and mango leaves assessed particle-size distribution and energy consumption at various speeds. Optimal operating speeds were identified for each mechanism. Rittinger's, Kick's, and Bond's constants were determined to facilitate future energy estimations for garden waste processing. The radial fan integrated with the chopping unit was evaluated through fan performance curves across operating speeds. Results showed that higher chopping speeds yielded finer particles with reduced energy consumption, as indicated by decreasing energy constants. Conversely, crushing finer particles required higher energy at increased speeds. Further, wetter foliage demanded more crushing energy than dryer foliage. At 3300 RPM, the chopper achieved a throughput of 45 kg/h with an average particle size of 8.6 mm, while the crusher produced 56 kg/h at 3500 RPM with a 5.5 mm particle size. Although the fan achieved a maximum efficiency of 88% at 3300 RPM and a flow rate of 0.018 m^3/s it was not very efficient in chopping due to increased flow rate. The machine demonstrated high energy efficiency and low operating costs (Rs. 3.86/kg for crushing and Rs. 4.71/kg for chopping), offering a sustainable, small-scale solution for effective garden waste management.

Keywords: Chopping and Crushing, Energy Efficiency, Garden Waste, Size Reduction Machine, Small-scale Design

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Designing and Evaluating a Mobile Decision Support System to Strengthen Dairy Extension in Sri Lanka

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The Sri Lankan dairy industry, vital to the rural economy, meets only about 35–40% of national demand. The Department of Animal Production and Health (DAPH) extension service relies on outdated paper-based methods, causing delays and data inaccuracies, while its fragmented digital tools lack mobile compatibility. This study aimed to bridge this gap by designing, implementing, and evaluating a user-centric Mobile Decision Support System (MDSS) to strengthen dairy extension. The objectives were to identify user needs, develop a functional prototype, assess user acceptance, and derive strategic guidelines for future scaling. A Design-Based Research (DBR) methodology was adopted, focusing on the Polpithigama Veterinary Service range. The study included need assessments with DAPH officers and farmers, prototype development using a six-layer role-based architecture, and an evaluation involving 11 officers and 30 farmers. The study revealed a positive level of satisfaction among participants, with 81.9% of officers and 84.4% of farmers reporting favorable perceptions. Officers highlighted improved efficiency and access to real-time data, while farmers appreciated the trilingual interface and simplicity (Mean = 4.22/5). The primary constraint identified was weak rural mobile internet. An Activity Theory analysis revealed key socio-technical tensions such as 'Tool vs. Infrastructure'. The research concludes that successful MDSS implementation requires addressing both technological and institutional challenges. The study proposes guidelines emphasizing offline functionality, tiered user training, and formal DAPH policy integration to ensure sustainable digital transformation within the dairy sector.

Keywords: Mobile Decision-Support System (MDSS), Dairy Extension, Sri Lanka, Design-Based Research (DBR), Activity Theory

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Designing and validation of an artificial bed protocol for sea water-based germination screening of salt tolerant rice varieties

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Salinity affects all growth stages of rice in varying degrees starting from germination up to maturation. This study aimed to design and validate an artificial bed protocol using seawater-based salinity for early-stage screening of rice varieties. Experiment was conducted at the Rice Research and Development Institute, Bathalagoda, Sri Lanka in artificial salinity beds. Screening of 4 improved rice varieties (Bg 369, Bg 360, Bg 352, and At 354) and check variety Pokkali was performed in different salinity levels (EC 0, 4, 8 and 12 dS/m) at the seedling stage in soil filled separate artificial (concrete) beds (580 cm length *140 cm width). Rice varieties were tested to check the growth performance of the seedlings under salt stress. Plant height was significantly affected by variety and treatment ($P < 0.05$), while the interaction was not significant ($P > 0.05$). At 10, 14 and 21days after sowing, Pokkali (14.46 cm) and Bg 369 (13.89 cm) were the tallest, and At 354 (10.24 cm) and Bg 360 (10.74 cm) were the shortest. Dry weight differed significantly among varieties and treatments ($P < 0.05$), with Bg 369 (0.0367 g) and At 354 (0.0286 g) the highest, and Bg 360 (0.0146 g) the lowest. Total root length varied significantly among varieties ($P < 0.05$) but not with treatment or the interaction. Root volume was highly significantly influenced by variety and treatment ($P < 0.05$), resulting the highest in Bg 369 and T1, and the lowest in Bg 360 and T3. The artificial bed protocol reliably distinguished salt-tolerant and susceptible rice genotypes, with significant differences observed in plant height, dry weight, total root length, and root volume among varieties and treatments. Further studies under field conditions are recommended to confirm the effectiveness of this protocol for large-scale screening and breeding programs.

Keywords: Rice, Salinity stress, Seedling screening, Salt tolerant varieties, Growth parameters

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Determination of Rates of Light and Dark Leaf Respiration in Tea (*Camellia sinensis* (L.) O. Kuntze) Nursery Plants Ready for Field Planting

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Leaf respiration (R) is essential for plant carbon balance and yield, yet its rates under light (R_L) and dark (R_D) conditions remain inadequately studied in tea nursery plants ready for field establishment. Therefore, this study aimed to determine the rates of leaf respiration in the light (R_L) and dark (R_D) in tea nursery plants (*Camellia sinensis* L.) of tea cultivars TRI 2023, TRI 2025, and TRI 4071, in plant house conditions. The Kok method was used to determine R_L, while R_D was measured continuously over 24 hours at three-hour intervals on 30-minute dark-adapted leaves at prevailing leaf temperatures. By fitting a second-order polynomial model to R_D values, the modelled respiration rates and the thermal sensitivity of (Q_{10}) for R_D were calculated. Results revealed no significant differences ($p>0.05$) among the three tea cultivars related to R_L or for the degree of light inhibition (D-LI). When averaged across the three cultivars, D-LI was 16±2%. Area-based rates of modelled R_D (at 25 ºC) were significantly higher ($p<0.05$) in the cultivar TRI 2023 compared to TRI 2025 and TRI 4071. Meanwhile, in the 15-30 ºC measurement range, all three tea cultivars showed a decreasing trend in Q_{10}, with cultivar TRI 2023 exhibiting significantly higher Q_{10} (1.73±0.02) at room temperature (i.e., 25 ºC) when compared to cultivars TRI 2025 (1.45±0.08) and TRI 4071 (1.47±0.04). These results suggest that the higher metabolic cost of cultivar TRI 2023 associated with warming could influence its carbon balance and growth efficiency under fluctuating temperature conditions, compared to cultivars 2025 and 4071. These findings further suggest that TRI 2025 and TRI 4071 are better suited for broader cultivation across tea-growing regions, while TRI 2023 is better adapted to cooler, high-altitude environments.

Keywords: Carbon Budget, Light Inhibition, Light Response, Tea, Temperature

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Development and Evaluation of an Interactive Web-Based Application to Enhance Ingredient Transparency and Allergen Awareness in Large-Scale Food Catering Services in Sri Lanka.

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Food allergy management has been identified as a progressively challenging task for catering services with diverse ingredients, rapid services, and a lack of communication between various units that may raise the unintentional food allergen exposure. Although allergen labeling and recipe documentation exist for catering services, there is a lack of a comprehensive web system that enables catering staff and guests to access accurate ingredient and allergen information. This study aimed to develop a web application to enhance ingredients transparency and allergens awareness in large-scale catering environments. In the initial phase, focus group discussions and key informant analyses were carried out with culinary experts, quality assurance representatives, and store managers to identified the existing challenges and requirements for management of allergens. A web application was then developed incorporating the requirements of the study into a customized web application that provide comprehensive ingredient and meal databases, including allergen information. Two user levels were incorporated as general users and staff, allowing public viewing and authorized data modification respectively. Effectiveness of the application was also tested by a pre- and post- knowledge assessment involving 20 participants. A paired t-test showed a marked improvement in scores after the test ($t = -4.945$, $p < 0.05$), which further justified that the web application increased the knowledge of users towards allergens and ingredients. Further performance evaluation with a one-sample Wilcoxon Signed Rank Test of the web application resulted in a high level of user satisfaction with a median value of more than 4.0 for almost all the criteria except feature set. The outcome of this study reveals that the developed system is a practical, reliable and user-friendly digital solution that improves allergen control, support safer meal preparation, and promotes informed decision making for guests within large-scale catering services.

Keywords: Food allergens, Focus group discussions, Catering services, Web application, Ingredient transparency

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Development of a Capacitance Tea Moisture Meter for Instant Moisture Measurements

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Tea quality, its flavor, aroma, and stability, are critically dependent on moisture content, which must be carefully controlled, typically between 2% and 6%, to prevent mold and preserve its sensory characteristics. There are no quick tea moisture measuring methods in the industry level and available equipment are expensive, cannot be afforded by middle- and low-income tea industries. The novel approach of this study was to address this problem by developing a portable, capacitance-based meter that measures moisture content in processed tea instantly and accurately, without destroying the sample. The research involved designing and testing three prototypes, with each version becoming more stable and accurate than the previous one. The final device used a sensitive coaxial capacitive sensor and a microcontroller to measure tiny changes in the tea's electrical properties caused by the presence of water. The final prototype was the most successful, providing the best performance. It delivered instantaneous readings with a response time of less than one minute. Crucially, the results showed its accuracy was extremely high, falling within ±1% of the standard, gravimetric method. The correlation with the official method was nearly perfect (r = 0.9995), proving that the meter is highly reliable for practical use.

Keywords: Capacitance Sensor, Instant Measurement, Non-Destructive, Quality Control, Tea Moisture Meter

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Development of a Deep Learning Application for Weed Detection and Localization for a Small-Scale Weeder

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Weed management is a critical challenge in agriculture. It is often requiring significant labor and chemical usage that negatively impacts crop yield and the environment. This project presents the development of an automated vision-guided robotic weed pickup system designed to identify and mechanically remove weeds with minimal human intervention. The system integrates an Artificial Intelligence (AI)-based weed detection model, trained using a custom dataset and fine-tuned You Only Look Once (YOLOv8) architecture on Google Colab with an Nvidia T4 Graphic Processing Unit (GPU), to achieve accurate weed identification. The hardware design consists of a three-axis linear actuator mechanism mounted on a four-wheel steel chassis, driven by stepper motors with A4988 motor drivers controlled via an Espressif Systems 32-bit (ESP32) microcontroller. A web camera provides real-time visual feedback for weed detection, while a rack-and-pinion-based gripper performs the physical weed removal. The system's control interface was developed in Python communicating serially with the ESP32 for motion and grip control. Experimental testing evaluated travel accuracy, movement speed, and weed removal efficiency. Results showed that the system achieved uprooting accuracy of 27.5%, an average operation time of 42.96 seconds per weed, and a detection accuracy exceeding 93% depending on confidence threshold settings. These findings demonstrate the feasibility of combining computer vision and low-cost automation for precision weeding.

Keywords: Computer Vision, Precision Agriculture, Robotic Weeder, Sustainable Farming, Weed Detection

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Development of a Microbial Inoculant for Composting of Strawberry Crop Residues

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Intensive strawberry production generates a large volume of crop residues that decompose slowly due to high lignocellulosic materials resistant to degradation, leading to crop residue accumulation and pathogen survival in the field. This study aimed to develop a microbial inoculant for enhancing decomposition of strawberry crop residues. Five initial microbial inoculants were developed using cow dung, naturally decomposing strawberry leaves and vegetable crop residues as sources of microbial decomposer communities. A culture-independent approach was followed under controlled temperature conditions to develop five inoculants enriched with microorganisms that could effectively decompose strawberry leaves. A 14-day incubation period trial indicated that all inoculants significantly increased dry matter (DM) loss and decreased green-stalks content compared to uninoculated control. Based on the performance of the decomposer communities, the inoculants developed from cow-dung and mixture of all three sources of decomposers were selected to develop an inoculant (LMC). The same inoculants were used to isolate mesophilic and thermophilic microorganisms and added to LMC to develop an improved inoculant (HMC). Effectiveness of LMC and HMC on decomposing strawberry leaves were tested in laboratory incubation. HMC resulted in significantly lower DM loss but comparable C: N to that under LMC. HMC was tested against a microbial inoculant used in a strawberry farm for decomposition of strawberry leaves in bin-method in three replicates. The pattern of changing electrical conductivity, pH and C:N ratio of both decomposing material and slurry, temperature and height of piles were comparable ($p>0.05$) during composting with the two inoculants. But new inoculant HMC showed a significantly low ($p<0.05$) remaining stalks content and nutrient loss, but high compost yield compared to farm practice. These results confirm that new inoculant promotes efficient decomposition of strawberry residues under both controlled and field conditions, supporting its potential to use for accelerating composting process.

Keywords: Crop residues, Decomposition efficiency, Dry matter loss, Lignocellulolytic microorganisms, Microbial inoculant

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Development of AI-Driven Imaging Models to Predict the Correct Harvesting Maturity and Crude Palm Oil Yield of Oil Palm (*Elaeis guineensis*) Fresh Fruit Bunches

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Inefficient and subjective harvesting practices in the USD 75 billion global oil palm industry continue to create a substantial gap between potential (25-28%) and actual (18-20%) Oil Extraction Rate (OER). In Sri Lanka, this challenge is further intensified by a USD 150-200 million annual edible oil import bill and a national policy ban on plantation expansion. Addressing this dual constraint, the present study pioneers a multidisciplinary Artificial Intelligence (AI) framework integrating agricultural engineering, food quality, computer vision, and data science to revolutionize yield estimation and grading accuracy of oil palm industry. The research introduces the world's first non-destructive Crude Palm Oil (CPO) yield predictor alongside Sri Lanka's first digital AI-based Fresh Fruit Bunch (FFB) grader. The methodology employed a comprehensive dataset of 1,000 FFBs captured under controlled conditions using a custom-designed fixed-light imaging chamber to ensure data uniformity. The ripeness classification model (Model 1) was trained and tested using morphological and colour-based features, while the novel CPO yield prediction model (Model 2) utilised these same features against ground-truth OER values determined by FOSS NIRS™ analysis. Model 1 achieved an exceptional 97.42% accuracy using Gradient Boosting, effectively mitigating losses in OER due to misclassification. Model 2 attained 84.54% accuracy in high/low OER classification and an R^2 of 0.5205 (XGBoost) for regression, confirming a significant correlation between image-derived features and OER. These results establish a robust proof-of-concept for scalable, data-driven CPO prediction. The study demonstrates how AI can transform palm harvesting from a subjective art into an objective, science-based process. This innovation has national significance for Sri Lanka's edible oil sector by reducing import dependency and enhancing productivity within existing land constraints. More broadly, it presents a globally transferable framework for sustainable intensification, transparent quality-based payment systems, and efficiency benchmarking, marking a decisive step toward digital transformation in the food and agricultural industries.

Keywords: Oil palm, Ripeness classification, CPO yield prediction, Machine learning, Artificial intelligence

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Development of an AI assisted Lysimeter for real-time Automation of Greenhouses

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This study presents the development of an AI-driven weighing lysimeter system designed for real-time monitoring and optimization of plant water and nutrient dynamics in greenhouse cultivation. The lysimeter quantifies soil water movement by continuously recording weight variations, providing accurate estimations of evapotranspiration and plant water uptake. Integration of IoT-enabled sensors enables continuous acquisition of key environmental variables, including temperature, humidity, and light intensity, facilitating adaptive responses to crop requirements. The experimental setup employed load cells, ESP32 (dev kit V1) microcontrollers, DHT22 and DS18B20 sensors, light (BH1750) and Capacitive moisture sensors, a real-time clock (RTC) module, 16*2 LCD display an OLED display to ensure precise data acquisition and visualization. Using the mass-balance approach, evaporation, transpiration, and total evapotranspiration were computed to determine plant water-use efficiency. System performance was evaluated under controlled greenhouse conditions using three scenarios; bare soil, planted-uncovered, and planted-covered to isolate soil evaporation, total evapotranspiration, and transpiration components. The developed system integrates real-time weight data and environmental parameters within AI models to predict irrigation demands and optimize growing conditions. Experimental results demonstrated that transpiration, a strong physiological indicator of nutrient uptake, correlated positively with environmental factors and plant growth stage. Under optimal conditions, increased transpiration coincided with improved nutrient absorption and biomass accumulation. The AI-assisted lysimeter exhibited stable operation, accurate measurements, and effective decision support for irrigation control. Overall, this system represents a cost-efficient, scalable, and intelligent platform for sustainable greenhouse automation, improving water-use efficiency, nutrient management, and overall crop productivity through data-driven, adaptive control mechanisms.

Keywords: AI-assisted Lysimeter, Evapotranspiration, Greenhouse Automation, Plant Transpiration, Precision Irrigation

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Development of an AI-Based Predictive Model for Tea Grade and Region of Origin Identification Using NIR Spectroscopy

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Ceylon tea is internationally acclaimed for its distinctive aroma, flavour, and superior quality, forming one of Sri Lanka's most valuable export commodities and a cornerstone of the national economy. However, the traditional tea grading process remains largely subjective, labour-intensive, and dependent on expert perception, leading to inconsistencies in quality assurance and market classification. In response, this study sought to develop a rapid, objective, and data-driven approach for tea grade classification and regional authentication by integrating Near-Infrared (NIR) spectroscopy with Artificial Intelligence (AI). Representative black tea samples (n = 1,050) were collected from the seven major agro-climatic regions of Sri Lanka to capture the nation's diverse terroir. The chemical composition including total nitrogen, crude fibre, caffeine, moisture, and polyphenol contents was determined using an NIR spectrophotometer (Instalab 700, DICKEY-john Corp., USA). Data were processed using R Studio, incorporating normality, correlation, and regression analyses to identify key spectral predictors, which were subsequently used to train two Artificial Neural Network (ANN) models. The models classified tea grade and region of origin with accuracies of 68.97% and 73.43%, respectively, demonstrating substantial predictive capability. Moisture, polyphenol, and nitrogen emerged as the most influential predictors of grade, whereas caffeine, fibre, and moisture were critical for regional identification. Comparison with previous studies confirmed that NIR-AI integration markedly enhances speed, reproducibility, and precision compared with traditional grading. Furthermore, a prototype mobile application was developed to facilitate real-time, field-level classification, advancing digital transformation within the sector. This research exemplifies a multidisciplinary convergence of agronomy, analytical chemistry, and artificial intelligence to modernise quality evaluation systems. The outcomes underscore the potential of AI-driven sensing technologies to strengthen efficiency, traceability, and sustainability in the tea value chain, reinforcing Sri Lanka's global reputation for high-quality tea production and its strategic importance to the national food and export economy.

Keywords: Tea grading, Near-Infrared spectroscopy, Artificial Intelligence, Chemical composition, Artificial Neural Network (ANN)

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Development of an Artificial Intelligence-Based Automated Shrimp Size Estimation Model Using Image Processing for Pacific White Shrimp (*Litopenaeus vannamei*) Culture Systems in Sri Lanka

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Accurate and real-time monitoring of shrimp growth parameters is essential for optimizing feed management and enhancing production efficiency in commercial shrimp farming. Conventional manual measurement techniques are labour-intensive, error-prone, and stressful to the shrimp, resulting in reduced accuracy and productivity. Therefore, an Artificial Intelligence (AI)-based automated shrimp size estimation model was developed using hybrid convolutional neural networks (CNNs) integrated with advanced image processing techniques. A dedicated shrimp image dataset consisting of 1056 annotated images was created to train and validate the model. Pacific white shrimp (*Litopenaeus vannamei*), one of the globally valuable species was used for this study. The adopted AI-based automated shrimp size detection system accurately predicted shrimp length and weight from pond-captured images under the real aquaculture conditions. For length estimation, the developed model achieved a Mean Absolute Error (MAE) of 0.1600 cm and an R^2 value of 0.9801, demonstrating strong correlation and precision in predicting shrimp body length. The model achieved an overall accuracy exceeding 97% in length prediction. For weight estimation, the system achieved an R^2 score of -0.0764, and the overall accuracy of 79.0%. The research highlights that the integration of computer vision and AI-based hybrid CNN models provides a reliable, non-invasive, and automated solution for shrimp size monitoring. This approach minimizes human intervention while offering real-time insights into shrimp growth stages, thereby supporting effective feed management and sustainable aquaculture practices. The findings lay a foundation for the development of intelligent shrimp farming systems in Sri Lanka and similar aquaculture environments worldwide.

Keywords: Artificial Intelligence (AI), Computer Vision, Convolutional Neural Network (CNN), Shrimp Size Estimation, Image Processing[12]

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Development of an Integrated Blockchain-IoT Framework for End-to-End Quality Management and Traceability in Sri Lankan Egg Supply Chains

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Egg supply chains in Sri Lanka face significant gaps in traceability as eggs are mostly moved through informal and multi-step marketing channels without consistent record-keeping. As a result, eggs cannot be tracked from production to retail, posing challenges in quality assurance and food safety risks, such as *Salmonella*. This study was conducted to develop an Integrated Blockchain-IoT Traceability Framework for the egg supply chain. The study was comprised of a consumer survey, market survey, key-informant interviews (KII), development of the framework and pilot testing. The consumer survey, conducted online with 207 participants, revealed that out of 28% of respondents (n=58) who usually buy egg packs, 58% (n =33) indicated a willingness to pay 5% more for eggs that have been verified from farmer to retailer, accessible through QR codes. The market survey identified issues like mislabeling, misinformation, and certification challenges. Inputs from KIIs with Department of Animal Production and Health, Sri Lanka Standards Institution, Consumer Affairs Authority, and Food Control Administration Unit offered insights for designing the smart contract layer of the framework. In the proposed framework, the decentralized, immutable features of the Blockchain technology enable monitoring and verification, while IoT utilizes sensors to automatically capture and transmit real-time data such as location, temperature, etc. The QR codes can give access to consumers for detailed product histories, boosting authenticity and confidence. The framework was validated by technology experts and subsequently pilot tested to assess consumer feedback. The pilot tracked eggs (n=180) from the Livestock Field Station, Uda-Peradeniya, to the Sales Centre of the Department of Animal Science, whereas 61% of the buyers responded with an average of 4.64/5.00 for access to the information. It is expected that the developed framework on blockchain-IoT integration would enhance traceability, boost consumer confidence, by ensuring a safer, transparent egg supply chain in Sri Lanka.

Keywords: Egg supply chain, blockchain, IoT, traceability, quality management

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Development of an IoT Based Heat Pump Controlling System with AI

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This project presents the design and real-world validation of an IoT and AI-driven control system for multi-stage heat pump dehumidifiers in agro-industrial environments. Addressing the inefficiency and inconsistency of conventional manual control, the implemented solution enables continuous, real-time monitoring and adaptive management of air temperature, humidity, and inter-pump airflow. The system leverages an ESP32 microcontroller for sensor data acquisition and logic processing, in conjunction with an Arduino Nano-based relay module for robust, isolated actuation of heat pumps. Remote access and full manual override are provided through a cloud-integrated dashboard with synchronized control menus and comprehensive historical data logging. A non-blocking software architecture, combined with an intelligent staged ON/OFF control algorithm, maintains critical process parameters with minimal energy wastage. The methodology includes custom PCB hardware, shielded sensor channels, and automated logic for cascade activation and outlet-protected relay switching, validated in operational conditions at Ruhunu Foods Pvt. Ltd., Sri Lanka. Results demonstrate reliable real-time response, dual-mode control, and accurate, persistent data acquisition both locally and remotely. By fusing IoT connectivity with AI-based adaptive control, the system delivers scalable, user-friendly, and energy-efficient environmental management for demanding process industries. The proven platform is readily extensible for higher-accuracy sensors, predictive optimization, and multi-line deployments. This innovation bridges a critical gap in Sri Lankan spice milling, setting a benchmark for future industrial automation and data-driven process improvement

Keywords: Artificial Intelligence, Dehumidification, Energy Efficiency, Heat Pump Controlling, Internet of Things (IoT)

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Development of a Practical tool and an AI-Based Application to predict Bread Quality in real Bakery Environments

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Bread quality is a decisive factor in consumer satisfaction and industrial success. However, it remains difficult to achieve consistent quality due to variations in dough performance during production. A scientifically sound objective method of dough quality evaluation that is simple enough to be employed in real bakery environments is not yet available. Without such a method, it is hard to predict the final bread quality, which leads to inconsistency and inefficiency in production. The main objective of this research was to develop a practical measurement tool combined with an AI-based application capable of predicting the quality of bread by loaf volume in real bakery conditions. Experiments were conducted at Serendib Flour Mills (Pvt) Ltd. where 40 flour batches were prepared following standard formulations, and each batch was divided to have eight replicates, developing a dataset comprising 320 dough samples. A practical tool was developed to measure dough proofing rate and radial expansion during fermentation. The tool was tested and validated under industrial bakery conditions to determine its reliability and repeatability in capturing dough behavior. An AI model and application were developed and tested using data gathered in this study. The developed low-cost, laminated-sheet-based tool, DoughForm Indexer, demonstrated strong performance with an accuracy of 82.5% in identifying dough characteristics associated with final bread volume. The AI application, BreadSense, built on an XGBoost algorithm, achieved an accuracy of 97.8%, effectively classifying ideal and non-ideal bread outcomes based on dough parameters. The study illustrated the fact that the integration of a low-cost physical tool with artificial intelligence allows the reliable and early-time prediction of bread quality. The developed system introduces a fast, scalable, and industrially feasible solution for real-time dough assessment, minimizing waste and ensuring consistent quality within bakery operations.

Keywords: Dough quality evaluation, Bread quality prediction, Artificial intelligence

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Development of Image Processing-based AI Model for Ripeness Classification and Detection of Defects in Tomato

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Automated grading of tomatoes is important as it ensures consistent quality and reduces post-harvest losses in commercial supply chains. Unlike manual sorting, which is slow, labor-intensive, and error-prone due to human involvement, Artificial Intelligence (AI) models, such as Convolutional Neural Networks (CNNs), can more accurately identify tomatoes by ripening stages and external defects. This study was conducted to develop and validate a dual CNN system to automate the classification of tomatoes based on ripening stages and external defects using image processing techniques. Images of *Gowri* F1 hybrid tomato variety were acquired in different lighting and diverse backgrounds, reflecting the manual sorting criteria practiced by the Keells supermarket chain. The dataset consisted of 2,500 images representing five ripening stages and 1,400 images for defect detection. The images were captured using a 50 MP smartphone camera and systematically labeled. The model architecture incorporated feature extraction for simultaneous multi-class ripening stage prediction via sigmoid activation and binary defect detection via sigmoid activation. Data augmentation and normalization was done to improve the model robustness to variations in lighting and orientation. Training and validation were performed in Google Colab using Keras API with 20% validation split. The ripening stage classification model achieved 97% accuracy and 0.0896 loss, while the defect detection model achieved 55% accuracy and 0.7042 loss. The combined system offers rapid, objective, and scalable assessment, addressing key limitations of manual grading such as subjectivity and labor intensity, and has practical utility for reducing economic losses through improved post-harvest quality management. The research highlights the feasibility and potential of integrate AI-driven grading platforms for enhancing sustainability across tomato supply chains.

Keywords: Tomato ripening, Defect detection, CNN, Image processing, AI grading

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Effect of Soil Moisture on Nitrous Oxide Emission from Intensively Cultivated Agricultural Soils at *Nuwara Eliya* and *Mahailluppalama* – An Incubation Study.

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Nitrous oxide (N_2O) is a potent greenhouse gas that significantly contributes to global warming and climate change. Agricultural soils are one of the main anthropogenic sources of N_2O, mainly due to nitrogen fertilization and soil moisture dynamics that influence microbial nitrification and denitrification processes. This study aimed to estimate the N_2O emission rate of intensively cultivated agricultural soils, Reddish Brown Earth (RBE) and Red Yellow Podzolic (RYP) soils from *Mahaillupallama* and *Nuwara Eliya*, respectively through a microcosm experiment. Soil samples were incubated under two moisture levels (60% and 90% water-filled pore space) with three treatments: non-amended control, treated with urea alone, and with a nitrification inhibitor. Sampling was carried out after 1, 5, 15, and 30 days and assessed for N_2O and for soil ammonium (NH_4^+) and nitrate (NO_3^-) concentrations. Results revealed that urea application significantly increased ($p< 0.05$) in N_2O emission emissions from both soils, with peaks of 0.81 and 667.2 N_2O µg/kg /h at 90% WFPS. The reduction in NH_4^+ concentration and simultaneous increase in both NO_3- concentrations and N_2O emission imply that nitrification pathway contributes significantly to N_2O emission under low moisture levels. The opposite trend observed in NO_3^- concentrations and N_2O emission at the high soil moisture level suggests a higher relative contribution made N_2O emission by the denitrification pathway. The maximum nitrification rate (V_{max}) and saturation constant (K_m) for RBE were 6.17 NO_3^- N/kg/h and 0.99 mM whereas RYP showed much higher V_{max} (34.96 NO_3^- N/kg/h) and K_m value (2.80 mM). These results suggested a possible difference in the diversity of bacteria and archaea communities between RBE and RYP soils. The biological inhibitor prepared with plant extractants showed a significant reduction ($p< 0.05$) in N_2O emission in RBE soils but not in RYP soils. The results emphasis on avoiding high soil moisture contents and application of urea along with a nitrification inhibitor can reduce the N_2O emission from agricultural lands.

Keywords: Denitrification, Inhibitor, Intensive agriculture, Nitrification, Nitrous oxide

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Epitope-Based Peptide Vaccine Targeting the B175L Protein of African Swine Fever Virus: An Immunoinformatics Approach

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African swine fever virus (ASFV) poses a major threat to global swine production, primarily due to the absence of a licensed and broadly protective vaccine. The ASFV B175L protein, which interferes with the Stimulator of Interferon Genes (STING) pathway and modulates host immune responses, is highly conserved across viral strains, making it an attractive target for multi-epitope vaccine design. In this study, forty-six B175L protein sequences from geographically diverse ASFV isolates were analyzed to identify conserved regions using multiple sequence alignment tools (MUSCLE v5, Clustal Omega, and Jalview). Linear B-cell epitopes were predicted using the Kolaskar-Tongaonkar method in BepiPred 3.0 Server, while CD8+ and CD4+ T-cell epitopes were identified using NetMHCpan 4.1 and the NetMHCIIpan 4.0 tools. Epitopes with strong predicted binding affinities were subsequently evaluated for antigenicity (VaxiJen v2.0), non-allergenicity (AllerTOP v2.1), non-toxicity (ToxinPred3.0), and cross-strain conservation (IEDB Conservancy Analysis Tool). During the epitope selection, eight MHC class I, one MHC class II, and five B-cell epitopes were identified as promising candidates. A multi-epitope vaccine construct was then designed *in silico* by linking the selected epitopes with suitable peptide linkers and incorporating an adjuvant sequence (CpG-ODN-2007) to enhance immune stimulation. Docking and molecular dynamics simulations were performed to assess the interaction between the designed vaccine construct and SLA-1*0401. The docking results demonstrated strong and stable binding, which was further supported by molecular dynamics analyses showing high binding affinity and structural stability. MM-GBSA analysis revealed a binding free energy of -2070.09 kcal/mol, indicating that complex formation is strongly favored thermodynamically. Immune simulation was analyzed using the C-ImmSim server. Intriguingly, results suggested that the multi-epitope vaccine could elicit a robust adaptive immune response, effectively activating both humoral and cell-mediated immunity. Overall, *in silico* analyses indicated that the designed multi-epitope vaccine is stable, highly antigenic, and capable of eliciting robust immune responses, highlighting its potential as a promising ASFV vaccine candidate for further *in vitro* and *in vivo* validation.

Keywords: African Swine Fever Virus, Multi-epitope Vaccines, Docking, Molecular Dynamic Simulation, *In silico*.

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Evaluating Spray Drone Efficiency and Prescription Map-Based Variable Rate Nitrogen Fertilizer Application in Sugarcane

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Conventional uniform nitrogen (N) fertilizer application in sugarcane (*Saccharum officinarum* L.) cultivation leads to nutrient inefficiency, environmental pollution, and elevated production costs. This study evaluated the operational efficiency of spray drone technology and the effectiveness of geographic information system (GIS)-based prescription maps for variable rate N fertilizer application (VRT) in sugarcane fields at Sevanagala, Sri Lanka. A factorial experiment (2×2×3×2) with 2 replicates was conducted using a DJI Agras T25 spray drone, testing flight height (1.5 m, 2.5 m), flight speed (3 m/s, 5 m/s), application rate (60 L/ha, 79.95 L/ha, 100.05 L/ha), and swath spacing (3 m, 7 m) to identify optimal operational parameters. Concurrently, GIS-based prescription maps were generated from geo-referenced leaf N analysis to classify fields into low-N (<1.8%) and high-N (≥1.8%) management zones. A randomized complete block design experiment with 6 treatments (3 fertilizer methods × 2 N zones) and 2 replicates compared drone-based variable rate technology vs conventional manual uniform urea application with reference to zero fertilizer control during the grand growth period of sugarcane. Regression analysis revealed the optimal drone configuration as 2.5 m height, 5 m/s speed, 60 L/ha rate, and 7 m spacing, achieving minimum battery consumption of 1.15 cycles/ha ($R^2 = 0.974$, $p < 0.001$) and minimum time use of 7.92 minutes·ha^{-1} ($R^2 = 0.954$, $p < 0.001$). Application results showed significant improvement in leaf N content within low N zones under drone VRT compared to manual and control treatments. Economic analysis demonstrated that drone-based nano-liquid fertilizer application reduced costs by 53% and application time by 90% compared to manual urea application. Variable rate technology enabled targeted nutrient management while, improving N use efficiency and thereby reducing the environmental impact. These findings support the adoption of drone and precision agriculture technologies for sustainable sugarcane production in Sri Lanka.

Keywords: GIS, Nitrogen use efficiency, Precision agriculture, Spray drone technology, Variable rate application.

Acknowledgement: This research was conducted in collaboration with the Sugarcane Research Institute, Sri Lanka and Lanka Sugar Company (Pvt) Ltd, Sevanagala.

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Evaluating the Efficacy of Formulated Nano-Enabled Biotic Elicitors as a Seed Treatment in Controlling Soil Borne Diseases of Selected Solanaceous Vegetable Crops

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Soil-borne diseases pose a significant threat to solanaceous vegetable crops. Pathogen-derived fragmented genomic DNA (FgDNA) acts as a biotic elicitor, activating plant defense responses when applied externally. Incorporating FgDNA into nanomaterial, facilitates more efficient delivery and enhances the host plant resistance against biotic and abiotic stresses. This study evaluated the effectiveness of nano-enabled biotic elicitors formulated with FgDNA of *S. rolfsii* combined with nanomaterials (montmorillonite and hydrotalcite) as seed treatments to suppress soil-borne diseases and promote growth of three solanaceous vegetable crops. The FgDNA was incorporated at 2 µg/ g of the nanomaterials. The seeds treated with FgDNA incorporated nanomaterials were compared with FgDNA-treated, nanomaterial-treated and untreated seeds. Seeds were treated by two methods, namely bio-priming and seed coating. Seeds of tomato (var. Thilina), brinjal (var. S.M.), and chilli (var. MI-2) under different treatments were sown on non-autoclaved soil naturally infested with soil-borne pathogens and in plastic containers laid with cotton wool according to a completely randomized design with three replications. Disease incidence, germination percentage, speed of germination, seedling vigour, and peroxidase enzyme activity were quantified 12 days (for tomato and brinjal) and 16 days (for chilli) post-treatment. Both seed treatment methods significantly ($p<0.05$) reduced disease incidence compared to untreated controls in all three crops. Nanocomposite treatments (montmorillonite+FgDNA and hydrotalcite+FgDNA) demonstrated a significantly higher disease suppression, germination percentage, speed of germination, and seedling vigour ($p<0.05$) compared to the rest of the treatments. In general, tomato responded most favorably followed by brinjal and chilli, showing a varietal variation on the treatments. Both bio-priming and seed coating methods were equally effective in suppressing soil-borne diseases across all three crops. These findings revealed the higher efficacy of nano-enabled FgDNA with montmorillonite and hydrotalcite in controlling soil-borne diseases and promoting seedling growth, highlighting their potential as a greener option in plant protection.

Keywords: Nano-enabled biotic elicitors, PAMP-triggered immunity, Seed priming, Seed coating

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Evaluation of Microbial Metabolites of Beneficial Microorganisms and Their Cell- Free Culture Supernatant-Based Nanoformulations to Manage Damping Off in Chilli

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Damping-off disease caused by soil-borne pathogens such as *Fusarium* sp. and *Rhizoctonia solani* severely affects chilli seedling production, leading to significant yield losses. The excessive use of chemical fungicides has raised environmental concerns, which warrants the need of sustainable alternatives. Microbial metabolites of beneficial microorganisms and their cell-free culture supernatant (CFCS)-based nanoformulations have emerged as promising ecofriendly options for disease management. This study aimed to evaluate the efficacy of metabolites of beneficial microorganisms and their CFCS-based nanoformulations in managing damping-off in chilli. Pathogens were isolated from diseased chilli seedlings, and potential bacteria and fungi were isolated from the rhizosphere soil of infected plants. Fifty bacterial isolates and 5 fungal isolates were screened for antagonism. CFCS and extracted metabolites of selected antagonists were tested *in vitro* for antifungal activity. CFCS-based nanoformulations were developed with carboxymethyl cellulose and montmorillonite. *In vivo* assays were conducted using treated chilli seeds under pathogen-infested soil conditions. One bacterial isolate out of 50 and 2 fungal isolates out of 5 were antagonistic against *Fusarium* sp. and *R. solani in vitro*. *In vitro* screening revealed that the selected antagonists inhibited pathogen growth by 64.52–72.97%, and the combined CFCS-based nanoformulation exhibited the highest antifungal inhibition (87.48%). *In vivo* assays demonstrated that CFCS and nanoformulations significantly ($p<0.05$) enhanced seed germination and seedling vigour index while reducing disease incidence (71–75%) for both pathogens. Moreover, seeds treated with CFCS-based nanoformulations exhibited elevated peroxidase activity. Based on morphological analysis, the bacterial isolate was identified as *Bacillus* sp., while the fungal isolates were identified as *Aspergillus* sp. and *Penicillium* sp. This study demonstrates that CFCS-based nanoformulations are highly effective in suppressing damping-off disease in chilli.

Keywords: *Bacillus* sp., Biocontrol, *Fusarium* sp., *Rhizoctonia solani*, Nanoformulations

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Evaluation of Montmorillonite-Green Nano Copper Oxide-Fragmented Pathogenic DNA Nanocomposites for the Management of Damping Off in Tomato

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Damping off is a soilborne disease that affects tomato plants at early stages of growth. This disease is caused by several soilborne fungal pathogens such as *Fusarium* and *Pythium* spp. The use of synthetic fungicides can cause environmental and health risks. The present study aims to determine the potential of montmorillonite (MMT)-green nano copper oxide (CuO)-fragmented pathogenic DNA nanocomposites for the management of tomato damping off. Damping off pathogens were isolated from affected tomato seedlings and confirmed their pathogenicity according to Koch's postulates. CuO nanoparticles were green synthesized using *Swertia chirayita* leaf extract. *In-vitro* antifungal efficacy of CuO nanoparticles was tested against a *Fusarium* sp. Fragmented pathogenic DNA from above *Fusarium* sp. and CuO nanoparticles were incorporated into MMT to formulate as nanocomposites. Carboxymethylcellulose (CMC) pre-coated tomato seeds (var. Thilina) were treated with MMT-CuO, MMT-DNA and MMT-CuO-DNA nanocomposites. Germination percentage (GP), germination speed (GS), seedling vigor (SV), percentage disease incidence (DI) and peroxidase enzyme activity (PEA) were quantified. Five *Fusarium* spp. were successfully isolated, and CuO nanoparticles showed 21% and 15% growth inhibition against above *Fusarium* sp. at 250ppm while 44% and 39% growth inhibition at 500ppm on potato dextrose agar and potato dextrose broth respectively. All three nanocomposites showed significant ($p<0.05$) reduction of DI along with higher peroxidase enzyme activity and seedling vigor without affecting the normal seed germination compared to the control treatments. The MMT-DNA nanocomposite showed the lowest DI (autoclaved soil - 10%, non-autoclaved soil-20%), highest seedling vigor index (883.9) and peroxidase activity (0.019 ΔAbs/min/g FW), indicating fragmented pathogenic DNA can effectively suppress the damping off disease in tomato by inducing plant defence enzyme activity.

Keywords: Green Copper Oxide Nanoparticles, Fragmented DNA, Damping Off, Nanocomposites, *Swertia chirayita*

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Fabrication and Functional Evaluation of Hydrogel-Based Slow-Release Systems of Essential Oils for Insect Pest Control: A Study with Cinnamon Oil

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Insect pest management faces growing challenges from pesticide resistance and regulatory constraints on synthetic chemistries. Botanical Essential Oils (EOs) are promising biopesticides due to inherent insecticidal and repellent properties, and cinnamon leaf oil, rich in eugenol, is particularly potent. However, rapid volatilization, high application costs, and photodegradation limit their field applicability and usage in pest control. To address these limitations, two slow-release cinnamon leaf essential oil (CLEO)-loaded hydrogels were fabricated: calcium alginate beads (CAB) and agar gel cubes (AGC). Fabrication parameters were optimized, and CLEO loading of CAB was quantified using UV–Visible spectrophotometry, which resulted 71.78% w/w loading. Laboratory bioassays assessed repellency against black house ants and rice weevils. Kruskal–Wallis tests confirmed significant treatment effects, with CAB showing superior ant repellency (93.2–96.8% reduction in visitation) compared to AGC (87.4–91.6%). Repellency against rice weevils remained significant across eight weeks, indicating sustained bioactivity. Environmental stability/keeping quality tests showed CAB retained 92.3% of its weight at 33% RH and 88.0% at 75% RH after eight weeks, outperforming AGC (65.4% and 73.3%, respectively). Under temperature regimes of 26–29 °C and 31–34 °C, CAB exhibited lower weight loss (12.3–16.3%) and CLEO volatilization (24.0%) than AGC (14.7–15.3% weight loss; 18.7% volatilization), confirming CAB's superior thermal and structural stability with controlled release performance. Direct cost calculation revealed CAB's production cost was ~27.03% lower than AGC. In a one-month user trial (n = 30), ~90% of participants reported reduced ant activity, validating laboratory outcomes. Overall, CLEO-loaded CAB demonstrated greater ant repellency, durability, and cost-efficiency than AGC. Future field trials should evaluate CAB's potential as a scalable, long-lasting delivery system for sustainable pest management in agricultural, storage, and household environments.

Keywords: Calcium alginate, Essential Oils, Repellency bioassay, Slow-release pest control systems, Hydrogel formulations

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Identification and Screening of Resistance in Selected Cucurbit Accessions Against Root Knot Nematodes (*Meloidogyne* spp.)

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Root-knot nematodes (*Meloidogyne* spp.) cause severe yield losses in cucurbit crops by inducing gall formation and damaging root function. In Sri Lanka, many local cucurbit accessions remain unevaluated for resistance to nematode and pest infestations. The present study evaluated ten cucurbit accessions including 3 snake gourd, 5 luffa gourd, 1 bitter gourd, and 1 ivy gourd for resistance against *Meloidogyne incognita* under controlled conditions. Plants were inoculated with infective second stage juveniles (J_2) and resistance was assessed based on the root gall index (RGI), number of root knots per gram of roots and hatchability, as well as calculating the mean reduction percentage (MR%) using key plant growth parameters. Data analysis revealed a significant variation among accessions for RGI and root knots per gram demonstrating differences in host plant responses. Mean reduction% values showed limited growth suppression in most of the tested accessions indicating tolerance to nematode damage. A composite Resistance Index (RI) was calculated based on RGI, root knots/g, and MR% values and accordingly accessions were ranked and categorized for resistance. Accession No. 00434 (ivy gourd) displayed the highest resistance and the next highest by accession No. 15316 (luffa gourd). Moderate resistance was recorded in accessions No. 11164 (luffa gourd) and No. 17228 (bitter gourd), while the remaining accessions were grouped as susceptible. The identified resistant accessions assist as valuable genetic resources for breeding or grafting nematode resistant cucurbits, contributing to sustainable nematode management strategies.

Keywords: Root-knots, Resistance index, Root gall index, *Meloidogyne incognita*, Hatchability

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Implementing a Smart Waste Tracking System to Reduce Food Waste in Large Scale Hotel Kitchens: A Pilot Study in Sri Lanka

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Food waste generation from hotel industry have a significant negative impact on the environment, society, and economy. Measuring is a one of important steps for taking necessary actions for food waste mitigation. Manual food waste measuring is labor-intensive and low in precision. Although AI driven waste-tracking systems have been introduced for efficient food waste monitoring and measuring, implementation of such technologies in Sri Lankan hotels impose difficulties due to high implementation cost and no customization for local food items. This study aims to implement a pilot-scale smart waste tracking system that can measure food waste in large-scale hotel kitchens. System integrates Internet of Things (IoT) technology using load cells, an HX711 amplifier, and an ESP32 microcontroller, connected to a firebase real-time cloud database and a flutter-based mobile application. The hardware captures the weight of discarded food and transmits real time data to database. Firebase database used for persistent data storage and real time data synchronization through connected devices. Mobile application allows hotel staff to select waste sources and categories, acting as central user interface. Mobile application also generates waste reports, providing insights such as amounts of waste, edible vs. non-edible waste analysis, key waste indicators and recommendations by supporting data driven decision-making in waste management. Prototype was implemented in a hotel kitchen environment. To analyze performance of the system paired t test was done by comparing system weight measurements with manual system weight measurement, resulting ($p=0.77>0.05$), indicating mean difference between two systems was statistically insignificant, validating accuracy of scale. Evaluation of staff feedback by Wilcoxon Signed Rank test results indicated a significant ($p<0.05$) improvement in system usability, usefulness, clarity, organization, and relevance compared to manual system. This locally developed, data driven system presents a novel and practical approach for reducing food waste in hotel industry.

Keywords: Food waste, Weight sensor, Database, Mobile application, Hotel industry

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In-silico Screening of *Abutilon indicum* Root Compounds as UL15 Inhibitors against Marek's Disease Virus in Poultry.

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Marek's disease virus (MDV) is an infectious and long-lasting pathogen that causes T-cell lymphomas, immunosuppression, and neurological disorders in chickens, creating a major challenge to the poultry sector. While vaccines do exist, the continuous development of more virulent MDV strains has complicated efforts to produce effective antiviral treatments. This study aimed to identify the antiviral potential of bioactive compounds from *Abutilon indicum* root as inhibitors of the MDV UL15 protein, a key viral enzyme involved in DNA cleavage and packaging during replication. We initially screened 19 phytochemicals through the literature survey, of which 8 were shortlisted using DataWarrior based on drug-likeness and toxicity profiles following Lipinski's Rule of Five. Further validation was performed using the SwissADME web server. In this analysis, four compounds were identified as promising candidates according to their pharmacokinetic parameters. The three-dimensional (3D) structure of UL15 was modelled using SWISS-MODEL and AlphaFold3, the most accurate model was refined with GalaxyWEB. Model validation was done with the SAVES v6.1 server confirmed the best refined structure, whose physicochemical properties were further evaluated using ProtParam. Virtual screening performed with PyRx 0.8 identified one lead compound whose binding affinity was stronger than -6 kcal/mol. Molecular docking with CB-Dock2 showed that (R)-N-(1′-methoxycarbonyl-2′-phenylethyl)-4-hydroxybenzamide exhibited the highest binding affinity (–7.8 kcal/mol) to UL15. Molecular dynamics (MD) simulations confirmed the stability of the UL15 ligand complex, with root mean square deviation (RMSD) and fluctuation (RMSF) analyses showing minimal conformational changes. The MM-GBSA analysis further indicated strong and favorable binding free energy (-64.13 kcal/mol) between the compound and the target protein. Overall, our findings suggest that *A. indicum*-derived (R)-N-(1′-methoxycarbonyl-2′-phenylethyl)-4-hydroxybenzamide is a promising UL15 inhibitor, offering potential for the development of novel antiviral therapies against MDV.

Keywords: Marek's Disease Virus (MDV), UL15, *Abutilon indicum*, Molecular Docking, Molecular Dynamics (MD) Simulation.

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In-silico **Screening of** ***Withania somnifera*** **(Ashwagandha) Phytochemicals as Anti-Prion Protein Compounds Against Bovine Spongiform Encephalopathy**

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Bovine spongiform encephalopathy (BSE) is a fatal neurodegenerative disorder in cattle caused by the conformational conversion of the normal cellular prion protein (PrP^{c}) into its pathogenic isoform (PrP^{sc}). The accumulation of PrP^{sc} in the brain leads to neuronal death, spongiform degeneration, and severe economic losses in the livestock industry. Currently, no effective vaccines or therapeutic drugs are available for the prevention or treatment of BSE, highlighting the need for novel therapeutic approaches. This study was conducted as an *in silico* analysis to identify potential anti-prion compounds from *Withania somnifera* (Ashwagandha), a medicinal plant with neuroprotective, antioxidant, and anti-inflammatory properties. Fifty phytochemicals were identified from *W. somnifera* through a literature review. Twenty-five compounds satisfied the drug-likeness and ADMET (Absorption, Distribution, Metabolism, Excretion and Toxicity) properties, adhering to Lipinski's rule of five. The 3D structure of the bovine prion protein was modelled using AlphaFold3, refined with GalaxyWeb, and validated using ProSA-web and MolProbity (Z-score −5.23; >90% residues in favoured regions). Molecular docking was performed using PyRx 0.8 to evaluate the binding affinities between the identified phytochemicals and the bovine prion protein. Compounds with binding affinities ≤ −6.0 kcal/mol were selected for further analysis. Withanolide B exhibited the strongest binding affinity (−7.5 kcal/mol) and formed stable hydrogen and hydrophobic interactions with key residues Asn159, Arg156, Gln160, Glu196, and Lys194. Molecular dynamics simulations (100 ns, 310 K) confirmed the complex stability, with protein RMSD values ranging from 1.9 to 2.5 Å and Withanolide B ligand RMSD between 1.2 and 2.4 Å. Most residue RMSF values ranged from 0.4 to 3.6 Å, indicating that residues within secondary structure regions remained more stable and rigid during the simulation. The results suggest that Withanolide B can stabilize the native prion conformation and may serve as a promising anti-prion candidate against BSE. Further *in vitro* and *in vivo* studies are recommended to validate its therapeutic potential.

Keywords: Molecular Docking, Molecular Dynamics Simulation, Prion Protein, *Withania somnifera*, Withanolide B.

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In-silico Exploration of Chaperonin GroEL Inhibitors from *Vitex negundo* L. (Nika) Leaf Compound Against *Streptococcus agalactiae* to Control Bovine Mastitis

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Mastitis from *Streptococcus agalactiae* reduces milk yield and antibiotic resistance, highlighting the need for safer alternatives. Chaperonin GroEL, a virulence factor, plays a key role in bacterial pathogenesis and in the folding of a broad range of proteins, particularly large, slow-folding, and aggregation-prone proteins. Targeting chaperonin GroEL, therefore, represents a promising approach to reduce bacterial survival and virulence. The present study aimed to identify bioactive compounds from *Vitex negundo* L. leaves that could inhibit chaperonin GroEL and thereby interfere with bacterial pathogenicity and protein folding. The UniProt database was used to retrieve the amino acid sequence of chaperonin GroEL, and its 3D structure was predicted by using AlphaFold3, refined with GalaxyRefine, and validated with the SAVES server. A total of 117 compounds from *Vitex negundo* L. were retrieved from PubChem for computational screening. Virtual screening using PyRx 0.8 identified 18 compounds with binding affinities stronger than –6 kcal/mol. These were further analyzed via molecular docking with CB-Dock2, revealing significant interactions with the chaperonin GroEL active site. Additionally, absorption, distribution, metabolism, excretion, and toxicity (ADMET) properties were assessed, and Lipinski's rule of five was applied to evaluate drug-likeness and safety. Among all compounds, khellol glucoside showed the strongest binding affinity of –9.7 kcal/mol. To further validate binding stability, we performed 100 ns molecular dynamics (MD) simulations, with protein RMSD fluctuating between 6.5–8.5 Å, ligand RMSD between 3.0–6.5 Å, and protein RMSF values for most core residues ranging from 1.5–6 Å. MM-GBSA analysis revealed a binding energy of −87.83 kcal/mol, suggesting favorable and stable complex formation. These findings suggest that khellol glucoside is a promising chaperonin GroEL inhibitor, warranting further experimental validation as a plant-derived therapeutic agent against bovine mastitis.

Keywords: Bovine Mastitis, *Vitex negundo* L., Chaperonin GroEL, *Streptococcus agalactiae*, Molecular Docking.

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Inhibitory Effects of *Senna alata* Phytochemicals on Bovine CYP1A1 and CYP3A74: An *In-silico* Approach to Reduce Aflatoxin B1 Bioactivation

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Aflatoxin B1 (AFB1) is a carcinogenic mycotoxin produced by *Aspergillus* species that frequently contaminates cattle feed. In the bovine liver, AFB1 is bioactivated by cytochrome P450 enzymes (CYP1A1 and CYP3A74) into toxic metabolites, particularly aflatoxin M1 (AFM1), which poses significant hepatotoxic and carcinogenic risks through milk contamination. At present, no specific inhibitors have been identified for these enzymes in cattle, limiting effective mitigation strategies against AFB1 bioactivation. This study applied a comprehensive *in-silico* strategy to evaluate the inhibitory potential of phytochemicals from *Senna alata* (L.) Roxb, a medicinal plant rich in phenolic and flavonoid compounds, against CYP1A1 and CYP3A74. Literature-based screening using Elsevier, ScienceDirect, and Google Scholar identified 54 phytochemicals, of which 26 fulfilled drug-likeness and ADMET (absorption, distribution, metabolism, excretion, and toxicity) criteria, screened using DataWarrior and filtered through Lipinski's rule of five. Homology models of 2 proteins were generated by SWISS-MODEL & refined, then validated by SAVES v6.1. Virtual ligand screening was performed using PyRx 0.8, with binding pocket prediction supported by CASTp and UCSF Chimera. CB-Dock2 was utilized to prioritize compounds with binding affinities lower than −6 kcal/mol. Interestingly, we found that Campesterol ligand displayed the strongest docking scores (−8.9 kcal/mol for CYP1A1 and −8.2 kcal/mol for CYP3A74), forming hydrogen bonds with active-site residues, indicating stable interactions. MD simulation confirmed that the complexes remained stable, with protein RMSD values of 2.5–4.0 Å (CYP1A1) and 2.0–3.2 Å (CYP3A74), and ligand RMSD ranging from 1.0–4.0 Å (CYP1A1) and 1.5–4.0 Å (CYP3A74). Most residue RMSF values were 0.5–2.5 Å (CYP1A1) and 0.5–2.0 Å (CYP3A74). MM-GBSA analysis showed binding free energies of −105.56 kcal/mol and −82.84 kcal/mol for these proteins, indicating favorable complex formation**.** These findings suggest that Campesterol may act as a competitive inhibitor of these proteins, potentially limiting AFB1 bioactivation. Additional *in-vitro* and *in-vivo* studies are recommended to confirm the effectiveness of these compounds.

Keywords: Aflatoxin B1, CYP1A1, CYP3A74, *In-silico*, *Senna alata.*

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Investigating the Effect of Different Light Spectra on Chlorophyll Fluorescence in Tissue-cultured *Camellia sinensis* during the Subculture Stage

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Light quality has a significant influence on photosynthetic efficiency and morphogenesis in in-vitro plant culture systems. This study investigated the effects of different light spectra, white (control), red, blue, and green, on chlorophyll fluorescence in tissue-cultured *Camellia sinensis* during the subculture stage. Three tea cultivars, PK-2, TRI 2025, and TRI 5004 were cultured with respective light treatments (Intensity 1500 Lux) to assess variations in fluorescence parameters in light energy transformation of PSII (Fv/Fm), electron transport efficiency (Psi-o), quantum yield of electron transport (Phi-Eo), the effective antenna size of an active RC (ABS/RC), maximum trapping rate of PS II (TR_0/RC), electron transport in an active RC (ET_0/RC), effective dissipation as an active RC(DI_0/RC), and performance index (Pi-Abs). The results showed that light quality has different effects depending on the cultivar. In both PK-2 and TRI 5004, there were no significant differences (*P=0.5*) related to Fv/Fm among light spectra, while TRI 2025 showed a significant (*P<0.05*) difference, with blue light producing a notably higher Fv/Fm compared to green light. However, all treatments had Fv/Fm values below 0.79, indicating that they were experiencing some level of stress, as typical Fv/Fm values for healthy plants are above 0.79. The differences observed for ABS/RC, ET_0/RC, TR_0/RC and DI_0/RC did not show a consistent pattern across the cultivars tested. Parameters of Psi-o, Phi-Eo, and Pi-Abs were not significantly (*P<0.05*) affected by any light spectra across all cultivars. Since Pi-Abs reflects overall performance of PSII, it indicates that none of the light spectra caused a significant change in the overall performance of PSII. These findings show that although there are cultivar-specific changes in some chlorophyll fluorescence parameters, the overall performance of PSII was not significantly (*P<0.05*) affected by the light-spectrum treatments at 1500 lux.

Keywords: Chlorophyll fluorescence, Light spectrum, Photochemistry, Tissue culture, White/green/ blue/red light

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Isolation and Characterization of Phosphate-Solubilizing Microorganisms from Eppawala Rock Phosphate (ERP) and Adjacent Soils

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Phosphorus (P) is an essential macronutrient for plant growth; however, its bioavailability in most agricultural soils is limited. Farmers therefore rely on costly, inefficient and environmentally detrimental synthetic phosphate fertilizers. Eppawala Rock Phosphate (ERP), Sri Lanka's main indigenous P source, has low solubility, restricting its agricultural use. This study aimed to isolate, identify, and characterize native phosphate-solubilizing microorganisms (PSMs) from ERP and adjacent soils to enhance P bioavailability through biological means. Preliminary screening for PSMs was conducted on Pikovskaya's (PVK) and National Botanical Research Institute's Phosphate (NBRIP) media using rock and soil samples from the ERP deposit. Twenty-three bacterial and 2 fungal isolates produced halo zones, indicating phosphate-solubilization. The most efficient isolates selected based on Phosphate-solubilizing Index (PSI) on NBRIP medium were characterized morphologically, microscopically, and biochemically. Inorganic phosphate solubilization was quantified in NBRIP broth containing tri-calcium phosphate (TCP) as the sole P source using the ascorbic acid method. The same method was used to assess, solubilization of high-grade ERP (HERP), an agricultural P source derived from the deposit. Gluconic acid production was also analyzed colorimetrically. The bacterial isolate SB8 (*Bacillus* sp.) recorded the highest solubilization of HERP (148.78 ± 3.32 mg L^{-1}, $p<0.05$), while the fungal isolate SF1 (*Aspergillus* sp.) released 138.24 ± 2.95 mg L^{-1} P from TCP. Combined inoculation of SB8 (*Bacillus* sp.) and SB11 (*Staphylococcus* sp.) demonstrated synergistic enhancement of solubilization. The most efficient cultures caused significant pH reduction, indicating organic acid or proton extrusion-mediated solubilization. Gluconic acid production was confirmed colorimetrically in the isolates SB9 (*Bacillus* sp.), SF1 (*Aspergillus* sp.) and SF2 (*Penicillium* sp.). The findings highlight that the ERP deposits harbor efficient PSMs capable of dissolving native rock phosphate, demonstrating strong potential for developing biofertilizer formulations to support sustainable phosphorus management in Sri Lankan agriculture.

Keywords: Phosphate-solubilizing microorganism, Eppawala Rock Phosphate, Phosphorus bioavailability, Biofertilizer, Sustainable agriculture

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Isolation, Identification and Screening of Entomopathogenic Bacteria and Fungi from Tea Soils Treated with Different Fertilizer Treatments

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Entomopathogenic microorganisms play a crucial role as biological control agents of pests. This study aimed to isolate, identify, and screen entomopathogenic bacteria and fungi from tea soils at St. Coombs estate, Talawakelle which have been treated under compost, neem oil cake, tea waste, and the TRI recommended fertilizer mixture for 20 years. Isolation of soil bacteria was done by serial dilution technique using selective media and fungi were isolated using termites as baits. A total of 12 fungal morphospecies and 20 bacterial morphospecies including both Gram positive and Gram-negative bacteria were isolated. The overall highest abundance of Gram-positive bacteria was observed in soil treated with Neem Oil Cake and TRI recommendation (57.0%). Compost treated soil showed the highest abundance of Gram-negative bacteria (56.2%). Statistical analysis revealed that the different fertilizer treatments have no significant impact on bacterial colony counts ($p > 0.05$). The soil treated with neem oil cake and TRI recommendation has the highest average bacterial richness. Bioassays revealed that isolated *Metarhizium* sp. caused a mean mortality of 86.67% (±15.06) in shot hole borer (TSHB) (*Euwallacea fornicatus)* at the 9th day after treatment. This efficacy was statistically comparable to the mortality caused by *Beauveria bassiana,* the positive control (95.0%). Out of two isolates of bacteria used for bioassay with white grubs (*Holotrichia* sp.), a fluorescent *Pseudomonas* sp. demonstrated a significantly higher mean mortality of 73.33 % (±11.54), compared to the untreated control which is 13.33 % (±11.54). The findings demonstrate that tea soils under different organic and inorganic fertilizer regimes are a valuable source of virulent, local isolates of entomopathogens. The *Metarhizium* and *Pseudomonas* isolates were identified as promising biological control agents for the effective management of TSHB and white grubs, respectively, offering an environmentally friendly alternative to chemical pesticides in the tea ecosystem.

Keywords: Entomopathogenic fungi, entomopathogenic bacteria, *Metarhizium*, *Pseudomonas*, biological control

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Mapping and Modelling Spatial Diversity of Rainfall and Evapotranspiration: Assessment of Surface Water Availability using Remote Sensing, GIS & Machine Learning

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Surface water availability, determined by the balance between rainfall and evapotranspiration, plays a significant role in sustainable agricultural water management. In Sri Lanka, assessing water availability is challenging due to limited data availability for the estimation of evapotranspiration loss across the country. Traditional climatic zone classification in Sri Lanka, developed during 1956-1961, may not accurately represent the current surface water availability patterns due to climate change and changes in land use/land cover conditions. This study aimed to assess the spatial and temporal variability of surface water availability in Sri Lanka and to validate the traditional climatic zonation using contemporary data. Reference evapotranspiration (ET_0) was estimated at 22 locations using a modified empirical model. Accordingly, this study introduced a modified Romanenko equation to estimate ET_0 in Sri Lanka with high accuracy ($R^2 = 0.96$). In this study Random Forest model was used to predict ET_0 at unmeasured locations in Sri Lanka, and satellite-derived NDVI and land surface temperature (LST) data were used for the modelling process. Evapotranspiration was estimated by integrating the crop coefficient (Kc) derived from NDVI, while rainfall maps were developed using the IDW interpolation in ArcGIS Pro. Monthly, seasonal, and annual water availability maps were developed as the difference between rainfall and evapotranspiration maps. These maps show the surface water availability distribution of any location of the country. Based on the annual surface water availability map, a new water availability zonation map was developed. Comparison of maps of surface water availability zones with traditional climatic zones using a contingency table and Kappa statistics shows a moderate agreement, and the K statistical test shows that there is no statistically significant agreement ($p > 0.05$) between the two maps, confirming that traditional climatic zones do not represent the current surface water availability patterns. The study confirmed spatial shifts in traditional climatic zones, indicating the need for an updated climatic zone map for Sri Lanka.

Keywords: Climatic Zones, Evapotranspiration, Random Forest, Romanenko Equation, Water Availability

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Morphological and Molecular Screening of *Deeper Rooting 1 (DRO1*) in Selected Sri Lankan Rice Varieties

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Rice (*Oryza sativa* L.) is the staple food for more than 60% of the global population, making yield improvement essential for global food security. Drought remains a major limitation in rainfed rice ecosystems, affecting plant performance during both vegetative and reproductive stages. Deep rooting is a key adaptive trait that improves plant anchorage and enhances the uptake of water and nutrients under stress. The *Deeper Rooting 1* (*DRO1*) gene, located on chromosome 9, has been identified as a major regulator of this trait. This study evaluated the deep-rooting ability of selected Sri Lankan rice varieties under well-watered hydroponic conditions and soil, along with molecular screening for the *DRO1* gene. A Completely Randomized Design (CRD) was used with three treatments: T1 – Bg300, T2 – Bg314, and T3 – Bg352. Growth parameters such as plant height, number of leaves, and tiller number were measured. Root morphology, including root angle, number of deep roots, and root length, was assessed in both soil and hydroponics. Significant differences ($p<0.05$) in root angle and root number were observed under soil conditions. Bg300 produced 56.01 ± 9.27 shallow roots (0°–45°), indicating a shallow-root phenotype. Bg314 produced 60.03 ± 4.9 total roots, with 54.04 ± 4.91 classified as deep roots (45°–90°), whereas Bg352 produced 75.05 ± 2.9 total roots, with 73.05 ± 2.8 deep roots, demonstrating a strong deep-rooting ability. Under well-watered conditions, Bg352 had significantly ($p<0.05$) more total roots (160.03 ± 10.20) and deep roots (153.05 ± 10.3) compared to Bg300 and Bg314. Molecular analysis using *DRO1*-specific primers confirmed the presence of the gene region in all varieties. Sequencing of exon 4 revealed the known 1-bp deletion in IR64, while Bg314 and Bg352 showed no deletions. Bg300 also had an intact exon 4 but displayed shallow roots, suggesting that additional genetic factors influence its root architecture.

Keywords: *Deeper Rooting 1* (DRO1) gene, Drought tolerance, Molecular screening Root morphology, Sequencing

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Optimizing Inlet Temperature in Industrial-Scale Spray Drying: Balancing Oxidative Stability and Physical Functionality in Full Cream Milk Powder

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Spray-dried full cream milk powder is a vital global commodity, but its quality and shelf life are compromised by lipid oxidation and poor solubility, leading to significant economic losses and limiting market reach. A critical gap exists in the lack of precise, evidence-based protocol for optimizing the inlet temperature to simultaneously mitigate these issues in an industrial setting. This study aimed to bridge this gap by identifying the optimal inlet temperature to balance oxidative stability and physical functionality in an industrial context. The impact of inlet temperatures ranging from 130-160°C on peroxide value (POV), thiobarbituric acid reactive substances (TBARS), free fatty acids (FFA), solubility, and bulk density was investigated using a preliminary analysis and a subsequent controlled validation trial. Quadratic regression models revealed strong and significant ($p<0.05$) non-linear relationships for the primary targets of optimization: oxidative stability (POV, TBARS, FFA) and key physical functionality (solubility, bulk density). The analysis identified a critical optimal window of 138-142°C. Within this range, lipid oxidation was minimized, with POV, TBARS and FFA values remaining below 0.60 mEq/kg, 0.06 mg MDA/kg, and 0.70% Oleic acid respectively, while physical functionality was maximized, evidenced by solubility exceeding 94% and optimal bulk density. Temperatures below this optimum enhanced solubility and density, but also increased oxidation, whereas higher temperatures drastically accelerated oxidation and induced protein denaturation, reducing solubility. It is concluded that precise control of the inlet temperature within the 138–142°C range serves as a critical control point for producing high quality full cream milk powder, thereby potentially extending shelf life and ensuring superior functionality for industrial application.

Keywords: Lipid oxidation, Milk powder, Optimization, Solubility, Spray drying

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Optimization of Coconut Petiole - Derived Biochar Production under Different Pyrolysis Conditions and Its Characterization

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This study investigated the optimization of biochar production from coconut petiole biomass under varied pyrolysis conditions and characterized the physicochemical properties of the resultant biochar. First at the laboratory, pyrolysis was conducted at 3 temperatures (400, 500, and 600 °C) and 3 residence times (60, 90, and 120 minutes) in small-scale reactors (0.044 cm^3 volume) kept in muffle furnace, with 3 replicates per treatment. Two heating methods: heating from atmospheric temperature to the desired temperature and stating the pyrolysis at desired temperature, were employed to evaluate the biochar recovery and quality under laboratory and simulated upscaled field reactor environment. Statistical analysis revealed temperature as a significant factor influencing biochar recovery, with 400 °C and 60 minutes identified as the optimal combination, balancing maximum yield (approximately 30 % db.) and minimum energy input. Based on laboratory test outcomes, field trials conducted in the Double Barrel Chamber Reactor (0.077 m^3 volume, 25kg/batch throughput) confirmed laboratory findings, demonstrating consistent temperature profiles and retention time. The resultant biochar from the laboratory scale reactor and field reactors were further analyzed for-mass balance and physicochemical properties. Proximate analysis showed volatile matter in the range of 83%-94%, fixed carbon 9-15% and ash content < 10%, with no significant differences ($P>0.05$) between lab and field production. The pH of biochar ranged from 10-11.5, indicative of high alkalinity, while electrical conductivity varied from 1.2-3.5 (mS /cm), reflecting its soluble salt content. Advanced chemical characterization revealed nitrogen content ranging from 2-3 mg/kg, total phosphorus content between 1-3 mg/kg and notably high potassium levels ranging from 6-12 mg/kg, underscoring its potential as a potassium -rich soil amendment. This biochar displayed considerable liming potential from 37% and 73% $CaCo_3$ equivalents. The findings demonstrate that air dried coconut petiole pyrolysis at 400±40 °C for 60 minutes offers an effective, energy-efficient, and scalable approach for production of high-quality biochar.

Keywords: Biochar, Biochar Recovery, Characterization, Pyrolysis, Residence Time

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Pharmaceutical Industrial Grade Analytical Method Development for Quantification of Active Ingredients in Oral Pharmaceuticals Using an Advanced Chromatography Technique

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The development and validation of a robust, specific, and stability-indicating analytical method are vital in pharmaceutical quality controlling. Thus, this research focused on development of a Reverse-Phase High-Performance Liquid Chromatography (RP-HPLC) method for the concurrent quantification of Chlorpheniramine Maleate (CPM) and Dextromethorphan Hydrobromide (DXM) in oral formulations, in accordance with ICH Q2(R1) guidelines. First, a mobile phase was optimized with a C18 column (300 mm × 4.6 mm, 5 µm) with an isocratic elution of methanol, acetonitrile, and phosphate buffer (pH 3.0) in a 60:10:30 (v/v) ratio at a flow rate of 1 mL/min, and detected at 210 nm using a diode array detector (DAD). The optimized mobile phase, buffered at acidic pH with potassium dihydrogen phosphate and sodium heptanesulfonate as ion-pairing agents, provided excellent peak symmetry and resolution. The developed method effectively separated the analytes from excipients and degradation products, confirming its stability-indicating capability. Validation studies demonstrated linearity over 80–120% of the target concentration with correlation coefficients (r^2) of 0.9998 for CPM and 0.9960 for DXM. The limits of detection (LOD) were 0.0145 µg/mL for CPM and 0.0160 µg/mL for DXM, while limits of quantification (LOQ) were 0.0439 µg/mL and 0.4844 µg/mL, respectively. Accuracy was confirmed with recoveries between 99–102%, and precision showed %RSD < 2. The method remained robust under small deliberate variations in flow rate, pH, and temperature, and system suitability parameters consistently met acceptance criteria.

Keywords: RP-HPLC, Chlorpheniramine Maleate, Dextromethorphan Hydrobromide, Method validation, ICH Q2(R1) guidelines

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Precision Nutrient Management for Sugarcane: Delineation of Soil Nutrient Management Zones and Development of Digital Soil Maps

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Sugarcane (*Saccharum officinarum* L.) is a major industrial crop and domestic sugar production in Sri Lanka meets only about 12% of national demand, highlighting the need for improved productivity through efficient resource use. This study aimed to delineate soil nutrient management zones and develop digital soil maps to support precision nutrient management in the sugarcane nursery of the Lanka Sugar Company, Sevanagala. Soil samples were collected from 71 geo-referenced locations at the depth of 0–15 cm using a 100 m × 100 m grid. Standard analytical methods were used to determine pH, electrical conductivity (EC), total nitrogen (N), available phosphorus (P), and exchangeable potassium (K). Soil chemical parameters were spatially interpolated using the Kriging method in ArcGIS 10.7 to generate digital nutrient maps. Yield zones were classified into low, medium, and high categories using historical yield data, and statistical analyses were conducted using R. The analyses showed that soil pH values were within the optimal range (5.5–6.5) for sugarcane growth, whereas available P exceeded critical levels across most areas. Total N remained below the desired threshold, and EC values (20−104 µS/cm) indicated the presence of localized salinity hotspots. Correlation and multiple regression analyses indicated that EC and K significantly affected sett yield ($p<0.05$). Ordinal logistic regression showed that higher pH and balanced K levels were positively associated with high yield zones, whereas elevated P and EC corresponded to low yield zones. The developed digital maps effectively visualized nutrient distribution and yield zones, demonstrating the potential of GIS-based tools in delineating spatial management zones. Overall, improving soil pH and properly managing salinity and high nutrient levels are important to increase sugarcane yield and maintain stable production in different zones. The approach provides a foundation for site-specific fertilizer recommendations and sustainable nutrient management.

Keywords: Digital soil mapping, Kriging interpolation, Precision nutrient management, Regression analysis, Spatial variability.

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Preparation of *Gymnema Sylvestre* & *Osbeckia octandra* Herbal Capsule for Human use: Investigation of Toxicity using ICR Mice

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Gymnema sylvestre (Masbedda) is a perennial woody climber widely used in Sri Lankan traditional medicine for regulating blood sugar, lipid profiles, and body weight, and for treating malaria, digestive and urinary disorders, and snakebites. *Osbeckia octandra* (Heenbovitiya) possesses hepatoprotective, hypoglycemic, antioxidant, and anti-inflammatory properties and is traditionally used for liver-related ailments. Considering their complementary effects, a combined *Gymnema–Osbeckia* herbal formulation was evaluated for its anti-diabetic potential and safety. Pharmacological and toxicological studies were conducted using 4–6-week-old ICR mice fed a high-fat, high-sugar (HF&S) diet for four weeks. Experimental groups received powdered leaf formulations of *O.octandra* and *G. sylvestre* at ratios of 25:75 (T1), 50:50 (T2), and 100% *G. sylvestre* (T3), administered with the HF&S diet. Mice fed only the HF&S or a normal diet served as positive and negative controls. Feed intake and behavior were recorded daily, and fasting blood glucose and white blood cell (WBC) counts were measured weekly. Serum glucose, and liver, and kidney histopathology were analyzed at the end of the trial. Data analyzed using repeated measures ANOVA followed by Duncan's multiple range test ($p < 0.05$) showed no significant differences in feed intake, WBC count, or behavior among groups. HF&S-fed mice exhibited elevated glucose (84.95 ± 0.82 mg/dl), whereas treated groups maintained near-normal levels (T1: 75.68 ± 1.42; T2: 75.69 ± 2.01; T3: 77.33 ± 0.81 mg/dl). Histopathology revealed no hepatic or renal lesions in treated mice. The *Gymnema sylvestre–Osbeckia octandra* formulation demonstrated effective glucose regulation without toxicity, supporting its potential as a safe, natural therapeutic for metabolic disorders

Keywords: *Gymnema sylvestre, Osbeckia octandra*, blood glucose, toxicity, liver and kidney histopathology.

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Symbiotic Assessment of Rhizobia from Non-Edible Legumes for Edible Legume Cultivation in the Dry Zone of Sri Lanka

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Legume–rhizobium symbiosis is fundamental to sustainable agriculture, and the introduction of compatible rhizobial inoculants can enhance legume production through improved soil nitrogen fertility and reduced dependence on synthetic fertilizers. However, inoculation success is dependent on soil characteristics, host specificity, and interactions with native microflora. Therefore, the introduction of indigenous rhizobia as inoculants can enhance their survival and establishment in the field, contributing to yield improvement. Black gram (*Vigna mungo* (L.) Hepper) and Cowpea (*Vigna unguiculata* (L.) Walp.) are vital grain legumes for smallholder farmers in the dry zone, Sri Lanka, where nutrient-poor soils constrain their yields. Hence, inoculants consisting of indigenous rhizobia could be a sustainable approach in low-input systems. This study evaluated the cross-inoculation efficiency of two indigenous strains, TBII1 and TBAS2, isolated from non-edible legumes, on plant growth, nodulation, and yield parameters of Black gram and Cowpea under sterilized and non-sterilized soils at Mahailluppallama, Sri Lanka, in a randomized complete block design with three replicates. Results indicated that indigenous rhizobial treatments enhanced nodulation and seed germination, particularly in non-sterilized soils. Cowpea in non-sterilized soil, treated with TBAS2 recorded the highest shoot (12.10±1.96) and root (1.54± 0.31) dry weights, while TBII1 also showed a similar root dry weight (1.65±0.31) at ($p<0.0001$) *in vitro* seed germination under TBAS2 was 98 ± 2.78% and 77±2.78% for Black gram and Cowpea, respectively. Black gram grown in non-sterilized soils and treated with TBII1 showed greater active nodulation (1.66±0.49, $P=0.0026$), the highest nodule number (19±4.36) and the highest lateral root nodulation in the 5–10 cm zone (3.77±1.49), indicating deeper, active nodules under TBII1.The results demonstrate initial basic information with the varying responses of TBII1 and TBAS2 cross-inoculation for the two tested legumes under different parameters. Therefore, further field trials under different growth and management conditions will ensure more conclusive outcomes.

Keywords: Black gram, Cowpea, Cross-inoculation, Edible legumes, Non-edible legumes

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Yield Prediction of Commonly-grown Rice Varieties in Sri Lanka by using Normalized Difference Vegetative Index (NDVI)

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Data-driven technologies help predicting crop yields accurately. This study attempted to estimate paddy yields in Sri Lanka using Normalized Difference Vegetative Index (NDVI) as a tool. Field experiments were conducted in the 2025 *Yala* season at the Rice Research and Development Institute (RRDI) at *Bathalagoda* (Intermediate zone - IZ; agro-ecological region IL1), Rice Research Station at *Ambalanthota* (Dry zone - DZ; agro-ecological region DL1) and the Regional Rice Research and Development Center at *Bombuwala* (Wet zone - WZ, agro-ecological region WL1). Twenty commonly-grown rice varieties, comprising 15 new-improved (Bg 300, Bg 352, Bg 357, Bg 358, Bg 359, Bg 360, Bg 366, Bg 374, Bg 375, Bg 409, At 362, At 307, Bw 367, Ld 253, Bg 94-1), one old-improved (H-4) and four traditional (*Suduheenati*, *Suwandel, Kaluheenati, Madathawalu*), were used. The NDVI values were recorded at four growth stages, *i.e.* 28 days after planting, maximum tillering, 50% flowering, and at maturity of each variety. Though the NDVI differed significantly ($p<0.05$) between rice varieties and climatic zones, it did not clearly differentiate individual rice varieties. However, the NDVI at the maximum tillering of paddy-crop showed a significant Co-efficient of Determination (R^2; $p<0.0001$) with the paddy yield, *i.e.* in the IZ (*Bathalagoda*), R^2 values were 0.83 for all varieties, 0.83 for improved varieties, 0.935 for new-improved varieties and 0.81 for traditional varieties respectively with RMSE=0.252, while in the DZ (*Ambalanthota*) they were 0.93, 0.92, 0.92 and 0.91 for respective varietal categories (RMSE=0.285). However, the actual and predicted yields were not significantly different ($p<0.05$). The NDVI represents canopy greenness, and showed a stronger linear-relationship with paddy yield in DZ-site than IZ-site. The NDVI value at the maximum tillering of paddy-crop can be considered as a reliable indicator for early prediction of paddy yield in Sri Lanka.

Keywords: Precision Agriculture, NDVI, SPAD, vegetative indices, paddy yield prediction

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Theme 3

Food Quality, Safety and Product Development

A Combined *In-vitro* and *In-vivo* Evaluation of the Potential of *Garcinia cambogia* Supplementation in the Prevention and Management of Urolithiasis

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Urolithiasis is a recurrent global health problem with limited safe preventive interventions. Conventional therapies such as lithotripsy and surgery target treatment but not recurrence, emphasizing the need for preventive strategies. This study evaluated the anti-urolithiatic and litholytic potential of a *Garcinia cambogia*–based supplementation developed using garcinia rind powder, natural annona powder, and sucralose. A three-phase approach was adopted; (i) morpho-constitutional analysis of urinary stones using FTIR and microscopy (n=17), (ii) formulation standardization and phytochemical characterization, and (iii) a randomized, placebo-controlled clinical trial (n=20; healthy adults). Stone analysis revealed calcium oxalate as the predominant type (91%). The standardized formulation contained 6.15% protein, 8.74% crude fiber, 3.45% ash, and key minerals (Mg 76 mg/100 g, P 100 mg/100 g, K 238 mg/100 g). *In-vitro* assays showed significant inhibition of calcium oxalate nucleation (47.2±2.1%) and aggregation (39.5±1.8%), with dissolution rates comparable to the positive control (Cystone®). In the clinical trial, garcinia supplementation demonstrated no adverse effects on serum calcium (p=0.64), uric acid (p=0.74), or creatinine (p=0.64), confirming safety. Anthropometric measures (weight, BMI, WC) remained stable ($p>0.05$). However, significant reduction was observed in urinary oxalate/creatinine ratio between baseline and endpoint in the intervention group (1.34±0.16 to 0.92±0.28 mg/dL; p=0.03), while control values remained significantly unchanged. White blood cell counts in urine also declined, suggesting reduced urinary tract inflammation. As a whole, garcinia supplementation showed promising anti-urolithiatic potential mainly through lowering urinary oxalate excretion, with supportive *in-vitro* litholytic activity. Although limited by short duration (16 days) and small sample size, these findings provide the first *in-vivo* clinical evidence for *Garcinia cambogia* as a preventive dietary intervention for urinary stone risk. Validation of these outcomes will require extended trials with more participants and the inclusion of imaging-based evaluations.

Keywords: *Garcinia cambogia*, Urolithiasis, Hydroxycitric acid, Anti-urolithiatic, Oxalate

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A Retrospective Study on Milk Quality Received to a Large-Scale Dairy Processing Plant in Uva Province of Sri Lanka

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This retrospective study was carried out to analyse milk quality received during the years 2020-2025 to a large-scale processing plant. In the study, bulk milk quality parameters were compared quarterly, yearly and in milk lean to rich seasons. The total milk collections showed significant increases from 2020 to 2024, with volume rising from approximately 80,000L to 175,000L across all quarters ($p<0.05$), with third quarter collections significantly higher than first quarter in all years due to the milk-rich period (June-October) versus the lean period (November-May). However, fat content declined significantly from 2020 to 2024 across all quarters ($p<0.05$), with significant differences observed between 2nd and 4th quarters annually, attributed to water adulteration, particularly during lean periods when payment scheme was based on milk quantity. Progressive decline in Corrected Lactometer Reading (CLR) was observed from 2020-2024, with significant differences between 2nd and 4th quarters (2020-2022), as lean periods showed lower density than rich periods in 2020, 2021, and 2024. Similarly, declining trends in total solids were evident in 1st, 2nd, and 3rd quarters from 2020-2025, with lean periods showing significantly lower Total Solid% (TS) compared to rich periods (2020, 2021, 2024), suggesting possible adulteration. Milk quality improvement was significant ($p<0.05$) in 2025, particularly in the 2nd quarter, with lean periods consistently showing lower percentages compared to rich periods across all years examined. The study concludes that while milk quantity increased substantially, quality parameters declined due to water adulteration practices until mid-2024. Interestingly, when strict quality standards were implemented at the milk procurement levels, the milk quality continued to be improved towards the third quarter of the year 2025, suggesting that imposing strict quality regulations at milk procurement could substantially improve the milk quality in Sri Lanka.

Keywords: Milk quality, Seasonal variation, Milk Quality regulations

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Application of Triacylglycerol Fingerprinting for Detecting Fat Adulteration and Characterizing Physical Quality of Commercial Milk Powders in Sri Lanka

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Milk fat adulteration is a common issue that affects its quality and safety, and there have been community concerns about milk powder adulteration in Sri Lanka. This study aimed to detect milk fat adulteration and evaluate the physical quality of commercial milk powders available in Sri Lanka, while comparing local brands with international market available products. Eight commercial milk powder brands (2 brands of locally produced milk powder, 3 brands of imported milk powder purchased from the local market and 3 brands purchased from other countries), along with authenticated cow and buffalo milk powders, were analysed. Extracted milk fat was analyzed by gas chromatography to determine the triacylglycerol (TAG) profile based on total carbon numbers (C24-C54), and S-limits were calculated according to the ISO 17678:2019 reference method. The physical properties of the milk powders were evaluated and compared with international quality standards. All commercial brands complied with the S-limit values (S3, S4, S5, S6, S7) specified in the standard (98.05-101.95, 99.42-100.58, 95.90-104.10, 97.96-102.04, 95.68-104.32, respectively). Principal component analysis revealed that the TAG profiles of locally produced brands closely resembled those of authenticated cow milk powder, whereas imported brands and brands from other countries exhibited similar profiles among themselves. It was additionally observed that the profiles of the authentic buffalo milk powder and cow milk powder showed variations in their overall TAG profiles. Spiked samples containing 5% (v/v) foreign fats (sunflower oil, palm oil, coconut oil, lard) showed expected deviations in S-limits. The refractive indices of local brands were not significantly different ($P>0.05$) from those of the authenticated powder, whereas the imported brands showed similar results ($P>0.05$) to milk powders from other countries. All the brands had acceptable moisture content. Except for one brand, all other brands available in Sri Lanka had higher flowability ($P<0.05$) and lower ($P<0.05$) cohesiveness than two authenticated powders. Solubility was similar ($P>0.05$) among all commercial powders. These results suggest that the S-limit is effective in detecting foreign fat adulteration in milk powders. Overall, milk powders in the Sri Lankan market can be considered pure in terms of fat content, and physical quality parameters varied significantly across brands.

Keywords: Milk powder, Triacylglycerol, S-limit, Refractive index, Physical quality

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Assessing the Effect of Maturity Stage on the Physicochemical, Nutritional and Functional Properties of *Ambul-Nadee* (*Musa acuminata*, AAB) and Cavendish (*Musa acuminata*, AAA) Commercial Banana Varieties at the Consumer Purchase Stage

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Banana (*Musa* spp.) is one of the most important fruit crops in Sri Lanka, where ripening method and maturity stage strongly influence consumer acceptability and nutritional value. This study assessed the effect of maturity stage and ripening method on the physicochemical, nutritional and functional properties of *Ambul-Nadee* (*Musa acuminata*, AAB) and Cavendish (*Musa acuminata*, AAA) varieties ripened to ripening stage 5 (yellow with green tips). Fruits were harvested at 4 maturity stages for *Ambul*; 8, 9, 10,11 weeks after flowering (WAF) and 5 stages for Cavendish; 10, 11, 12, 13, 14 WAF. *Ambul* was subjected to both natural ripening at ambient conditions and induced ripening using ethylene gas, while Cavendish was assessed primarily under induced ripening for nutritional and functional properties. Measured parameters included firmness, pH, titratable acidity, total soluble solids (TSS), proximate composition, total phenol content (Folin-Ciocalteu method), flavonoid content ($AlCl_3$ colourimetric method) and antioxidant activity (inhibition of DPPH). Statistical analysis showed that in *Ambul*, natural ripening at early maturity stages (8-9 WAF) retained significantly ($p<0.05$) higher protein, ash, fibre, carbohydrates, phenolic and flavonoid contents with greater antioxidant activity, while induced ripening accelerated acidity reduction and moisture gain. TSS values showed no significant difference ($p>0.05$) across maturity stages. In Cavendish, physicochemical properties such as pH and titratable acidity were significantly affected ($p<0.05$) by maturity, while proximate composition remained relatively stable. However, the presence of bioactive compounds and antioxidant activity peaked at 10 WAF and declined with maturity. These findings show that optimum maturity stage and ripening method significantly affect banana quality, with *Ambul* at 8-9 WAF under natural ripening offering superior nutritional and functional value. Cavendish shows stable quality under induced ripening, but shows higher antioxidant potential at early maturity.

Keywords: Induced ripening, Natural ripening, Maturity stage, Physicochemical properties, Proximate composition

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Assessment of Lead (Pb) Accumulation Under Different Fertilizer Practices in Cinnamon (Cinnamomum Verum) Growing Soils in Southern Province

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Cinnamon (Cinnamomum verum) is a globally valued spice known for its distinctive aroma, flavour, and numerous health benefits. Recently, concerns have been raised on the elevated lead (Pb) levels detected in some cinnamon products in the global market. This study investigated the effects of different fertilizer practices on soil physicochemical properties and Pb accumulation in soil and plant parts of cinnamon grown in Southern Province in Sri Lanka. Composite surface soil (0-15 cm) samples were collected from 10 cinnamon plantations with different fertilizer practices, i.e. inorganic fertilizer (IF), compost (CM), inorganic fertilizer + compost (IF+CM), poultry manure (PM), and no fertilizer (NF) application for more than 3 years. Soil was analyzed for pH, electrical conductivity, organic matter, available phosphorus, texture, and available and total Pb concentrations. Mature leaves, immature leaves, and bark samples were collected from each plantation and quill samples were collected from the local market and analyzed for total Pb concentration. Soil pH was acidic in all the samples. Highest Pb accumulation was observed in soils receiving CM with total Pb concentration of 17.43±0.29 mg/kg and available Pb concentration of 3.65±0.06 mg/kg. However, the total Pb content found in all the studied locations was far below the maximum permissible limit implied by the European Union. Immature leaves showed a significant difference, whereas mature leaves and bark samples did not show a significant difference in Pb concentration across fertilizer treatments. Total Pb concentration in cinnamon bark samples and quill samples ranged from 1.46±0.48 to 4.06±2.80 mg/kg and from 0.97 to 5.50 mg/kg, respectively. All the quill samples exceeded the maximum allowable limit established by the Sri Lanka Standards Institute (i.e. 0.2 mg/kg), indicating potential food safety risks. These findings underscore the need in adopting appropriate post-harvest management practices to minimize Pb contamination in Ceylon cinnamon to ensure the safety, quality, and global market competitiveness of Ceylon cinnamon.

Keywords: Bioaccumulation, Ceylon cinnamon, Contamination, Food safety, Spices

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Assessment of Microplastic Contamination in *Oreochromis niloticus* from Selected Reservoirs across Urban-Rural Gradient in Anuradhapura District, Sri Lanka

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Microplastic (MP) contamination has become a significant public concern in inland fisheries, given its impact on global fish production. Nile tilapia (*Oreochromis niloticus*), a popular choice for freshwater aquaculture, is at a high risk of exposure to MPs. Although global studies on MP pollution in *O. niloticus* exist, studies in Sri Lankan waters remain limited. This study aimed to assess MP contamination in *O. niloticus* collected from three different freshwater reservoirs, which are considered as popular locations for local capture fisheries, namely [Basawakkulama (BK), Nuwara Wewa (NW), and Mahakanadarawa (MK)] in the Anuradhapura district. A total of 30 tilapia specimens (10 from each reservoir) were dissected to collect the gastrointestinal tracts (GIT), which were subjected to digestion using 4 M KOH and 30% H_2O_2. The MPs were visually identified under a digital microscope and characterized by shape, size, and color. Polymer types were determined using Fourier Transform Infrared Spectroscopy (FTIR) coupled with a microscope, while Nile Red staining under UV light was used to quantify the MP abundance. The highest MP abundance was observed in BK (8.91±4.21 particles/ g of GIT weight), followed by NW (6.37±1.01 particles/ g of GIT weight) and MK (2.86±0.82 particles/ g of GIT weight), suggesting that fish from urban and peri-urban reservoirs tend to ingest more MPs than those from the rural areas. In all three tanks, fiber-shaped MPs were found to be predominant (55.8%) than fragments (37.6%) and foams (6.5%). Black was the most common color (32.6%) of MP, followed by white (31.6%) whereas most of the MPs were <250 µm in length (76.8%). Polyethylene (PE) was the most common form (66.3%), followed by polystyrene (PS; 14.8%), polypropylene (PP; 13%), and polyethylene terephthalate (PET; 5.9%). These findings highlight considerable MP contamination in *O. niloticus* from the tested reservoirs in Anuradhapura district, Sri Lanka, indicating a potential risk to food safety.

Keywords: Microplastics, Nile tilapia, urban-rural gradient, Nile Red staining

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Assessment of the Chemical Profile of Ceylon Cinnamon (*Cinnamomum zeylanicum)* Bark, Wood and Stem to Explore Their Potential in Value-Added Product Development

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While extensive research has focused on cinnamon bark and leaves, the cinnamon wood; a major byproduct of the industry, remains largely unexplored and is often discarded as waste. This study aimed to compare the biochemical profiles of cinnamon bark, wood, and stem; to evaluate the suitability of fresh cinnamon stem for bioactive compound extraction; and to assess the potential use of treacle as a natural solvent in cinnamon extraction and product development. Methanolic extracts of cinnamon bark, wood, and stem were analyzed using High-Performance Liquid Chromatography (HPLC). Total phenolic content (TPC) and antioxidant activity were determined using the Folin-Ciocalteu and DPPH free radical scavenging assays. Treacle-based extractions were prepared at concentrations of 0%, 20%, and 40% to evaluate their effect on extraction efficiency. For product development, five edible gummy formulations were prepared using either treacle-based or distilled-water cinnamon extracts at extract-to-sugar ratios of 1:8 and 2:7, along with a control made using only sugar. These formulations were subjected to sensory evaluation by thirty-five untrained panelists to determine consumer acceptability. Results showed that cinnamon bark had the highest TPC and antioxidant activity, followed by the stem and wood. Notably, the stem exhibited no dilution effect during extraction, indicating its potential for direct bioactive compound extraction without undergoing the quill-making process. Treacle-based extractions at 20% and 40% significantly increased ($p<0.05$) TPC, while 0% and 20% treacle concentrations showed the highest antioxidant activity. Sensory evaluation identified the 2:7 treacle-based cinnamon extract: sugar formulation as the most acceptable gummy product. Overall, the findings highlight that cinnamon wood can be effectively utilized and that fresh stems hold strong potential for bioactive compound extraction. Treacle-based extraction demonstrated similar phenolic yield compared to conventional aqueous extraction, indicating its effectiveness as a natural, food-grade solvent and the resulting extract has the potential for direct food applications.

Keywords: Ceylon Cinnamon, Bark, Wood, Stem, Treacle.

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Balancing Microbial Reduction and Phytotoxicity by Optimizing Calcium Hypochlorite in Cocopeat for Floriculture

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This study employed a two-phase experimental approach to establish the optimal concentration of calcium hypochlorite for disinfecting cocopeat. In the laboratory phase, cocopeat was treated with calcium hypochlorite at concentrations of 0, 0 ppm with rinse, 20, 40, 60, and 80 ppm, and microbial load was assessed by quantifying Colony Forming Units (CFU) for bacteria on nutrient agar (incubated at 37 °C for 2 days) and for fungi on potato dextrose agar (incubated at 25 °C for 5 days). Substrate chemistry was also analyzed by measuring pH and electrical conductivity (EC). In the greenhouse phase, a phytotoxicity bioassay was conducted by transplanting rooted cuttings of *Impatiens hawkeri* into the treated cocopeat. Plant physiological responses were monitored over eight weeks through performance index based on absorption (PI-Abs) measurements and by tracking growth parameters, including shoot count, leaf number, plant height, and biomass. The experiment was laid out using a Completely Randomized Design (CRD), and data were analyzed using ANOVA at a significance level of $p<0.05$. Results demonstrated dose-dependent antimicrobial efficacy, with fungal reduction substantially exceeding bacterial reduction across all treatments. The 80 ppm treatment showed the highest microbial reduction (41.4% for bacteria and 82.4% for fungi) but proved unsuitable due to increased heat dissipation indicating photosynthetic stress and more pronounced chlorosis symptoms. In contrast, the 60 ppm treatment achieved a substantial microbial reduction (30.0% for bacteria and 75.6% for fungi) while maintaining optimal substrate conditions (pH 6.3, EC 1.4 mS/cm) and showing no significant phytotoxicity. PI-Abs data confirmed preserved photosynthetic function and cellular integrity at 60 ppm. Therefore, the 60 ppm concentration is recommended as the optimal treatment, effectively balancing disinfection efficacy with plant health. This study provides a practical, scientifically-validated protocol for the horticultural industry to mitigate microbial contamination without compromising crop health and productivity.

Keywords: Cocopeat, Calcium Hypochlorite, Disinfection, Microbial Contamination, Phytotoxicity

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Bioactive Potential and Elemental Composition of Wild and Cultivated Kappaphycus alvarezii Morphotypes: Raw vs Boiled

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This study evaluated the antioxidant and antidiabetic potentials, and the trace element and heavy metal contents, in green and brown morphotypes of wild and cultivated seaweed *Kappaphycus alvarezii*, with particular emphasis on the effects of processing (raw vs boiled). Wild and cultivated seaweed samples were collected from Jaffna, Sri Lanka, and analyzed for total phenolic content (TPC), antioxidant potential by Azino-Bis(3-Ethylbenzothiazoline-6-Sulfonic Acid) Radical Scavenging Assay (ABTS), 2,2-Diphenyl-1-picrylhydrazyl Radical Scavenging Assay (DPPH) and Oxygen Radical Absorbance Capacity Assay (ORAC), α-amylase inhibition, and concentrations of trace elements and heavy metals using Inductively Coupled Plasma Optical Emission Spectrometry. (ICP-OES). Results demonstrated that cultivated morphotypes exhibited higher ($p < 0.05$) TPC and antioxidant capacities compared to wild counterparts. Cooking reduced ($p < 0.05$) TPC in both morphotypes regardless of source, indicating thermal degradation and leaching of phenolic compounds. However, DPPH antioxidant activity showed a source-dependent interaction with processing: it increased upon cooking only in wild samples which may be due to cell wall disruption releasing bound antioxidants. Alpha-amylase inhibitory activity was higher in cultivated brown morphotype and decreased after cooking, with a significant interaction effect between source and processing ($p < 0.05$), indicating that cultivated brown morphotype may contain more heat-sensitive inhibitory compounds. Nevertheless, in the green morphotype, inhibitory activity decreased in cultivated samples but increased following cooking ($p < 0.05$). Trace element analysis showed higher ($p < 0.05$) concentrations of Mg, Fe, and Zn in cultivated samples, whereas heavy metal contents varied depending on both source and processing method. Overall, cooking reduced heavy metal concentrations. These results demonstrate that cultivation enhances the bioactive potential of *K. alvarezii*, while cooking alters its antioxidant, antidiabetic, and elemental characteristics, reinforcing the need to consider both source and processing when evaluating its value as a functional food ingredient.

Keywords: *Kappaphycus alvarezii,* Bioactive potential, trace elements, heavy metals, boiled seaweed

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Characterization of Physicochemical, Structural, and Morphological Properties of Starch and Flour from *Nymphaea pubescens* Wild. Seeds

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Seeds of *Nymphaea pubescens* Wild. species is an underutilized edible seed rich in carbohydrates with a potential of contributing to the human diet. Flour and starch extracted from seeds can serve as functional food ingredients and as alternatives to conventional starch sources. This study aimed to characterize extracted starch and flour with respect to structural, physicochemical, and morphological properties. Furthermore, pasta was produced by substituting wheat flour with *Nymphaea pubescens* Wild. seed flour at levels of 15, 30, and 45%. The effect of substitution on cooking quality parameters, including optimum cooking time, water absorption, and gruel solid loss was evaluated. Sensory evaluation was conducted to assess consumer acceptability of the pasta formulations. The seed flour was composed of 78.30±0.11% of carbohydrates, 9.63±0.02% of crude protein, 0.44±0.02% of crude fat, 0.65±0.04% of crude fiber, and 0.55±0.03% of ash. The moisture content of the flour and starch was 10.26±0.14% and 9.04 ±0.78%, respectively. The amylose content of the starch was 18.16±0.68%. Light microscopy revealed that the starch granules were round to oval, with diameters ranging from 20 to 30 µm. The L* value (88.5± 0.55%) of starch indicated satisfactory whiteness. The FTIR spectra of starch and flour confirmed their carbohydrate nature. The water and oil holding capacities of flour were 0.79±0.06 g/g and 1.12±0.15 g/g, respectively. Solubility and swelling power of flour were 2.83±0.76% and 3.28±0.14 g/g, respectively at 80 °C. Among the three pasta formulations, both 15% and 30% wheat flour substituted pasta were acceptable to the consumer panel, offering a novel alternative ingredient with potential nutritional and economic benefits.

Keywords: Starch, Physicochemical Properties, Morphology, Underutilized crop

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Citrus Fiber as a Natural Alternative to Phosphate Salt in Frozen Chicken Sausages

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This study investigated the feasibility of incorporating citrus fiber as a natural alternative to phosphate salts in frozen chicken sausages, responding to the increasing demand for clean-label meat products. Four sausage formulations were developed by partially replacing phosphate salts with citrus fiber: a control sausage formulation with no citrus fiber and three sausage formulations replacing 20%, 40% and 60% of phosphate salt with citrus fiber. Products were analyzed for physicochemical, microbial, and sensory attributes under continuous frozen storage and repeated freeze-thaw (F-T) cycles to simulate real-world cold chain conditions. Results indicated that partial replacement of phosphate salts with citrus fiber maintained ($p > 0.05$) or improved ($p < 0.05$) product quality in terms of drip loss, pH stability, oxidative resistance, and textural integrity during frozen storage, compared to the control. Microbiological analysis confirmed all treatments remained within safe limits throughout the storage period. Texture profile analysis showed that 20% and 60% inclusion level of citrus fiber improved hardness, gumminess and chewiness, while cohesiveness was comparable among treatments ($p>0.05$). Sensory evaluation revealed no significant differences ($p > 0.05$) among treatments in appearance, color, or aroma, while taste, texture, and overall acceptability of sausages with 60% phosphate replacement were comparable to the control. Even after 13 F-T cycles, all samples retained acceptable sensory quality, indicating that citrus fiber preserved flavor and consumer appeal. In conclusion, up to 60% substitution of phosphate with citrus fiber produced chicken sausages with desirable textural, physicochemical, and sensory properties while ensuring microbial safety and freeze-thaw stability. Citrus fiber demonstrates strong potential as a natural, functional ingredient for partial phosphate replacement in Sri Lanka's processed meat industry.

Keywords: Citrus fiber, Phosphate salt, Chicken sausage, Clean-label, Freeze-thaw stability

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Comparative Analysis of Grains, Sprout, and Microgreen of Mung-bean for their Nutritional Properties

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Malnutrition continues to be a prevailing global challenge, particularly in developing regions where access to nutrient-dense food sources is limited. Mung-bean (*Vigna radiata* L.) is a valuable legume widely consumed in Asia and recognized for its rich nutritional profile and functional properties. This study investigated the variation in nutritional and antioxidant profiles of mung bean at three developmental stages; grain, sprout, and microgreen, to determine the best stage of improved nutritional and functional properties. The experiment was conducted as a Completely Randomized Design with four replicates per treatment. Certified seeds (variety M.I. 5) were germinated to produce sprouts (three days) and microgreens (seven days), and samples were analyzed for proximate composition (protein, ash, and moisture), macronutrients (N, P, and K), phytochemical components (total phenolics, carotenoids, and ascorbic acid), chlorophyll content, and antioxidant capacity using standard analytical procedures. The results indicated a clear progressive enhancement of nutritional quality from the grain stage to the microgreen stage. Protein, phenolics, carotenoids, vitamin C, and antioxidant activity were significantly higher ($p<0.05$) in microgreens, while sprouts exhibited intermediate values. The grain stage contained the lowest concentrations of bioactive compounds. These findings demonstrate that mung bean microgreens offer superior nutritional density and functional health benefits when compared to grains and sprouts, making them highly suitable for incorporation into nutrient-dense diets and public health nutrition strategies. The rapid cultivation time, low input requirements, and high biochemical value further position mung bean microgreens as an accessible and sustainable functional food for both household and commercial-scale production.

Keywords: Antioxidant Activity, Functional Foods, Microgreens, Mung-bean, Nutritional Profile

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Comparative Analysis of Paneer Quality and Yield Using a Novel Coagulant versus Conventional Acid Coagulation

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Paneer is a traditional heat-acid coagulated fresh cheese, popular in South Asia. The coagulant use critically influences the paneer yield, quality, and economic viability. Thus, this study evaluated the performance of a novel coagulant (Ezzential 4004) at three concentrations (T2= 0.3%, T3= 0.4% and T4= 0.5%) against conventional acid coagulants (T1= citric acid and T5= acetic acid) in paneer production using standardized cow's milk (5% fat). Fresh milk was subjected to standardized heat treatment (90 °C for 10-15 minutes) followed by coagulation at optimized temperatures. Quality parameters assessed included yield, moisture content, pH, hardness, nutritional losses in whey (fat and total solids), total plate count, and sensory attributes using a consumer panel. Results demonstrated that T2 produced significantly higher ($p<0.05$) yield (20.23%) compared to T1 (15.14%) and T5 (15.46%). T3 and T4 treatments resulted in a paneer yield of 19.76% and 19.70%, respectively. Moisture content varied significantly among treatments, ranging from 43.29% (T5) to 55.53% (T2), all complying with regulatory standards. pH values differed significantly ($p<0.05$), with conventional acids producing lower pH (both T1 and T5= 5.59±0.02) compared to the novel coagulant (T2= 6.29±0.01, T3= 6.22±0.01, T4= 6.13±0.04). No significant differences ($p>0.05$) were observed in hardness or nutritional losses across treatments. Microbiological quality analysis confirmed that all samples remained within acceptable limits ($1.4\text{-}3.9 \times 10^3$ CFU/g). Sensory evaluation by 48 untrained panelists revealed superior consumer acceptance for the novel coagulant, particularly at 0.3% concentration, in texture, mouthfeel, flavor, and overall acceptability. Economic analysis demonstrated that the novel coagulant's superior yield (20.23%) can compensates its higher production cost (Rs.32.61 per kg of paneer) compared to citric acid (Rs.12.36 per kg of paneer). This study establishes the novel coagulant as a viable and advantageous alternative for paneer production, offering enhanced yield, superior sensory quality, and improved economic efficiency.

Keywords: Cottage cheese, Glucono-delta lactone, Citric acid, Acetic acid, Calcium acetate

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Comparative Assessment of Physicochemical and Sensory Characteristics in Black Tea derived from Vegetative and Seedling Cultivars in St.Vigeans Estate in Bogawanthalawa

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Ceylon black tea (*Camellia sinensis* L.) is a globally renowned beverage, yet the impact of propagation methods on its final quality remains poorly understood. This study presents a comparative analysis of the physicochemical and sensory characteristics of black tea produced from vegetatively propagated (VP) and traditional seedling tea, cultivated under identical conditions at St.Vigeans Estate, Bogawantalawa (1546 m above sea level). Sixteen processed black tea samples (8 from each propagation type) were analysed using standardised ISO and AOAC methods. The analysis revealed that proximate composition (moisture, total ash, crude fibre, protein, and fat), total sugars, and mineral content (K, Mg, Na, Fe, Mn, Zn) were not significantly different ($p>0.05$) between the two types, with potassium being the dominant mineral in both. Similarly, key bioactive constituents, including total polyphenols (16-17%), flavonoids (65-78 mg/g), antioxidant activity (65-75%), and caffeine (3-3.5%), showed no significant variation ($p=0.05$). Furthermore, the brew colour, measured by absorbance at 460 nm, was comparable ($p=0.05$). A notable exception was found in the water extract, which was significantly higher in VP samples (39.58±0.47%) than in seedling samples (38.45 ± 0.53%, $p<0.001$). This difference in extractability was reflected in the sensory evaluation, where a professional tea taster assigned significantly higher scores for liquor colour to VP teas (median 2.5 vs 2.0, $p=0.008$). However, no significant differences ($p=0.05$) were detected in aroma, taste, or aftertaste. In conclusion, while the propagation method does not fundamentally alter the core nutritional or bioactive profile of black tea, the use of VP cultivars provides a distinct advantage in terms of brew strength and visual quality, which are critical attributes for market preference.

Keywords: Ceylon black tea, Seedling cultivars, Vegetative propagated tea, Bioactive compounds, Sensory characteristics

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Comparative Assessment of Physicochemical, Microbiological and Chemical Properties Related to Safety and Quality of Conventionally Processed and Boat-Dried Fish in Sri Lanka

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The marine dried-fish industry is a vital component of Sri Lanka's food security and coastal livelihoods. However, the conventional open-air drying method commonly practised along the coast exposes fish to unhygienic environmental conditions, leading to quality deterioration and potential health risks. On-board drying conducted on multiday fishing vessels (boat-dried fish; BDF) has recently emerged as a promising alternative, yet there is limited scientific evidence comparing its safety and quality with that of open-air dried fish (ODF). This study aimed to evaluate and compare the safety, quality, and consumer preference of BDF and ODF, while assessing prevailing processing practices. An exploratory survey was conducted among 40 dried-fish processors representing four major coastal regions. Thirty-two samples of *Katsuwonus pelamis* (Skipjack tuna) and *Scomberoides lysan* (Double-spotted queenfish) were collected from Matara, Hambantota, Negombo, and Puttalam. Samples were analysed for physicochemical, microbiological, and chemical safety parameters relevant to product quality and consumer safety. A paired-preference sensory evaluation (n = 30) was also undertaken. The drying method significantly influenced raw-fish freshness ($p<0.01$) and drying duration ($p<0.01$). ODF exhibited higher salt content, lipid peroxidation, total plate count, and yeast and mould counts ($p<0.05$) than BDF. Several ODF samples exceeded regulatory limits for moisture, histamine, microbial load, and lead, whereas most BDF samples complied with national safety standards. Sensory analysis revealed a significant preference for BDF (76.67%, $p = 0.0026$) due to its superior colour, odour, and texture. Overall, BDF demonstrated enhanced safety, product stability, and consumer acceptance. The findings highlight the potential of on-board drying to strengthen Sri Lanka's food safety framework, add value to marine fishery products, and promote sustainable, health-conscious post-harvest practices of national importance to the fisheries sector.

Keywords: Food security, Boat-dried fish, Open-air dried fish, Food safety, Sensory evaluation

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Comparative Assessment of Postharvest Meat Quality of Whiteleg Shrimp (*Litopenaeus vannamei*) and Giant Tiger Prawn (*Penaeus monodon*) under Different Storage Conditions

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The postharvest quality of Whiteleg Shrimp (*Litopenaeus vannamei*) and Black Tiger Pprawn (*Penaeus monodon*) was evaluated under different storage and packaging conditions to identify optimal strategies for maximizing meat quality and shelf life. The study compared the effects of ice storage (0 °C) and frozen storage (−20 °C), both with and without vacuum packaging, on specific intervals for pH, thiobarbituric acid reactive substances (TBARS), weight loss (%), color (L*, a*, b*), melanosis (ΔE), cooking loss (%), dimensional shrinkage (width-wise %), and texture, along with sensory evaluation of prawn meat quality. Results revealed significant ($p < 0.001$) species-specific differences influenced by muscle structure, water-holding capacity (WHC), and pigmentation characteristics. Whiteleg shrimp exhibited higher weight and cooking losses and higher hardness, attributable to its lower WHC and distinct protein composition. In contrast, Black Tiger prawns demonstrated greater shrinkage due to their denser muscle fibers. Color stability (ΔE) varied markedly between species ($p < 0.001$), reflecting inherent pigment differences. Vacuum packaging effectively reduced pH increase, thiobarbituric acid-reactive substances (TBARS), and weight loss in both species, although sensory improvements during ice storage were only up to 4–6 days, beyond which sensory rejection corresponded with analytical deterioration thresholds. Notably, vacuum-packed samples under ice conditions displayed visible drip loss, particularly in Whiteleg shrimp, indicating that vacuum sealing alone is insufficient for extended storage. Conversely, frozen storage combined with vacuum packaging significantly enhanced ($p < 0.001$) texture, hardness, and color stability while minimizing oxidative degradation. Black Tiger prawns maintained superior sensory quality and appearance for up to 28 days under these conditions. These findings demonstrate that integrating frozen storage with vacuum packaging provides the most effective post-harvest strategy for quality preservation, and Black Tiger prawns demonstrated greater stability and suitability for long-term storage and export compared to Whiteleg shrimp.

Keywords: *Litopenaeus vannamei, Penaeus monodon*, Vacuum packaging, Meat Quality, Storage temperature

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Comparative Development of Protein Hydrolysate from Skipjack Tuna (*Katsuwonus pelamis*) and Yellowfin Tuna (*Thunnus albacares*) Waste Using Papain and Bromelain Enzymes

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Fish processing industries generate large quantities of protein rich waste such as heads, tail and viscera. Which can be valorized through enzymatic hydrolysis into fish protein hydrolysates (FPH) with nutritional and functional applications. This study aimed to develop and compare FPH from Skipjack tuna (*Katsuwonus pelamis*) and Yellowfin tuna (*Thunnus albacares*) waste using papain, bromelain, and their combinations. These crude enzymes were prepared by using raw papaya (*Carica papaya L.*) and pineapple (*Ananas comosus*). The six enzymatic treatments that were prepared to produce FPH are control (no enzyme), 100% papain, 100% bromelain, and papain–bromelain combinations at 25:75, 50:50, and 75:25% ratios. The hydrolysates were evaluated for yield, proximate composition, degree of hydrolysis, peptide chain length, functional properties, and microbial quality. Treatment type significantly influences the yield ($p < 0.05$), while the main effect of species and interaction effect were not significantly influence on protein yield ($p > 0.05$). The highest yield was observed with 100% papain (6.43g/100 g for Skipjack and 5.11g/100 g for Yellowfin tuna). Therefore, papain has superior proteolytic efficiency. Skipjack FPH prepared by papain exhibited higher degree of hydrolysis (11.37%), protein solubility (68.57%), water binding capacity (4.12g/g) and foaming capacity (29.33%), while Yellowfin showed a slightly averaged peptide chain length11.78), oil binding capacity (2.04g/g). Proximate analysis of Skipjack tuna revealed high protein content (51 4%), low fat (<1%), and acceptable moisture (<9%) and microbial counts were within safe limits. It confirms the product safety. The study concludes that papain rich hydrolysis of Skipjack tuna waste produces high quality FPH suitable for food and feed applications. Enzymatic valorization using natural proteases thus offers a sustainable approach for reducing tuna processing waste while generating value added protein products.

Keywords: Fish protein hydrolysate (FPH), Papain and bromelain enzymes, Skipjack and Yellowfin tuna, Functional properties, Sustainable waste valorization

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Comparative Quality Analysis of Fish Oil Extracted from Skipjack (*Katsuwonus pelamis*) and Yellowfin Tuna (*Thunnus albacares*) Viscera

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This study compared the physical, chemical, and microbial quality parameters of fish oils extracted from skipjack (*Katsuwonus pelamis*) and yellowfin tuna (*Thunnus albacares*) viscera using a modified wet rendering method. Samples were collected from local fish markets in Kandy, Sri Lanka, and they were analyzed for oil yield, viscosity, refractive index, peroxide value, saponification value, iodine value, free fatty acid content, total lipid content, and microbial quality. Statistical analysis was performed using one-way ANOVA and Tukey's HSD test ($p < 0.05$). Significant differences ($p < 0.001$) were observed in oil yield, refractive index, peroxide value, iodine value, saponification value, free fatty acid percentage, total lipid content, and yeast–mold count between the two species. Yellowfin tuna oil exhibited significantly higher oil yield (4.21 ± 0.19 %) and total lipid content (25.00 ± 1.53 %) compared to skipjack oil (2.58 ± 0.08 % and 10.14 ± 0.83 %, respectively). Skipjack oil showed significantly higher viscosity ($p = 0.007$), peroxide value (46.67 ± 3.33 meq O_2/kg), and free fatty acid content (6.93 ± 0.09 %) than yellowfin oil (43.33 ± 3.33 meq O_2/kg and 5.73 ± 0.09 %). Yellowfin oil displayed a slightly higher refractive index (1.010 ± 0.005) and lower saponification value (174.00 ± 2.00 mg KOH/g), indicating a higher proportion of long-chain fatty acids. Both oils were free from *E. coli*, while total viable count showed no significant difference ($p = 0.079$). Yeast and mold counts were significantly higher ($p < 0.001$) in skipjack oil. Overall, yellowfin tuna oil demonstrated superior quality characteristics and higher lipid yield, suggesting greater suitability for nutraceutical and industrial applications, although further refining is required to meet international standards.

Keywords: Fish oil, Tuna viscera, Yellowfin tuna, Skipjack tuna, Quality analysis

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Comparison of Milk Quality at Three Different Chilling Centers Located in Three Different Agro-climatic Zones of Sri Lanka.

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This study was conducted to evaluate the quality of raw milk from three distinct climatic zones in Sri Lanka, Giradurukotte (low country intermediate zone), Haputale (upcountry intermediate zone) and Vishwamadu (low country dry zone), to assess the quality of milk received through different supply routes at the Vishwamadu Milk Collecting Center (MCC). The specific objectives were to determine the influence of agroclimatic and supply chain logistics on key quality parameters. Physicochemical parameters (fat, SNF, protein, FFA) and adulterants such as bicarbonate (HCO_3-) and sucrose were determined using a FOSS MilkoScan™ FT3. Data were subjected to a one-way analysis of variance (ANOVA). The results revealed a highly significant ($P<0.01$) effect of the collection center on most quality parameters. Significant differences were found for Fat ($F = 10.17$, $P=0.0026$), SNF ($F = 31.29$, $P<0.0001$), Protein ($F = 23.16$, $P<0.0001$), HCO_3 ($F = 78.38$, $P<0.0001$) and Sucrose ($F = 7.52$, $P=0.0076$). In contrast, no significant difference was observed for FFA ($F = 2.67$, $P=0.1097$). Post-hoc LSD tests indicated that milk from the dry zone (Vishwamadu) consistently exhibited the highest mean values for the significant components, while the up-country zone (Haputale) generally yielded the lowest. It is concluded that the agro-climatic zone significantly influences the composition of raw milk, with the dry zone demonstrating superior quality metrics for most parameters, suggesting the potential for region-specific management strategies to optimize milk quality.

Keywords: Milk Quality, Climate zones, Fat, SNF, Protein, Sri Lanka

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Detection of Bee Honey Adulteration with Sugar and Rock Bee Honey Additions through Physicochemical Characterization

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This study aimed to determine the effect of two common adulterants, sucrose solution (SS) and rock bee honey (RBH), at varying concentrations (10%, 20%, 30%, 40% w/w) on the physicochemical properties of pure bee honey (*Apis cerana*). Adulterated samples were prepared and analyzed for key parameters like pH, total soluble solids (TSS), moisture content (MC), electrical conductivity (EC), viscosity, and free acidity (FA). The results indicated that while the type and level of adulteration had a statistically significant impact based on Generalized Linear Model ($p < 0.05$) on all measured properties. Most values for individual parameters, including TSS, EC, pH, and FA remained within the acceptable limits defined by Codex Alimentarius. Notably, moisture content was the sole parameter that exceeded the maximum standard limit (20%) upon adulteration. Correlation analysis revealed that pH, and MC showed a positive correlation with levels of both adulterants, whereas viscosity and TSS showed a negative correlation. EC and FA exhibited a positive correlation with RBH and a negative correlation with SS adulteration. While routine analysis of individual physicochemical parameters proved insufficient for definitive detection of low-level adulteration, multivariate Principal Component Analysis (PCA) successfully differentiated pure honey from all adulterated samples. The PCA biplot further indicated that sucrose solution adulteration caused more significant quality degradation compared to rock bee honey blending. The study concludes that a multivariate approach is more effective than relying on individual standard tests for authenticating honey and detecting adulteration practices.

Keywords: Adulteration, Bee honey, Sucrose solution, Rock bee honey

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Determination of Glycaemic Index of Atta-Based Foods (Chapati, Puri, and Roti) and Modulatory Effect of Chickpea Curry as a Carrier Food

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The glycemic index (GI) is a measure of the postprandial glycaemic response of carbohydrate-rich foods, providing valuable information for dietary planning and metabolic health. This study evaluated the GI and glycaemic load (GL) of three commonly consumed atta-based foods, namely chapati, roti, and puri, and investigated the modulatory effect of chickpea curry when served as a carrier food. The test foods were prepared under standardised conditions and administered to healthy adult volunteers using glucose as the reference food. The mean GI values (± standard error) were 45 ± 5.5 for chapati, 44 ± 8.6 for roti, and 50 ± 8.0 for puri, classifying all three as low-GI foods. When consumed with chickpea curry, GI values were chapati 42 ± 5.7, roti 37 ± 7.0, and puri 46 ± 4.0. The GL values for typical edible portions were 19.1 (chapati), 18.3 (puri), and 16.5 (roti), also categorising them as moderate-GL foods. Statistical analysis revealed no significant difference ($p > 0.05$) in GI values between foods consumed alone and those consumed with chickpea curry, confirming that chickpea curry serves as a supportive carrier food without an adverse impact on glycemic response. These findings highlight that atta-based staple foods provide a favourable glycaemic profile, and their combination with chickpea curry may be recommended in culturally relevant meal planning for glycemic control.

Keywords: Glycemic index, Glycemic load, Atta-based foods, Chickpea curry, Low-GI foods

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Development and Characterization of a Novel Composite Flour from Jackfruit (*Artocarpus heterophyllus*) Waste (Rind, Rags, and Core): Optimization of Blending Ratios and Nutritional Profiling for Wheat Flour Substitution

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Jackfruit (*Artocarpus heterophyllus*) is regarded as an underutilized tropical crop. The non-edible parts (waste), such as the rind, rags, and core, make up around 60% of the total fruit weight and are usually discarded, polluting the environment. Thus, this research aimed to develop a novel composite flour utilizing jackfruit waste as a partial or complete substitute for traditional wheat flour. The fresh jackfruits were harvested, cleaned, cut into strips and dried at 60 ^{0}C in a dry air oven for 16 h. The samples were then ground and sieved through a 200 µm mesh to produce jackfruit waste flour. Three composite flour formulations were developed by incorporating jackfruit waste flour (JWF), jackfruit bulb flour (JBF) and wheat flour (WF) at different ratios, while 100% wheat flour served as the control (F1 = 1JWF:1JBF:1WF, F2 = 1JWF:2JBF, F3 = 1JWF:1.5JBF:0.5WF). All flour samples were tested for proximate composition, functional properties and physical characteristics. JWF reported a significantly higher ($p<0.05$) crude fibre content (16.29±0.43%) compared to the JBF, WF and all composite flours. Among the composite flours, F2 had the highest crude fibre content (8.53±1.20%). All three composite flours reported significantly higher ($p<0.05$) crude fibre, crude fat, total ash, water holding capacity (WHC), oil holding capacity (OHC) and solubility compared to the control. However, there were no significant difference ($p>0.05$) in crude fibre, crude fat, carbohydrate, OHC, swelling power and solubility among the blend samples. Overall, the F1 sample indicated the highest potential for substituting wheat flour with a moisture content of 10.07±0.06%, 9.72±0.6% crude protein, 3.4±0.04% total ash, a WHC of 3.37±0.42 g/g, and an OHC of 1.23±0.04 g/g. Thus, it can be concluded that waste flour development from jackfruit waste could be blended with JBF and wheat flour to develop a composite flour with higher fibre content.

Keywords: Jackfruit waste flour, Jackfruit Bulb flour, Fibre-rich, Functional properties

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Development and Characterization of Biodegradable Cassava (*Manihot esculenta*) Starch Film Incorporated with Lotus Petal (*Nelumbo nucifera*) Extract for Skipjack Tuna (*Katsuwonus pelamis*) Fish Fillet Preservation

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This research study aimed to extend the shelf life of skipjack tuna fillets using biodegradable films prepared from cassava starch incorporated with lotus petal extracts through the solvent casting method. Biodegradable films were developed using 3% cassava starch (v/w) and 20% glycerol as a plasticizer, with lotus petal extract 1%, 2% and 3% (T1,T2,T3 respectively) at volume basis and required amount of distilled water to make final volume as 100mL. A starch-only film was used as the control. The developed films were evaluated for the properties like thickness, water vapor permeability, moisture content, and biodegradability at the significance level of $P<0.05$. Among the treatments, 3% lotus incorporated film exhibited the highest thickness (0.19±0.02 mm), while the lowest water vapor permeability was observed in the film with 2% lotus petal extract ($6.21\times10^{-10}\pm3.46\times10^{-10}$ gm/m^{2}sPa). The biodegradability test revealed faster degradation in 2% lotus petal incorporated film compared with other treatments, indicating improved environmental compatibility. The developed biodegradable films were used to wrap skipjack tuna fillets, and unwrapped fillet was left as the control. Fillets were stored under refrigerated conditions ($4\pm1\,^0$C) for 0,3 and 6 days to assess quality changes. Fillets wrapped with the 3% lotus incorporated film maintained the lowest pH (5.52±0.01), TBARs value (2.52±0.05 mg MDA/kg), and total plate count (4.79±0.06 log CFU/g) on day 6, indicating delayed lipid oxidation and microbial growth. Sensory evaluation revealed that fillets wrapped with the 2% lotus incorporated film achieved the highest overall acceptability compared with other treatments. The results demonstrated that cassava starch-lotus petal extract films can effectively improve the quality and extend the shelf-life of refrigerated skipjack tuna fillets by 3 days than the control while offering a biodegradable alternative to synthetic packaging materials.

Keywords: Biodegradable, Cassava starch, Lotus petal extracts, Shelf-life, Natural preservation

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Development and Characterization of Biodegradable Composite Packaging for Yoghurt

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The increasing environmental impact of single-use plastic packaging has intensified the demand for biodegradable alternatives in the food sector. This study developed and evaluated a biodegradable yoghurt cup formulated from corn cob powder, corn flour, sawdust, and gelatin, with a beeswax coating applied to enhance barrier performance. The objective was to assess its physicochemical, mechanical, and functional suitability in comparison with a commercial plastic yoghurt cup. Three formulations were initially prepared, and the most suitable ratio was selected based on leakage resistance and water absorption tests. The optimized cup prototype was molded, oven-dried, coated with beeswax, and analyzed for physical properties (wall thickness, weight, density, and volume), barrier properties (moisture content and water absorption), and functional performance of packaged yoghurt (pH, titratable acidity, and microbial load). The developed cup exhibited significantly higher side-wall thickness (0.46±0.02 mm) and bottom-wall thickness (0.67±0.07 mm) than the commercial cup (0.12±0.00 mm and 0.21±0.02 mm, respectively) ($p < 0.05$). Weight and density were also higher (28.03± 1.51 g; 0.95±0.03 g/cm³) compared to the plastic cup (2.87±0.00 g; 0.35±0.01 g/cm³), indicating greater structural rigidity. Barrier analysis showed increased moisture content (6.00±0.19 %) and water absorption (4.15±0.08 % per 24 h) relative to plastic (0.00 %), attributed to the hydrophilic nature of lignocellulosic fibers, but beeswax coating successfully reduced excessive uptake. Functional evaluation of packaged yoghurt revealed no significant differences between cups in pH (4.46 vs 4.50), titratable acidity (1.01 % vs 1.02 % LA), or microbial load (6.84×10^7 vs 6.69×10^7 CFU/mL) ($p > 0.05$), confirming that the developed cup did not interfere with fermentation, storage stability, or microbial safety. These findings demonstrate that agro-waste-based bio-composites can provide a structurally reliable, food-safe, and environmentally friendly alternative to plastic yoghurt cups, with potential for commercial adoption following barrier optimization and cost reduction at scale.

Keywords: Corn-cob powder, Beeswax, Biodegradable, Packaging, Yoghurt

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Development and Characterization of Low-Calorie, Low-Glycemic Index Alternatives to Butter and Banana Cake Formulations for Health-Conscious Consumers

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Type 2 diabetes, affecting 23% of Sri Lankan adults is strongly linked to high-sugar, high-fat bakery products. This research developed low-calorie, low-glycemic index cake alternatives using sucralose as a sweetner, inulin as a fat replacer and fibre source, and replacing margarine with sunflower oil. Formulations were evaluated using proximate composition analysis using selected AOAC methods, physicochemical characterisation, in vivo glycemic index determination (ISO 26642:2010 protocol), and sensory evaluation (35 panellists). Treatment butter cakes showed fat reduction of 47.2% (32.61 ± 0.02% to 17.23 ± 0.02%) and treatment banana cakes a 42.2% (25.42 ± 0.03% to 14.70 ± 0.03%), reduction whilst protein increased by 54.3% in butter cakes (8.17 ± 0.12% to 12.61 ± 0.03%) and by 55.2% in banana cakes (7.55 ± 0.13% to 11.72 ± 0.03%). Glycemic index improvements were exceptional: treatment butter cake reduced from 84.35 ± 3.37 to 51.24 ± 5.64 (39.3% reduction) and treatment banana cake from 75.80 ± 2.28 to 48.49 ± 3.73 (36.0% reduction), transitioning from "high GI" (>70) to "low GI" (<55) categories. Sensory evaluation showed sucralose formulations achieved superior acceptability (1.59 ± 0.03 for butter, and 1.8 ± 0.02 for banana) compared to alternative sweetener systems. Treatment formulations achieved 36-39% glycemic index reduction and 42-47% fat reduction whilst increasing protein content and maintaining sensory quality, positioning them as therapeutic alternatives for diabetic and health-conscious consumers.

Keywords: Functional foods, Low-glycemic index, Bakery products, Sucralose, Inulin

Acknowledgement: DPO INTERNATIONAL, Colombo, Sri Lanka.

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Development and Characterization of the Prebiotic Incorporated Biscuit using Sprouted Mung Bean and Sprouted Red Rice Flour

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The growing global demand for functional foods necessitates the development of cost-effective, natural sources of prebiotics. Germination enhances the nutritional characteristics of cereals and legumes. This research aimed to develop a prebiotic-enriched biscuit using a composite flour blend of sprouted mung bean (*Vigna radiata*) and red rice (*Oryza sativa*). Biscuit samples were formulated using 20% sprouted mung bean flour (36h germination) and 20% sprouted red rice flour (24h germination) under optimized soaking conditions, blended with 60% wheat flour. Chemical analysis of the selected biscuit sample revealed resistant starch content of 5.14%, crude fiber 1.84%, crude protein 11.6%, crude fat 24.92%, ash content 3.76%, gross energy 470 kcal/100g, total phenolic content 8.52 mg GA/g, and antioxidant activity 0.67% (DPPH assay). Physical property evaluation showed a diameter of 4.09 cm, thickness of 0.35 cm, spread ratio of 8.6, baking loss of 0.27%, and hardness of 15.28 N. Sensory analysis indicated that biscuits with sprouted flours incorporation had a significantly higher scores ($p < 0.05$) for texture, odor, taste, and overall acceptability. This study demonstrates that sprouted mung bean and red rice flours are excellent natural ingredients for enhancing the nutritional and sensory qualities of biscuits, providing a prebiotics and promising avenue for functional food development.

Keywords: Prebiotic biscuit, Sprouted flour, Functional food, Mung bean, Red rice

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Development and Evaluation of a Nutrient and Energy-Enriched, Gluten Free Chocolate-Coated Cereal cookie to Meet Additional Dietary Needs of Children

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The rising prevalence of childhood obesity and diet-related non-communicable diseases underscores the urgent need for healthier, more nutritious snack alternatives. This study aimed to develop and evaluate a nutrient and energy-enhanced, gluten-free, chocolate-coated cereal cookie to meet the additional dietary needs of children over three years of age. A formulation was optimized using a mixture of horse gram, chickpea, and red rice combined with margarine, milk powder, sugar and sesame seeds as ingredients. Soya lecithin and sodium bicarbonate were used as food additives. Soya lecithin was enhanced the emulsifying, stabilizing and wetting properties of dough mixture where the sodium bicarbonate facilitated the leavening properties. The selected formulation demonstrated highest sensory attributes, as determined by trained sensory panel of Anods Cocoa (Pvt) Ltd. Proximate analysis confirmed a balanced nutritional profile, providing 413 kcal/100g, with 11.73% protein, 25.08% fat, 44.21% carbohydrates, and 4.23% dietary fiber. Physicochemical properties including low water activity (0.461) and appropriate texture (hardness; 11.27$Nmm^{-2}s^{-1}$) ensuring product stability and quality. The chocolate coating enhanced structural rigidity without compromising microbial safety. This research successfully developed a gluten-free, cereal cookie formulation with an improved nutritional profile, fulfilling additional dietary requirements with providing a best alternative to support healthier snacking habits among children.

Keywords: A cereal cookie, Nutrient-enrichment, Sensory evaluation, Proximate composition, Physicochemical properties.

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Development and Evaluation of Yellow Mealworm (*Tenebrio molitor*)-Based Protein Bars: Nutritional and Sensory Properties

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In Sri Lanka, edible insects remain largely untapped despite their high nutritional value. This study aimed to evaluate the potential use of yellow mealworm (*Tenebrio molitor*) flour in the formulation of protein bars. Food grade mealworm flour was received from Tecma Food, Leça do Balio, Portugal. Mealworm flour was roasted at three temperatures (90 °C, 110 °C, and 130 °C) and analyzed for swelling capacity, water- and oil-holding capacities, lipid peroxidation, total phenolic content, and sensory attributes. Roasting temperature did not affect ($p > 0.05$) physicochemical properties or lipid peroxidation of flour; however, the flour roasted at 130 °C produced a more pleasant aroma and was selected for protein bar formulation. Three types of protein bars were prepared: a control (CB, 0% mealworm flour), 12MB (12% mealworm flour), and 15MB (15% mealworm flour). Proximate composition, lipid peroxidation (Thiobarbituric Acid Reactive Substances - TBARS), and sensory properties of protein bars were evaluated. The incorporation of mealworm flour ($p < 0.05$) increased protein, fat, and fiber contents compared to the control, i.e., 21.52 ± 0.75% protein, 12.61 ± 0.74% fat, and 4.04 ± 2.06% fiber in 15MB versus 12.93 ± 1.82%, 10.50 ± 1.95%, and 2.93 ± 0.25% in CB. The TBARS value of the 15MB bars remained similar ($p > 0.05$) to that of the control, whereas the 12MB bars exhibited lower ($p < 0.05$) TBARS value. Sensory evaluation revealed that the 15MB was the most preferred ($p < 0.05$), showing strong consumer acceptance. Furthermore, mealworm inclusion reduces the production cost of protein bars, lowering it from 5 LKR per 100 g bar. In conclusion, yellow mealworm flour can be successfully incorporated into protein bar formulations to enhance nutritional value, maintain product stability, and reduce production costs, supporting its potential as a sustainable protein source for future food innovations in Sri Lanka.

Keywords: Insects, Yellow mealworm, Roasting, Protein bar, Sensory properties

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Development and Formulation of a Novel Pumpkin-Based (*Cucurbita maxima*) Spread

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This study aimed to develop and evaluate a novel pumpkin-based spread using *Cucurbita maxima* to promote the processing and value addition of locally available, nutrient-rich pumpkin varieties. Pumpkin was selected for its high β-carotene, dietary fiber, and antioxidant content, as well as its limited utilization in Sri Lanka's food industry. The objective was to formulate healthy, stable pumpkin spreads with acceptable physicochemical, sensory, and microbiological properties through the incorporation of emulsifiers, fat sources, and natural flavor enhancers. Three formulations were developed: a control base spread (T1) containing pumpkin, salt, and soy sauce; a seed-based spread (T2) incorporating 20 g of pumpkin seed powder as a natural fat source; and a fat-enriched spread (T3) containing 100 g of vegetable fat. Lecithin was used as an emulsifier, soy sauce as an umami enhancer, and potassium sorbate as a preservative. The products were analyzed for moisture, ash, and crude fat content, spreadability, microbial safety, and sensory attributes using a 9-point hedonic scale with 30 trained panelists. Results showed that the T3 formulation exhibited the highest spreadability (59 ± 1 mm) and significantly higher sensory scores ($p < 0.05$) for color, aroma, texture, taste, and overall acceptability. Proximate analysis indicated that T3 contained approximately 42.9% moisture, 40.6% crude fat, and 7% ash, while total plate count (TPC) revealed minimal microbial growth, confirming the preservative effect of potassium sorbate (100 mg/g) and low water activity. Fat enrichment and emulsifier incorporation notably improved the texture, spreadability, and sensory quality of pumpkin spreads. The findings provide a foundation for industrial-scale production of nutritious, functional spreads using locally sourced pumpkins, supporting sustainable growth in Sri Lanka's food processing sector.

Keywords: *Cucurbita maxima*, Functional spread, Value addition, Spreadability

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Development and Quality Determination of Young Jackfruit (*Artocarpus heterophyllus* Lam.) based Microbially Fermented Food Products

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Natural lactic acid fermentation offers a cost-effective strategy for adding value, enhancing safety, and improving sensory quality. This study was conducted to determine the effects of salt level and acetic acid on fermentation, and to develop fermented young jackfruit products. Eight treatments were prepared using salt concentrations of 6, 8, 10, and 12% (w/v), each with and without 0.2% acetic acid, and fermented for 7 days at 27 ± 3°C. Brine and particle pH, titratable acidity (TA), salinity, and °Brix were measured on Days 1, 3, 5 and 7. Data were analysed by two-way ANOVA (factors: Treatment, Day; $\alpha = 0.05$). At day 5, ATR-FTIR spectra qualitatively confirmed the availability of lactic acid. Sensory evaluation used 9-point hedonic scores for fermented samples and a ranking test ($n = 30$) for product prototypes. Day and Treatment significantly affected all chemical parameters, with significant interactions ($p < 0.01$). pH declined rapidly and stabilised by Day 5, while TA reached maximum at Day 5; °Brix decreased with time; salinity diminished as salt diffused into the tissue. Acetic-acid treatments achieved significantly lower pH and higher TA than non-acetic pairs, with 8% and 10% salt with acetic giving the strongest acidification at Day 5. ATR-FTIR confirmed availability of lactic acid (≈1730, 1550, 1410 cm^{-1}) at Day 5. Day 5 is an optimum endpoint for young jackfruit fermentation. Brine at 8% and 10% with 0.2% acetic acid yields superior chemical profiles and consumer acceptance. Sensory means favoured Day-5 ferments; product ranking indicated the highest acceptance for 8% salt with acetic-treated fermented young jackfruit chutney, and then 8% salt with acetic-treated fermented young jackfruit curry, and third strong liking was for 10% salt with acetic-treated fermented young jackfruit pickle.

Keywords: Young jackfruit, Lactic acid fermentation, ATR-FTIR, Sensory evaluation

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Development and Quality Evaluation of Spiced Pineapple and King Coconut Juice

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Beverages play an important role in nutrition and hydration. However, many fruti based beverages in the local market contains high sugar content and synthetic additives. Therefore, the current study focused on the development and quality evaluation of a spiced beverage utilizing pineapple (*Ananas comosus*) and king coconut (*Cocos nucifera var. aurantiaca*) with added spices (i.e pepper, cardamom, green chilli, and ginger). The formulations were prepared by blending pineapple and king coconut water at a 4:1 ratio, and the spice extracts were incorporated in varying concentrations to develop four distinct formulation series with each spice. Physicochemical parameters including the pH, total soluble solids, titratable acidity, ascorbic acid content, total phenolic compounds (TPC) and the antioxidant activity were assessed for each sample. Sensory evaluations were conducted using a panel of 35 untrained participants to assess color, flavor, taste, aroma and overall acceptability. Preliminary analysis identified the best formulation from each series (0.2% cardamom, 0.75% pepper, 3% ginger and 0.3% green chilli). Further analysis with the selected samples indicated that the ginger-based sample had the highest sensory acceptance with respect to all sensory parameters. This sample reported a pH of 3.61(SD=0.103), 9.96 (SD=0.125) brix, 2.65 (SD=0.64) mg/100mL Vit c, TPC of 0.046mg GAE/g (SD= 0.025) and an antioxidant activity of 13.3 mg AAE/g (SD= 0.036). Microbial analysis confirmed that the product met safety standards during storage for one week in refrigerated condition (total plate count= 58.5 CFU/mL on day 7. This innovation supports agro-industrial value addition in Sri Lanka and aligns with current global trends in functional beverage development. The findings demonstrate the potential of combining pineapple and king coconut water with local spices to produce a natural, health-oriented beverage with enhanced functionality and sensory appeal.

Keywords: Functional beverage, Pepper, Cardamom, Green chilli, Ginger

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Development of a Fruit Coating Derived from Polysaccharides Extracted from Banana (*Musa* spp.) Peel and Evaluation of Its Effectiveness in Enhancing the Postharvest Quality and Shelf Life of Selected Fresh Fruits

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With the global population continuing to rise, food waste has emerged as a major challenge to food security and environmental sustainability. Banana (*Musa* spp.), one of Sri Lanka's most widely cultivated and consumed fruits, generates substantial quantities of peel waste during processing and consumption. Despite being rich in polysaccharides and bioactive compounds, banana peel remains largely underutilized. This study aimed to develop an eco-friendly fruit coating derived from banana peel polysaccharides and to evaluate its potential in extending postharvest quality and shelf life of selected climacteric fruits – mango, banana, guava, and avocado. Pectin and cellulose were extracted from the peels of three local banana varieties (*Ambul, Ambun*, and *Seeni*) using acid and alkaline extraction methods, respectively. The highest polysaccharide yields were recorded for the *Ambul* variety (pectin: 39.47 ± 1.26%; cellulose: 22.10 ± 3.01%). Three coating formulations – pectin, cellulose, and a pectin-cellulose composite were prepared, characterized for physicochemical properties (thickness, moisture content, water solubility, opacity, and colour), and applied to fruits stored at 25 °C. Postharvest quality was evaluated through weight loss, firmness, pH, titratable acidity, total soluble solids, colour, and sensory appearance at regular intervals. Results revealed that coating treatment significantly ($p < 0.05$) affected both physicochemical and sensory parameters. Among treatments, the cellulose coating exhibited superior performance, effectively minimizing moisture loss, delaying ripening, and maintaining firmness compared to the control. The pectin and composite coatings also demonstrated notable improvements in quality retention. These findings confirm that banana peel-derived polysaccharides can serve as sustainable, biodegradable alternatives to synthetic coatings. The research underscores the national importance of banana waste utilization in strengthening Sri Lanka's circular bioeconomy, reducing postharvest losses, and enhancing food security. By transforming agro-waste into value-added materials, this study supports sustainable agriculture, rural income diversification, and environmentally responsible innovation within the country's fruit and food industries.

Keywords: Banana peel, Pectin, Cellulose, Fruit coating, Postharvest quality

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Development of a Functional Beverage from Water Extract of Fenugreek with *In Vitro* Lipase and α-Amylase Inhibitory Properties

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The rising prevalence of non-communicable diseases (NCDs), including type 2 diabetes and obesity, has intensified global efforts to develop functional beverages with proven health-promoting properties. Fenugreek (*Trigonella foenum-graecum* L.), locally known as "Ulu Hal" in Sri Lanka, is a traditional spice rich in alkaloids, flavonoids, and saponins that exhibit significant antidiabetic and lipid-lowering activities. However, its strong bitterness limits consumer acceptability and commercial utilisation. This study aimed to develop a Ready-to-Serve (RTS) functional beverage using fenugreek water extract by reducing bitterness while retaining its bioactivity. Ultrasound-assisted extraction was performed at 45–55 °C with a 1:10 seed-to-water ratio for 1, 2, and 3 h to determine optimal extraction time. The 2 h extract yielded the highest extraction efficiency and was selected for beverage formulation. To enhance sensory appeal, natural flavouring agents pineapple, ginger, and lime were incorporated alongside a low-calorie sweetener blend of sucralose, isomaltulose, and acesulfame-K. Fifteen formulations were prepared using three flavour combinations (pineapple–ginger, pineapple–lime, and lime–ginger) at five ratios (1:0, 1:1, 2:1, 3:1, and 4:1). Sensory evaluation included ranking tests to identify the least bitter and most acceptable formulations, followed by a 9-point hedonic scale assessment for appearance, aroma, taste, mouthfeel, and overall acceptability. The three most preferred formulations were analysed for Total Soluble Solids (TSS), Titratable Acidity (TA), and pH. Functional efficacy was evaluated through *in vitro* pancreatic α-amylase and lipase inhibition assays, using methanol extract data from prior studies as a benchmark. The fenugreek water extract exhibited significant ($p < 0.05$) inhibitory activity, achieving 11.13% pancreatic lipase and 8.95% α-amylase inhibition, confirming its potential in managing metabolic disorders. This research demonstrates a novel approach to developing consumer-acceptable, fenugreek-based functional beverages, supporting the Sri Lankan food sector in addressing NCD challenges while expanding market opportunities for value-added health-oriented products.

Keywords: Functional Beverage, Bitterness Masking, α-Amylase Inhibition, Lipase Inhibition, Sensory Evaluation

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Development of a Functional Stirred Yogurt Enriched with Palmyrah Sprout Flour (*Borassus flabellifer*)

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The current study evaluated the effectiveness of incorporation of palmyrah *(Borassus flabellifer)* sprout flour on physicochemical and sensory properties of probiotic stirred yoghurt. The flour was incorporated into stirred yoghurt formulations at different concentrations (control: 0%, T2: 2.5%, T3: 5%, and T4: 10%, w/v) and evaluated for physicochemical, microbiological, chemical composition, and sensory characteristics of fresh and stored yoghurts (stored at 4°C for 7, 14, and 21 days). The findings indicated that when 5% palmyrah sprout flour was added to stirred synbiotic yoghurt, it increased *Streptococcus thermophilus* viability (9.43 log CFU/g vs. 8.3 log CFU/g in the control $p<0.05$), reduced syneresis (4% vs. 16.33% in the control).Sensory evaluation revealed superior taste, texture, aroma and mouth feel in flour enriched yoghurt, achieving significantly higher scores than the control yoghurt ($p<0.05$). The incorporation of palmyrah flour did not have a statistically significant effect ($p > 0.05$) on the protein, fat, gross energy, and ash content of the treatments. Overall, the study demonstrated that fortifying stirred yoghurt with 5% palmyrah flour significantly enhanced its physicochemical, sensory and microbiological properties.

Keywords: Palmyrah sprout flour, Probiotic culture, Physicochemical properties, Sensory attributes, Stirred yoghurt

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Development of a Herbal Tea Using the Bael (*Aegle marmelos*) Fruit Peel Extract by Optimising Spray-Drying Conditions and Characterizing Its' Functional Properties

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The rising global demand for sustainable, antioxidant-rich beverages highlights the importance of valorising agro-industrial by-products to enhance food security and reduce waste. Bael (*Aegle marmelos*), widely cultivated in Sri Lanka, is a highly nutritious and health-promoting fruit. However, its peel is frequently discarded during processing, despite being rich in polyphenols, flavonoids, and essential oils with promising functional properties. This study aimed to develop an instant functional herbal tea from bael peel by optimising spray-drying parameters to preserve bioactive compounds and sensory attributes. Mature bael fruits were sun-dried, ground, and sieved into different particle sizes, and the 0.180 mm fraction was selected for efficient extraction. Hot-water extraction was carried out at 60–65 °C for 1.5 h, and extracts were blended with maltodextrin at 0.6%, 0.8%, 1.0%, and 0.6% + 10% essential oil before spray drying at 140–160 °C (inlet) and 75–85 °C (outlet). Extraction efficiency averaged 88.5 ± 0.3%, while spray-drying efficiency and final moisture content (0.07–0.11%) showed no significant differences ($p > 0.05$). Sensory evaluation ($n = 35$) indicated that the 0.6% maltodextrin treatment (T_1) was most preferred for flavour, colour, and aroma. Total phenolic content (TPC), total flavonoid content (TFC), and antioxidant activity (DPPH assay) were determined for both the hot-water extract and reconstituted tea (1.5 g/75 mL). Statistical analysis using a Completely Randomized Design (CRD) and Tukey's test showed that T_1 exhibited significantly higher ($P<0.05$) TPC and TFC and superior antioxidant capacity compared with the hot-water extract. The product demonstrated moderate hygroscopicity (~1.6%) and superior stability in aluminium-foil sachets, while microbial load (4×10^3 CFU/g) complied with SLS 516 standards. The study demonstrates the potential of bael peel waste for developing antioxidant-rich functional beverages, strengthening Sri Lanka's circular bio economy and food security through sustainable value addition.

Keywords: *Aegle marmelos*, Spray drying, Phenolic content, Antioxidant activity, Functional tea

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Development of a Jelly with Functional Properties Utilizing Nutmeg Pericarp

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Nutmeg *(Myristica fragrans)* is an aromatic tropical spice crop widely used for its seed and aril, while the pericarp is often discarded despite being the largest part of the fruit. This study aimed to develop a functional jelly from nutmeg pericarp and evaluate its sensory, physicochemical, antioxidant properties and shelf-life. Fresh nutmeg fruits were categorized into three ripening stages based on aril color (white, pink, and red), and juice extracted from each stage was analyzed for its pH and total soluble solids (TSS) to determine the most suitable maturity stage for the jelly preparation. Following the identification of the optimal ripening stage within the pH range 3.0 - 3.3 and highest TSS value, four jelly formulations were prepared by varying sugar and pectin concentrations and sensory evaluation was done using a 9-point hedonic scale with 30 untrained panelists. The most preferred formulation was then subjected to physicochemical, antioxidant, and shelf-life analyses. The red aril stage demonstrated the optimal characteristics, with pH 3.16 ± 0.03 and TSS 4.13 ± 0.15 °Brix. Sensory evaluation identified formulation F3 as the most acceptable, showing highest score of appearance, color, aroma, flavor, texture, and overall acceptability. The optimized jelly recorded pH of 3.08 ± 0.08, TSS of 65.1 ± 0.1 °Brix, moisture content of 33.69 ± 0.82%, and titratable acidity of 2.06 ± 0.04%. Antioxidant activity was recorded, with DPPH radical scavenging capacity of 86.81 ± 4.38%, total phenolic content of 0.36 mg GAE/g, and ascorbic acid content of 0.03 ± 0.01%. Shelf-life evaluation for four weeks indicated stable physicochemical properties and no countable microbial colonies (colonies < 25) growth. Overall, the results confirm that nutmeg pericarp can be effectively utilized to produce a stable, palatable, and antioxidant-rich jelly, offering a sustainable approach to value addition and food waste reduction.

Keywords: Nutmeg, Pericarp, Pectin, Antioxidants, Physicochemical Properties

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Development of a Ready-to-Dissolve Amukkara Tablet

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The present study focused on the development and evaluation of a ready-to-dissolve Amukkara (*Withania somnifera*) tablet formulated to enhance energy and sexual vitality while ensuring convenience and consumer acceptability. The main objective was to convert a traditional Ayurvedic herbal preparation into a modern, consumer-friendly functional product suitable for incorporation into milk. The research followed a standardized process including selection of raw materials, ingredient weighing, mixing, and tablet compression. The formulation contained Amukkara powder as the key functional ingredient, along with xanthan gum as a stabilizer, corn flour as a natural binder, and icing sugar and sucralose as sweeteners. Three formulations with varying ingredient ratios were developed and evaluated to determine the most acceptable product. Sensory evaluation was conducted with 32 untrained panelists, using a 7-point Hedonic Scale. Physicochemical analysis was performed to determine pH, color, total soluble solids, water activity, and proximate composition, while microbial stability was assessed using Total Plate Count (TPC) for four weeks. Results indicated that formulation 1 achieved the highest overall acceptability. The pH values gradually decreased from 5.84 to 5.19 over four weeks, showing good product stability. The Brix value (8.2 °Brix) and water activity (0.57) confirmed favorable solubility and safety for storage. Proximate analysis revealed balanced nutritional composition with high carbohydrates and moderate protein and fiber content, while TPC values remained within acceptable limits throughout the storage. The study successfully developed a stable, safe, and consumer-acceptable Amukkara tablet as a potential nutraceutical product. The formulation offers a practical, modern solution for promoting sexual wellness and vitality while overcoming social hesitation associated with traditional herbal products.

Keywords: Ready-to-dissolve, Tablet, Nutraceutical, Sexual vitality, Functional food

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Development of a Sauce having Characteristic Barbecue Flavour Using Barbecued Peppercorns (*Piper Nigrum L.*) and Analysis of Physico-Chemical Properties

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This study aimed to develop a novel sauce with a characteristic barbecue flavour, utilizing barbecued peppercorns (*Piper Nigrum L.*) using smoking and burning methods. This study encourages the production of agricultural value-added food products using locally available ingredients, while reducing the reliance on imported condiments. The physicochemical properties: contents of piperine, volatile oil, moisture of barbecued peppercorns were evaluated with barbecuing time (5 min, 10 min, 15 min, 20 min, 25 min and 30 min.). Four distinct sauce formulations with varying amounts of barbecued peppercorns (F1=30 g, F2=40 g, F3=50 g and F=60 g) were developed without changing the other ingredients. The developed sauces were subjected to sensory analysis and their physicochemical properties: pH, total soluble solids (TSS), colour, viscosity, piperine and moisture content were analysed. The most preferred formulation was selected using a 9-point hedonic test conducted using 30 untrained panelists and was subsequently analysed for its microbial quality using total plate count. Piperine content of barbecued peppercorns significantly increased ($p<0.05$) with increasing barbecuing time while volatile oil and moisture contents showed no significant changes ($p<0.05$). The barbecuing time of 25 minutes was selected as the most suitable time for preparation of sauce formulations. Formulation F2 was significantly preferred ($p<0.05$) for all the tested sensory attributes, colour, taste, aroma, texture, appearance and overall acceptability, and exhibited its total plate count within the acceptable limits (<100 cfu/ml). Among sauce formulations, F1 showed a significantly lower ($p<0.05$) pH, while F4 showed significantly lower ($p<0.05$) TSS and moisture content. Formulation F1 showed a significantly lower ($p<0.05$) piperine content and viscosity and colour were not significantly different ($p<0.05$) between all the sauce formulations. These findings highlight the potential of developing a pepper sauce with barbecued peppercorns as a viable method for creating value-added products.

Keywords: Barbecued peppercorns, physicochemical properties, Piperine content

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Development of a Smooth Gherkin Spread from Downgraded Raw Material as a Sustainable Solution for Gherkin Off-Cuts Waste

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The gherkin (*Cucumis sativus* L.) processing industry in Sri Lanka generates significant quantities of off-cuts and downgraded material during export-oriented production, with rejection rates of 6-10% of total accumulation. Three formulations with varying gherkin content paste levels 60%, 65%, and 70% (w/w) were developed and evaluated by a trained sensory panel (n=10). The selected optimal gherkin content paste was further improved by adding spices, sweetness, and preservatives. The selected spread was stored at 25°C, 37°C and 40 °C for 21 days, and physiochemical, microbiological and consumer acceptance were assessed at weekly intervals. Consumer acceptance testing was conducted with 115 consumers from the general public. Among the formulations, 95% gherkin content paste with 4% (w/w/) spices and 22% (w/w) sweetness levels showed the highest consumer acceptance score (8.39±0.69), lowest energy content (25.33±2.99 kcal/100 g), minimal fat (0.21±0.02%), optimal pH (3.93±0.09), acetic acid (0.65±0.02%) and water activity (0.83±0.83). The Total Plate Count remained below 500 CFU/g with no detectable yeast and mold throughout the storage period across all temperature conditions. No significant ($p>0.05$) physicochemical changes were observed during the 21-day storage period. This study concluded that 95% gherkin content paste with 4% (w/w/) spices and 22% (w/w) sweetness was the best formulation for developing a shelf-stable spread from gherkin processing waste with high consumer acceptability and extended shelf-life.

Keywords: Gherkin waste valorization, *Cucumis sativus* L., processing waste, sustainable food product, shelf-life stability

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Development of Agar Based Edible Coating with Organic Acid Additives for Fresh Cut Mango (TomEJC)

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Fresh cut mangoes are more popular due to its convenience, but fresh - cut mangoes rapidly deteriorate due to moisture loss, browning, microbial spoilage and texture degradation. This study was conducted to develop an agar based edible coating with incorporation of organic acid (OA) additives; ascorbic acid (AA) and citric acid (CA) to enhance the preservation of fresh cut TomEJC (TJC) mango slices. Agar, a natural polysaccharide was used at two concentrations in six treatments: 0.5% agar + 1% AA, 0.5% agar + 1% CA, 0.5% agar + (1% AA+CA), 1% agar + 1% AA, 1% agar +1% CA and 1% agar + (1% AA+CA). Agar and OA was prepared according to w/v basis. Mango slices were coated using dipping and stored at 4 ± 1 °C for 7 days. Quality parameters including weight loss (WL), firmness, shrinkage, colour, pH, titratable acidity (TA), total soluble solids (TSS), microbial load and sensory attributes; colour, taste, texture, aroma and overall acceptance were tested throughout the storage period. Results showed that WL and firmness loss have significantly (p<0.05) reduced in coated samples compared to uncoated sample. Shrinkage was increased during storage and there was no significant (p<0.05) difference between coated and uncoated samples. This suggests that the coating controls the surface moisture loss; but cannot fully prevent internal tissue level physical changes. Coated samples showed significant (p<0.05) effect on pH, TA, TSS, colour change and microbial counts than uncoated sample. Sensory evaluation confirmed the higher overall acceptability of coated samples over uncoated slices, especially with 1% agar + (1% AA+CA) treatment. The study showed that agar-based edible coating with OA offers a natural, biodegradable and effective preservation method to prolong the shelf life and retain the quality of fresh cut TJC mango. Overall, 1% agar + (AA+CA) showed the best performance among the treatments in effectively increasing the shelf life and retaining the quality of TJC mango slices.

Keywords: Edible coating, Agar, Organic acids, TJC mango, Shelf life

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Development of an Instant 4-in-1 Powder Mix with Ashwagandha Herbal Powder

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The contemporary consumer society is increasingly interested in convenient, healthy, and functional foods which can sustain a balanced and health-conscious lifestyle. This research has responded to this trend by proposing and testing a novel 4-in-1 instant drink powder prepared using Ashwagandha (*withania somnifera),* milk powder, coffee and sucralose. Three formulations were developed through systematic variation of ingredient ratios and evaluated by 7-point hedonic scale with 32 un-trained panelists. Statistical analysis employing the Friedman test and Wilcoxon signed-ranks test identified Formulation 3 as significantly superior across all sensory attributes of mean score of colour (6.03±0.65), aroma (5.72±0.92), flavour (5.41±1.27), mouthfeel (5.41±1.21), and overall acceptability (5.88±0.94), with $p<0.05$ demonstrating clear consumer preference. Comprehensive physicochemical characterization of the optimized formulation revealed a pH of 6.24±0.03, water activity of 0.41, total soluble solids of 15 Brix, and CIE Lab* colour values of L*=20.52±1.87, a*=3.73±0.37, and b*=17.65±2.56. The flowability with Carr's Compressibility Index 21.74% and Hausner Ratio value of 1.28. The particle size distribution analysis revealed that the retention on 0.250 mm sieve was 93.03%. The nutritional profile determined was protein 23.18±0.06%, fat 25.62±0.04%, carbohydrates 39.00±0.10%, dietary fibre 1.20±0.06%, ash 7.00±0.03%, and moisture 4.00±0.02% and revealed higher nutritional value with four weeks shelf life based on microbiological test, 2.44×10^3 CFU/g - 2.62×10^3 CFU/g, which was considerably lower than the international standards. The selected formulation was commercially viable functional food product blended with the traditional medicine and the modern knowledge on food science. The consumers will be benefited with adaptogenic compounds in addition to the nutrients.

Keywords: Functional beverage, Instant herbal powder, Sensory attributes, Physicochemical characterization.

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Development of an Optimized Sri Lankan Black Tea Blend from Low, Mid and High Grown Teas for Enhanced Bioactive Compound Retention

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Sri Lankan black tea, manufactured from *Camellia sinensis L.* exhibits significant variability in bioactive composition across low, mid, and high grown regions. While local blending practices traditionally emphasize sensory property evaluation, they rarely address targeted retention of health-beneficial compounds. This research aimed to scientifically optimize blending ratios of Sri Lankan black teas from varying elevations to enhance concentrations of polyphenols, antioxidant capacity, caffeine and sensory acceptance. Five blend formulations were developed using BOPF, FGS 1, Dust 1 and PD tea grades from 11 tea estates representing major 3 elevations in Sri Lanka. The resulted tea blends were evaluated for the total phenolic compounds using Folin-Ciocalteu assay, antioxidant activity using DPPH radical scavenging activity, caffeine using ISO 10727:2002. The moisture content, total ash, crude fiber and crude fat were assessed using standard AOAC methods while the Na, K, Mg and Fe were determined using Atomic Mass Spectrophotometer (AAS) according to the method described by Hwang, Ki and Chung, 2013. Sensory properties including aroma, colour, taste and overall acceptability were evaluated using a 9-point hedonic scale by an untrained consumer panel and 5 score ranking test by a tea expert. Significant differences ($p<0.05$) were observed among blends in terms of moisture, total ash and antioxidant activity, when analyzed with SPSS 22.0 reporting the highest antioxidant activity (34.68 ± 1.24) in blend 5. However, the overall results indicated that no individual blend excelled in all sensory properties with blend 1 being the most preferred by the tea expert for colour, with blend 2 for aroma, and blend 4 for taste. The findings confirmed that elevation-based scientific blending can optimize health-related and consumer-driven characteristics in Sri Lankan black teas. This study establishes a practical framework for elevating tea blend quality through targeted chemical profiling and offers insight for future innovation in functional beverage formulation.

Keywords: Elevations, Black tea blending, Bioactive compounds, Blend ratios, Sensory properties

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Development of FDM 3D Printing Edible Filament for Pharmaceutical Applications

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The rapid evolution of digital manufacturing has positioned Fused deposition modeling (FDM) 3D printing as a transformative technology in both food and pharmaceutical innovation. Its application in personalized nutrition and oral drug delivery represents a timely and strategic advancement toward efficiency, customization, and consumer-centric design in the modern food sector. However, progress in this field is constrained by the limited availability of biocompatible and edible filaments possessing the mechanical and thermal characteristics required for consistent extrusion and printability. This study developed and evaluated food-grade polymer and plasticizer blends, processed via hot-melt extrusion, to produce edible filaments suitable for FDM 3D printing applications. The formulations were optimized to achieve an ideal balance of tensile strength, flexibility, and processability while ensuring safety and biocompatibility. Fourier transform infrared (FTIR) spectroscopy confirmed chemical compatibility and preservation of functional groups across the formulations. Mechanical performance was assessed using a texture analyzer to simulate the compressive and feeding forces encountered during extrusion, producing detailed flexibility and resilience profiles. Principal component analysis (PCA) and correlation analysis were subsequently employed to assess mechanical similarity between formulated and commercial filaments, enabling data-driven evaluation of feedability and printability. PCA successfully differentiated mechanically robust, printable filaments from weaker, non-feedable ones, while correlation scores confirmed that mechanical integrity is strongly predictive of successful extrusion performance. This research establishes a foundational framework for the development of edible, printable materials that bridge food engineering, materials science, and consumer innovation. The outcomes hold significant industrial and national relevance, offering pathways for Sri Lanka and similar developing economies to advance high-value food and pharmaceutical manufacturing. By fostering digital transformation and precision production, this study demonstrates how FDM 3D printing can contribute to sustainable industrial growth, product diversification, and the global transition toward efficient, consumer-driven health and nutrition solutions.

Keywords: Fused deposition modeling 3D printing, Hot melt extrusion, Plasticization, Personalized medicine, Extrudability screening

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Development of Fiber-enriched Cookies Incorporating Psyllium Husk and Selected Underutilized Flours and Evaluation of Physicochemical and Sensory Properties

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Inadequate intake of dietary fiber is a major global concern associated with arising prevalence of various non-communicable diseases. This study aimed to develop fiber enriched cookies through the partial substitution of wheat flour with psyllium husk, *kohila* flour (*Lasia spinosa*), and horse gram flour (*Macrotyloma uniflorum*), and to assess their physicochemical and sensory characteristics. *Kohila* flour and horse gram flour were prepared using hot air oven drying method and composite flour formulas were prepared by replacing 30% and 40% of wheat flour with different proportions of the selected fiber sources. Cookies were prepared using the composite flour blends, whereas cookies formulated solely from wheat flour served as the control. Functional properties of composite flour and wheat flour were evaluated and significant differences were found ($p<0.05$) in water and oil absorption capacities, swelling volume and color values (L*, a*, b*) in composite flour when compared to wheat flour. The physical parameters of cookies, thickness, diameter, spread ratio and color showed significant differences among formulations ($p<0.05$), except for weight, which remained similar. However, sensory evaluation indicated that the formulation containing 20% of psyllium husk, 5% of *kohila* flour and 5% of horse gram flour (30% total substitution) was most acceptable. Proximate analysis revealed higher moisture (3.88 ± 0.04%), crude fat (20.37 ± 2.27%), crude fiber (0.94 ± 0.04%) and total ash (1.70 ± 0.04%) contents in the selected cookie compared to the control while crude fat (10.24 ± 0.26%) and carbohydrates (66.06 ± 1.60%) were lower. The selected formulation also exhibited higher water activity (0.39 ± 0.02[a]) and a markedly increased the total dietary fiber content (12.6%) compared to the control cookie (2.0%). These results illustrated that the partial replacement of psyllium husk, *kohila* flour and horse gram flour significantly enhanced dietary fiber content while maintaining desirable quality characteristics of cookies.

Keywords: Dietary fiber, Psyllium husk, *Kohila* flour, Horse gram flour, Cookies

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Development of Ginger-Collagen Concentrate and Assessment of its Antioxidant, Anti-Inflammatory, Anti-Aging and Vitamin C Capacities

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This study focused on the development and evaluation of a ginger-collagen concentrate as a functional food product for skin health enhancement. The formulation combined ginger oil marine collagen, and ascorbic acid in a viscous concentrate intended for daily oral consumption at 15 mL per serving. The product was assessed for its antioxidant, anti-inflammatory, anti-aging, and vitamin C capacities through standardized in-vitro assays. The developed concentrate demonstrated strong antioxidant activity with a DPPH radical scavenging capacity of 63.2 ± 0.4% at 1.22 mg/mL concentration. Total phenolic content was quantified at 6.66 ± 0.29 mg GAE/g, while total flavonoid content measured 2.04 ± 0.03 mg RE/g. The reducing capacity of the product was determined to be 23.86% Ascorbic Acid Equivalent using the DCPIP titrimetric method. Vitamin C analysis confirmed an ascorbic acid content of 659 mg per serving. Anti-aging capacity was evaluated through the Bovine Serum Albumin-glucose glycation inhibition model, showing progressive inhibition rates of 22.0%, 40.6%, and 61.3% on days 0, 3, and 6 respectively. Microbiological shelf-life analysis over eight weeks revealed colony counts consistently below detection limits, demonstrating excellent product stability. Sensory evaluation with 30 untrained panelists using a 9-point hedonic scale was conducted on four formulations: original ginger shot, peppermint-flavored, cinnamon-flavored, and vanilla-flavored. Friedman test analysis revealed significant differences ($p < 0.05$) in aroma ($p = 0.021$), flavor ($p = 0.017$), and overall liking ($p = 0.015$), with the vanilla-flavored formulation receiving the highest consumer acceptability scores. The results demonstrate that the developed ginger-collagen concentrate possesses significant bioactive properties with potential applications as a nutraceutical product for skin health enhancement. The combination of potent antioxidant activity, substantial vitamin C content, and proven anti-glycation effects positions this product as a viable functional food alternative to conventional topical skincare products.

Keywords: Ginger, Marine collagen, Ascorbic acid, Nutricosmetics, Skin health

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Development of Mushroom-Based Kimchi Alternative Using Locally Available Mushroom Varieties; Process Optimization and Quality Evaluation

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This study aimed to develop a mushroom-based kimchi alternative using locally available mushroom varieties and to evaluate their physicochemical, microbial, nutritional, and sensory characteristics. Initially, a kimchi alternative formulation was prepared using American oyster mushroom (*Pleurotus ostreatus*) with a 15% (w/v) brine concentration and a 10 h soaking period. Four treatment combinations were then applied by varying the use of *Lactobacillus plantarum* culture and temperature of storage: T1 (with culture + room temperature), T2 (with culture + refrigeration), T3 (without culture + room temperature), and T4 (without culture + refrigeration). The fermentation process was monitored over 14 days at 0, 3, 7, and 14 days. Using the optimized fermentation process, four locally available mushroom varieties American oyster (*Pleurotus ostreatus*), pink oyster (*Pleurotus djamor*), Bhutan oyster (*Pleurotus pulmonarius*), and abalone (*Pleurotus cystidiosus*) were further evaluated. A sharp decrease in pH was observed during the early stages, followed by stabilization after day 7, while titratable acidity and salinity gradually increased, indicating proper fermentation progress. Sensory evaluation identified day 7 as the optimum fermentation point, and the T4 treatment (without culture + refrigeration) demonstrated the highest overall acceptability with balanced acidity, flavor, and color. Sensory results revealed that American oyster and Bhutan oyster were the most preferred varieties. Comparative proximate and functional analysis showed higher protein content in Bhutan oyster than American oyster, while both varieties exhibited comparable total phenolic content and antioxidant activity. These findings indicate that naturally fermented mushroom kimchi, particularly using American oyster, offers strong potential as a nutritious and consumer acceptable kimchi alternative for commercial development.

Keywords: Mushroom kimchi alternative, Fermentation, *Lactobacillus plantarum*, Sensory evaluation, optimization

Acknowledgement: This research was supported by Prof. J.K. Vidanarachchi

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Development of Nutrient-Rich Sourdough Bread Formulation, Analysis of Proximate Composition and Shelf-Life Evaluation

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Sourdough bread, produced through natural fermentation develops unique flavors, improved texture, and enhanced nutritional quality due to the formation of organic acids, alcohols, and volatile compounds. Sourdough bread made using different ratios of wheat, finger millet, green gram and atta flour composite flour mixtures with the control wheat flour bread were evaluated for their sensory attributes. A composite flour mixture consisted of 70% wheat flour, 20% finger millet flour, 10% green gram flour, and 10% atta flour demonstrated its suitability of the best formulation for sourdough bread making without adversely affecting the sensory attributes. The sourdough bread prepared using the composite flour mixture showed significantly higher ($p<0.05$) crude protein content (22.11±0.25%), fat (2.44±0.23%), fiber (1.38±0.08%), and ash (3.25±0.01%) compared to 100% wheat flour sourdough bread that reported 16.86±0.42% crude protein, 1.50±0.18% fat, 0.83±0.00% fiber and 2.50±0.04% ash. In contrast, the carbohydrate content of the composite flour bread (29.74±0.43%) was lower than that of the wheat flour sourdough bread (35.38±0.64%), likely due to carbohydrate utilization during fermentation. The percentage increases in the composite flour bread over wheat flour bread were protein by 31.1%, fat by 62.7%, fiber by 66.3%, and ash by 30%, while carbohydrates decreased by 15.94%. Overall, the composite flour formulation contributes to an improved nutritional profile.

Keywords: Sourdough bread, Composite flour, Nutritional composition, Fermentation

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Development of Protein Enriched Nutrition Bar using Underutilized Local Ingredients

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Protein enriched food products formulated using plant-based ingredients are being demanded by the present consumers locally and internationally. This study aimed to develop a nutritious protein-enriched nutrition bar using underutilized local ingredients such as pumpkin seeds and mung beans to combat protein deficiency. Various formulations with different proportions of pumpkin seeds and mung beans were evaluated for their physicochemical properties, sensory attributes, nutritional composition, and microbiological quality in accordance with the Association of Official Agricultural Chemists (AOAC) standards. The mung bean-based formulation developed with mung bean 12 g and pumpkin seeds 6 g scored a mean overall acceptability score of 6.37 on the 7-point Hedonic scale. In contrast, the pumpkin seed–based nutrition bar (pumpkin seeds 12 g and mung beans 6 g scored a higher mean preference score (6.67). The mung bean-based protein bar revealed an average of 6.51±0.03% moisture, 10.04±0.86% fat, 1.84±1.14% ash, 0.02±0.05% crude fibre, 16.32±1.18% protein, 65.20±0.99% carbohydrates, while pumpkin seed-based bar possessed 6.79±0.07% moisture, 23.22±0.34% fat, 2.59±0.30% ash, 0.02±0.05% crude fibre, 19.60±2.07% protein, 47.78±1.96% carbohydrate. The energy value of mung bean-based protein bar was 416 kcal and pumpkin seed-based bar was 478 kcal. Statistical analysis confirmed that the variations in ingredient ratios had a significant impact on both sensory and nutritional properties ($p < 0.05$). The developed product was economically feasible for large-scale production. In conclusion, the developed pumpkin seed and mung bean-based protein bars provides a balanced nutritional profile and appealing sensory attributes for health-conscious consumers.

Keywords: Protein bar, Pumpkin seed, Mung bean, Underutilized ingredients, Nutritional evaluation

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Development of Set Yogurt Fortified with Heen Bovitiya (*Osbeckia octandra*) Leaf Powder Extract: Evaluation of Sensory, Physicochemical, and Functional Properties

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The growing demand for functional dairy products has encouraged the incorporation of medicinal plant ingredients into yogurt formulations to enhance their nutritional and therapeutic value. This study aimed to develop set yogurt fortified with Heen Bovitiya (*Osbeckia octandra*) leaf powder and to evaluate its sensory, physicochemical, and functional properties. Proximate composition, pH, titratable acidity, color, syneresis, phytochemical composition, microbial quality, and sensory acceptability were analyzed during 14 days of refrigerated storage. Fortification significantly affected ($p < 0.05$) several quality parameters. Total solids increased with concentration, reaching the highest value in T3 ($18.28 \pm 0.90\%$), while moisture content decreased correspondingly. The 1% treatment exhibited the highest crude protein ($4.17 \pm 0.01\%$) and ash content ($5.12 \pm 0.01\%$). pH decreased gradually, reflecting active fermentation, while syneresis increased with concentration, indicating a softer gel at higher fortification levels. Color parameters showed reduced lightness (L*) and yellowness (b*) during storage, with a mild rise in redness (a*). Phytochemical screening confirmed the presence of alkaloids, tannins, flavonoids, steroids, terpenoids, and saponins, demonstrating the retention of bioactive compounds. Microbial counts were within acceptable limits, confirming product safety. The results of this study indicated that 2% *Osbeckia octandra* leaf powder extract can be used to produce set yogurt with improved physicochemical, microbiological and sensory attributes.

Keywords: Heen Bovitiya, *Osbeckia octandra*, Phytochemicals, Set yogurt, Sensory attributes

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Development of Soursop (*Annona Muricata)* based Electrolyte Drink and Evaluation of Its Sensory, Physicochemical Properties and Physiological Impact

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The global beverage market is shifting towards natural options. Soursop (*Annona muricata*) is an underutilized tropical fruit, rich in electrolytes and health promoting compounds. This research aimed to develop a natural, fruit-based alternative utilizing the soursop fruit to support effective hydration and evaluate its physicochemical and sensory properties, and storage stability. Three formulations were developed using fresh soursop pulp with three variations based on pulp content: 8.33% (F1), 16.48% (F2), and 20% (w/w) (F3). A sensory evaluation was conducted by an untrained consumer panel using a 9-point hedonic scale and 20% pulp formulation (F3) was identified as the most preferred and received the highest scores for overall acceptability, taste, mouthfeel, and appearance. The fresh optimal (F3) formulation showed a favorable physicochemical profile with pH of 3.10 ± 0.10, total sugar content of 98.5 ± 1.2 g/L, non-reducing sugar content of 39.83 ± 2.59 g/L, and titratable acidity content of 0.39 ± 0.00% (w/w). It contained a significant electrolyte profile suitable for hydration, containing 242.3 ± 0.0 mmol/L of sodium (Na^+) and 32.8 ± 0.2 mmol/L of potassium (K^+), which was also within the recommended range according to the Australia New Zealand Food Standard. The physiological assessment yielded a Beverage Hydration Index (BHI) of 1.51 ± 0.06, indicating that the soursop beverage provided significantly superior hydration compared to water. The osmolality of the soursop beverage was 419.0 mOsm/kg, indicating that it was a hypertonic drink. A 3-week storage study showed changes in the physicochemical properties of samples stored at room temperature (25–30 °C) and under refrigeration (4–5 °C). Therefore, the present study showed that developed beverage is a palatable, natural alternative to synthetic electrolyte drinks with superior hydration efficiency.

Keywords: Electrolyte drinks, Soursop, Hydration index, Sodium content, Total Sugars

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Development of Vegan Low-Amylose Rice Milk Fermented Product as a Plant-Based Alternative to Dairy Set Yogurts

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Rising consumer demand for plant-based dairy alternatives, driven by lactose intolerance, cow's milk allergies, and ethical veganism, necessitates the development of novel products. This study aimed to develop a novel vegan yoghurt utilizing milk from a low-amylose sticky rice (CIC Savandara) and to evaluate the feasibility of using cooked sticky rice as a natural thickening agent. Four treatments were formulated with varying concentrations of cooked sticky rice (T1: 5%, T2: 10%, T3: 15%, T4: 20%; w/v) in a standardized base containing 3.5% isolated soy protein (w/v) and 10% sugar (w/v), and fermented with *Streptococcus thermophilus*. The physicochemical, microbiological, and sensory properties of rice milk fermented products were evaluated over a 21 day refrigerated storage period at 4 °C. Results showed that increasing the cooked rice concentration had a highly significant ($p < 0.001$) effect on texture, effectively increasing viscosity and hardness while significantly ($p < 0.001$) reducing syneresis, confirming its function as a natural stabilizer in the developed rice milk fermented product. All formulations were microbiologically safe, testing negative for coliforms. Viable starter culture counts, enumerated using M17 agar, confirmed high, stable populations of *Streptococcus thermophilus* throughout storage ($p < 0.001$ across all days), verifying the product as a live culture fermented product. Sensory analysis revealed that the rice milk fermented product with 15% cooked sticky rice (T3) was significantly ($p < 0.001$) preferred, scoring the highest for taste, aftertaste, and overall acceptability on both day 1 and day 21. Overall, the results of this study indicate that low-amylose rice milk can be used to produce a stable, microbiologically safe, vegan fermented product, demonstrating that low-amylose sticky rice is a highly viable and functional ingredient for developing a commercially promising plant-based alternative to dairy set yoghurt.

Keywords: Low amylose sticky rice, Natural stabilizer, Plant-based, Rice milk, *Streptococcus thermophilus*, Veganism

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Development, Formulation, and Physiological Evaluation of Nitrate-Rich Beetroot-Based Functional Sports Beverage for Enhancing Athletic Performance in Trained Individuals

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Beetroot (*Beta vulgaris* L.) is recognized as a rich dietary source of nitrate, enhancing nitric oxide bioavailability and offering proven ergogenic and cardioprotective benefits. This study aimed to develop and evaluate a nitrate-enriched beetroot-based sports drink for athletes through a three-phase research approach. Ethical clearance was obtained from the Ethical Clearance Committee, Faculty of Agriculture, University of Peradeniya (ECC/2025/E/042). In Phase I, consumer attitudes towards sports drinks were assessed using structured questionnaires among athletic communities across Sri Lanka, confirming strong interest in natural, performance-enhancing beverages. In Phase II, beetroot cultivated in 3 agro-climatic zones was analyzed for nitrate (modified Kjeldahl–Devarda's alloy) and Na^+/K^+ content (Atomic Absorption Spectroscopy) under three pasteurization conditions. Results confirmed nitrate's thermal stability (~138.1 mg/100 g), enabling standardization of the drink to 500 mg nitrate per serving. In Phase III, a four-week randomized controlled trial was conducted among physically active university athletes (n = 30; 16 male, and 14 female). Anthropometric parameters, aerobic performance (Cooper's 12-min run, VO_2-max), resting blood pressure, psychological well-being (DASS-42), and sensory acceptability (n = 51 untrained panellists) were evaluated. Statistical analysis (IBM SPSS v23) revealed significant improvements in endurance performance ($p = 0.036$) and reductions in resting systolic ($p = 0.002$) and diastolic ($p < 0.001$) blood pressure in the intervention group, indicating enhanced cardiovascular efficiency. The developed product also achieved higher sensory acceptability than two commercial sports drinks, while psychological well-being scores exhibited positive trends. Overall, the nitrate-enriched beetroot sports drink demonstrated measurable physiological and sensory benefits, supporting its potential as a natural, functional alternative to synthetic sports beverages. The findings emphasise the national significance of utilising locally grown beetroot to develop value-added, health-promoting functional products for Sri Lanka's expanding sports nutrition sector.

Keywords: Beetroot, Dietary nitrate, VO_2 max, Blood pressure, Ergogenic aid

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Effect of Chilling Methods and Deskinning Practices on Discoloration in Pharaoh Cuttlefish (*Sepia pharaonis*) during Post-Harvest Handling

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Inadequate cooling promotes pink discoloration from chromatophore oxidation, leading to quality loss. This study aimed to investigate the effect of different chilling methods and deskinning practices on pink discoloration and quality of cuttlefish (*Sepia pharaonis*) during chilling storage. Thus, development of pink color and quality changes of cuttlefish was investigated using 48 cuttlefish (3-4 cuttlefish/kg) with and without deskinning in three different ice chilling conditions where the frozen condition was considered as control. Observations were made on third and seventh days of storage. The chilling treatments were, direct interaction of cuttlefish with ice (DI), indirect interaction of cuttlefish with ice (InI) and indirect interaction of cuttlefish with salted ice (1% W/W sodium chloride, InSI). All treatments were 1:2 ratio of cuttlefish and ice in W/W basis. Quality parameters evaluated were pH, total volatile basic nitrogen (TVB-N) and thiobarbituric acid reactive substances (TBARS). The color changes (L*, a*, b*) were observed to determine the extent of pink discoloration. Both storage duration and chilling treatment significantly ($p< 0.05$) influenced pH, TVB-N, TBARS and Colorimeter values. pH increased significantly from day three to day seven, with the highest values observed under InI and InSI ice treatments, indicating more pronounced postmortem alkalinization. The increase in a* and b* values of cuttlefish mantle was observed with increasing storage time in all three treatments ($p< 0.05$). A slight reduction of L* values was observed during the storage period ($p< 0.05$) while TVB-N and TBARS values increased significantly ($p< 0.05$) in all the treatments, indicating that quality deterioration was more pronounced under ice-based chilling at extended storage durations. Deskinning did not significantly affect pH or TBARS, skin-on samples exhibited marginally higher TVB-N and colorimeter values, ($p< 0.05$) suggesting faster nitrogenous spoilage under skin-intact conditions. The control maintained lower discoloration intensity and delayed pinking development compared to all ice-based methods. Among chilling conditions, InI treatment performed better than DI and InSI, indicating that direct and salted ice exposure accelerate oxidative reactions.

Keywords: *Sepia pharaonis*, Ice direct Interaction, Ice Indirect Interaction, Deskinning, Chilling

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Effect of Moringa (*Moringa oleifera*) Leaf Extract in Maintaining Microbial, Nutritional, and Physicochemical Quality of Fresh-cut Carrots (*Daucus carota*)

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This research assesses the potential of using *Moringa oleifera* leaf extract (MLE) as an environmentally friendly preservative to maintain the microbial, nutritional, and physicochemical quality of fresh-cut carrots (*Daucus carota*) during refrigerated storage. The fresh-cut carrots were cleaned, topped, peeled, followed by dipping in treatment solution, air dried, packed, and refrigerated. The five treatments included MLE at 5% (M5), MLE at 10% (M10), MLE at 15% (M15), chlorine (50 ppm) as the chemical treatment (CH), and water as the untreated control (C). Samples were evaluated for quality parameters, including colour (L*, a*, b*), pH, firmness, titratable acidity (TA), total soluble solids (TSS), weight loss, vitamin C, total phenolic content, antioxidant activity, total plate count (TPC), and sensory attributes on days 0, 3, and 6. The results indicated that MLE treatments had a significant effect on the quality of preservation of fresh-cut carrots compared to the control sample. Treatment with M15 resulted in a significant ($p<0.05$) reduction in firmness and total soluble solids, accompanied by a significant ($p<0.05$) increasement in weight loss. Conversely, the M5 treatment led to a significant ($p<0.05$) reduction in weight loss. All MLE treatments had higher retention of vitamin C and phenolics than the controls. Microbial analyses indicated that chlorine treatment achieved the lowest TPC (4.4 CFU/g), followed by M10 (4.6 CFU/g). Sensory evaluation demonstrated that M5 was the most preferred treatment for colour, aroma, taste, and overall acceptability. Overall, the findings demonstrate that *Moringa oleifera* leaf extract, particularly at low to medium concentrations (5–10%), serves as an effective, natural alternative to chlorine-based disinfectants. The study underscores MLE's potential as a sustainable and safe preservative for minimally processed vegetables in the food industry.

Keywords: Fresh-cut carrots, Moringa leaf extracts, Natural preservatives, Antioxidant activity

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Effect of Pre-Cooling and Packaging on Postharvest Quality of Green Beans (*Phaseolus vulgaris* L.) Stored under Controlled Condition

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Green beans (*Phaseolus vulgaris* L.) are a widely consumed and economically important vegetable in Sri Lanka; however, their high respiration rate and moisture content make them extremely perishable, resulting in significant postharvest losses. Reducing these losses through improved handling and storage practices is vital for ensuring food security, enhancing farmer income, and strengthening the national fruit and vegetable industry. This study evaluated the combined effects of pre-cooling and packaging methods on maintaining postharvest quality and extending the shelf life of green beans under controlled storage conditions. Freshly harvested beans were subjected to three pre-cooling treatments: no cooling, forced-air cooling, and hydrocooling, followed by packaging in open crates, low-density polyethylene (LDPE), or anti-fog polypropylene (PP) films. Samples were stored at 20 °C and analysed periodically for physicochemical, microbiological, and sensory attributes. Both pre-cooling and packaging significantly affected postharvest quality parameters. Hydrocooling best preserved chlorophyll content ($p < 0.001$), firmness ($p < 0.001$), and ascorbic acid levels ($p < 0.001$), while forced-air cooling was moderately effective but less efficient in maintaining greenness and texture. LDPE packaging minimised weight loss ($p < 0.001$), disease incidence ($p < 0.001$), and maintained overall visual freshness. Anti-fog PP packaging preserved surface appearance and colour during short-term storage but was less effective over extended periods. The combination of hydrocooling and LDPE packaging produced the highest sensory acceptability, retaining superior colour, texture, and taste for up to 12 days. These findings demonstrate that integrating hydrocooling with LDPE packaging offers a practical, scalable, and cost-effective strategy for maintaining the freshness, nutritional quality, and marketability of green beans. The outcomes provide critical insights for Sri Lanka's postharvest and food industries, enabling quality assurance from farm to retail, reducing wastage, and contributing to the sustainable development and competitiveness of the country's horticultural value chain.

Keywords: Green beans, Pre-cooling, Hydrocooling, LDPE packaging, Postharvest

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Efficacy of a Liver Protective Herbal Candy in Overweight and Obese Adults with Liver Health Risk: A Randomised, Placebo-Controlled Clinical Trial.

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Non-alcoholic fatty liver disease (NAFLD) is increasingly prevalent among overweight and obese populations. This study evaluated the hepatoprotective efficacy of LivosBEE™, a novel herbal candy formulation, in overweight and obese adults with liver health risk factors. A randomised, single-blind, placebo-controlled trial was conducted over ten weeks with 30 participants (BMI $\geq$ 25 kg/m²) aged 20-55 years. The treatment group received 5 g daily of LivosBEE™ (2.5 g twice daily), while the control group received placebo. Biochemical assessments including liver function markers [Alanine Aminotransferase (ALT), Aspartate Aminotransferase (AST), Gamma-Glutamyl Transferase (GGT), Alkaline Phosphatase (ALP), bilirubin], lipid profile (total cholesterol, triglycerides, High-Density Lipoprotein, Low-Density Lipoprotein), and glycemic markers (Fasting Blood Glucose, Triglyceride-Glucose Index) were measured at baseline, week two and week eight. Phytochemical analysis of herbal candy revealed that the total phenolic content was 28.56 ± 1.35 mg GAE/g, total flavonoid content 8.45 ± 0.5 mg RE/g and DPPH radical scavenging activity of 64.54 ± 1.38%. ALT level of the treatment group showed a statistically significant reduction from baseline to week two ($p=0.034<0.05$) and baseline to week eight ($p=0.002<0.05$), with significant differences between groups at endpoint ($p=0.022<0.05$). AST levels also decreased significantly within the treatment group, from baseline to week two ($p=0.003<0.05$) and baseline to week eight ($p=0.007<0.05$), though between-group differences were not statistically significant. GGT levels were maintained at stable ranges in the treatment group with significant difference from the control group ($p=0.028<0.05$). Bilirubin levels significantly decreased within the treatment group ($p=0.04<0.05$), from baseline to week two and baseline to week eight, though between-group differences were not statistically significant. ALP, Lipid profile markers and glycemic parameters showed no significant changes between groups or within groups. These findings demonstrate that LivosBEE™ effectively reduces particular liver function markers. Therefore, LivosBEE™ could have potential beneficial effects on hepatoprotection.

Keywords: Non-alcoholic fatty liver disease, Herbal candy, Hepatoprotective, Liver function markers, Antioxidant

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Energize Naturally: The Development of Coffee Based Energy Drink

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The global energy drink market has expanded rapidly, yet high consumption of commercial products is often associated with negative health effects, primarily due to synthetic ingredients and excessive sugar content. This has created a growing consumer demand for natural, healthier substitutes that provide functional benefits. The primary objective of this research was to develop a natural, high-quality, energy drink with acceptable taste, stability, and enhanced stimulant effects using coffee as the natural source of caffeine, and to exclude the issues with the existing energy drinks as much as possible. The methodology involved determining the optimal concentration levels of coffee extract, taurine, and natural sweeteners (*Kithul honey and Kithul jaggery*) utilizing different water bases (Carbonated Water, Coconut water, and King coconut water). Varying the ingredients yielded 36 different formulations. One-way Analysis of Variance was performed on the different attributes of these formulations. The functional attributes varied significantly amongst different formulations ($p<0.05$), while consumer acceptance was high in certain specific formulations. Caffeine content showed a statistically significant difference amongst the 36 different formulations ($P<0.001$), with a maximum concentration of 186.2 mg/100 mL. Antioxidant activity, measured as Trolox equivalents, varied to a maximum of 1,667 µg/g. This study successfully formulated a natural coffee-based energy drink, with the best-perform offering a superior natural caffeine concentration comparable with commercial products, thus validating the achievement of enhanced stimulant effects. Future work should focus on optimizing the sensory and storage stability of the energy drink formulation.

Keywords: Antioxidant, Coffee, Energy Drink, Taurine, Natural Caffeine,

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Enhancing Fruit Quality and Shelf Life of 'TomEJC' Mango Using Hot Water Treatment

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This study investigated the influence of hot water treatment (HWT) on the postharvest quality and shelf life of 'TomEJC' mango (*Mangifera indica* L.), a highly perishable climacteric fruit. Fruits were stored under ambient conditions (29 ± 2 °C; 60–70% RH) and arranged in a Completely Randomized Design with five treatments: untreated control, 50 °C for 5 min, 50 °C for 10 min, 55 °C for 5 min, and 55 °C for 10 min. Physiological, physicochemical, and sensory attributes were assessed at four-day intervals for 16 days. The HWT significantly influenced postharvest responses of 'TomEJC' mango ($p<0.05$). Treatments at 55 °C for 5 and 10 min effectively delayed ripening, reduced disease incidence and decay (<20%), and maintained higher titratable acidity, peel and pulp lightness (L*), and overall visual quality than the control. Mild heat treatments (50 °C for 5–10 min) enhanced soluble solids content and perceived sweetness, indicating accelerated sugar conversion. Although fruit firmness declined progressively across treatments, HWT at 50 °C for 5 min best retained firmness during the early storage period. Physiological weight loss was the lowest in untreated fruits and highest at 55 °C for 10 min, likely due to heat-induced moisture loss. Sensory evaluation consistently favored fruits treated at 55 °C for 5 and 10 min, which scored the highest for peel color, texture, taste, and overall acceptability. Overall, the results demonstrated that hot water treatment can modulate ripening, maintain quality attributes, and influence shelf life of 'TomEJC' mango, with effects depending on treatment temperature and duration.

Keywords: Disease incidence, hot water treatment, postharvest quality, shelf life, 'TomEJC' mango

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Evaluating the Common Household Water Treatment Methods on Physico-Chemical and Microbiological Parameters of Water Obtained from Selected Regions in Sri Lanka

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This study evaluated the efficiency of commonly used household water treatment methods in improving the physico-chemical and microbiological quality of drinking water from different regions in Sri Lanka. Water samples were collected from four sources: treated National Water Supply and Drainage Board (NWSDB) water (Peradeniya, Kandy), untreated well water (Asgiriya, Kandy), untreated well water (Mahailuppallama, Anuradhapura), and poor quality well water (Navakkadu, Puttalam). Each sample was subjected to five treatments: untreated control (T1), boiling (T2), ceramic filter (T3), mineral cartridge filter (T4), and multistage germicidal purifier (T5). A total of 60 samples (4 sources × 5 treatments × 3 replicates) were analyzed for turbidity, pH, electrical conductivity (EC), total dissolved solids (TDS), color, nitrite, sulphate, phosphate, total iron, alkalinity, hardness, *Escherichia coli*, and total coliforms. Mean ± SD values were computed, and two-way ANOVA followed by Tukey's test ($p \leq 0.05$) was used to determine significant differences between treatments and water sources. Results indicated that re-treating NWSDB water did not significantly improve quality parameters. Poor-quality well water could not be made fully safe using none of the tested common household methods. The multistage germicidal purifier (T5) consistently showed the highest overall performance, significantly reducing ($p < 0.05$) turbidity, sulphate, hardness, color, E. *coli*, and total coliforms. The ceramic filter (T3) was effective in reducing total iron content. Overall, treatment efficiency was strongly dependent on the initial water quality.

Keywords: Water quality, Treated water, Household treatment, Physico-chemical parameters, Microbiological parameters

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Evaluating the Impact of Compliance with Voluntary Food Standards on Export Penetration: A Strategic Analysis of the Coconut – Based Processed Food Industry in Sri Lanka

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Sri Lanka's coconut-based processed food sector holds significant untapped potential in the global market; however, export performance remains constrained by limited alignment with international buyer requirements. Voluntary Food Standards (VFS) play a crucial role in enhancing export penetration by aligning products with global quality and safety expectations and improving buyer confidence. Therefore, this study aimed to examine the relationship between VFS compliance and export penetration in Sri Lanka's coconut-based processed food industry. A mixed-method approach integrating both quantitative and qualitative techniques was used to identify major products, export destinations, and buyer requirements across regions. Primary data were collected through questionnaires administered to 34 direct exporters and 13 industry experts, along with focus group discussions involving key stakeholder groups. The United States, European Union, Middle East, Canada, India, and Australia were identified as major export destinations for Sri Lanka's coconut-based processed foods. Quantitative findings revealed that all surveyed exporters held ISO 22000 certification, while 93% also possessed organic certification, indicating strong industry commitment. Statistical analysis showed a significant positive correlation ($p < 0.01$) between VFS compliance and export performance, including export volume ($r = 0.44$, $p = 0.003$) and export revenue ($r = 0.32$, $p = 0.034$). Qualitative findings indicated that buyer demand acts as the main driver of VFS adoption. Internal challenges identified included employee resistance and difficulties in infrastructure development, while external challenges involved certification credibility issues and inadequate external support. The findings highlight that strengthening VFS adherence can significantly improve export consistency, product credibility, and international market access. This research provides evidence-based insights for stakeholders to develop targeted interventions that support certification adoption, and promote sustainable trade. Ultimately, the outcomes emphasize that improving VFS compliance is a strategic pathway for Sri Lanka to enhance its export competitiveness, expand its global market share, and strengthen its economic resilience.

Keywords: Voluntary Food Standards, Export penetration, Coconut – based processed food products

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Evaluation and Comparison of Physical Properties and Consumer Perception on Physical Attributes of Mozzarella Cheese Brands Available in the Local Market

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The demand for mozzarella cheese in the Sri Lankan fast-food industry is growing rapidly. However, a lack of functional quality testing methods and documented product quality poses challenges for local producers and consumers. This study aimed to develop and apply simple, cost-effective laboratory methods to evaluate the key functional properties of mozzarella cheese and to compare the physicochemical and sensory characteristics of six leading commercial brands (A to F) available in the Sri Lankan market. Simple laboratory protocols for meltability (area spread method), stretchability (fork test), and oiling-off (filter paper method) were developed and optimized for local conditions. The physicochemical properties (pH, moisture content, stretchability, meltability, oiling-off) were analysed. A consumer sensory evaluation (n=10) was conducted using a 9-point hedonic scale to assess aroma, colour, mouth feel, sourness, greasiness, appearance, stretchability, flavour, texture, meltability, and overall acceptability. Physicochemical analysis revealed significant differences ($p < 0.05$) among the brands. A composite quality index identified Brand E as superior. It exhibited excellent stretchability (39.17 cm), ideal moisture content (44.80%), and moderate pH (5.64). In contrast, Brand C showed excessive oiling-off (19.47%), while Brands A and B had critically low moisture. Sensory evaluation showed there was no significant ($p > 0.05$) difference. Brand E consistently scored the highest in overall ranking based on composite data. The study successfully established simple, practical methods for functional property evaluation. Brand E delivered superior and consistent quality. This study provides valuable insights specifically for mozzarella cheese consumers and offers local manufacturers accessible, cost-effective methods for quality control and product development, supporting improved product consistency and market competitiveness.

Keywords: Functional properties, Mozzarella cheese, Quality assessment, Sensory evaluation, Sri Lankan market

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Evaluation of Activated Carbon as a Decolorization Agent for Unrefined Coconut Oil: Impact on Color and Sensory Attributes

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This study evaluates the potential of activated carbon (AC) as a decolorization agent for unrefined coconut oil, examining its impact on color and sensory attributes. The AC sources for the current study were coconut shells (CS) and rice husks (RH) produced by weak acid activation with vinegar. Four treatments were prepared based on AC source and particle sizes (T1-T4), an unrefined oil sample filtered through a silica bed (T5), and a control sample without decolorization/filtration. During the decolorization process, oil samples with AC were shaken at 600 rpm and heated to 80 °C, followed by filtering under pressure. Both treated and control samples were analyzed for the color (CIE Lab method L, a*, b* values), pH, refractive index (RI), moisture content (MC) as physical parameters; acid value (AV), free fatty acid (FFA) content, peroxide value (PV) as chemical parameters, and color perception, aroma perception, flavor perception, overall acceptability as sensory attributes. Results showed that all AC treatments (T1-T4) significantly increased the L value and decreased a* and b* values compared to the control, indicating effective color removal. All treated samples (T1-T5) reported significantly lower MC ($p<0.05$) compared to the control. There are no significant differences in pH or RI values ($p >0.05$) among samples. All AC-treated samples (T1-T4) had a significantly lower AV ($p<0.05$), PV ($p<0.05$), and FFA content ($p<0.05$) compared to the T5 and control samples. Sensory evaluation using 35 untrained panelists identified powdered CS-AC with <106 µm particle size (T1) produced the most preferred oil in terms of color, flavor, aroma, and overall acceptability. The study concludes that activated carbon derived from agricultural waste is a cost-effective, efficient, and sustainable agent for improving the color and quality of unrefined coconut oil without significantly affecting its natural sensory attributes. The developed filtration system demonstrates strong potential for scaling up in industrial coconut oil processing.

Keywords: Acid activation, Coconut shell, Rice husk, Vinegar, Adsorbent

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Evaluation of Antacid Activity of Aloe Vera and King Coconut Water-Based Beverage in Comparison to a Commercially Available Antacid Agent

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Gastroesophageal reflux disease (GERD) is a common gastrointestinal disorder in the young adult population and is typically managed using pharmaceuticals. However, due to their potential side effects and economic burden, it is essential to evaluate their effectiveness and explore safer, natural alternatives. This study aimed in producing a aloe vera & king coconut water based beverage and to do a comparison with Commercially Available Antacid (CAA). After conducting a comprehensive survey, it was found that skipping meals, eating fried food, wheat-based food and drinking caffeinated drinks are high risk factors for GERD development. By considering the response of the survey, a beverage mainly containing Aloe-Vera, king-coconut water and basil seeds was produced and sensory tests were performed to finalise the formulation. Then a chemical analysis was done for the beverage to check the physicochemical properties, storage stability and finally a quantitative analysis. An *In-Vitro* analysis was performed for the final formulation of the beverage and CAA, where both groups were fed to an artificial stomach model and measures the pH levels. pH level of commercially available antacid was higher than that of the beverage but both pH levels were comparatively at a high amount than gastric pH (1.2pH). Statistical tests were carried out in order to assess significant differences between two groups ($p<0.05$). It was found that there was no statistically significant difference between the two groups. Finally, a clinical trial was performed for both CAA and the natural beverage and it was concluded that there is no statistical difference between the two groups in relief time. This study concludes that the natural beverage decreases the symptom severity comparably with CAA, establishing the natural beverage as a healthy alternative for GERD and hyperacidity.

Keywords: Gastroesophageal reflux disease, *Aloe Vera*, King coconut, Natural beverage, *In vitro* and clinical evaluation

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Evaluation of Milk Lactose Hydrolyzing Potential of Crude Extract from Tomato (*Solanum lycopersicum)* Fruit

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Lactose intolerance is present in approximately 65% of the global population, predominantly among the Asian and African populations, due to a deficiency in lactase activity essential for lactose digestion. The milk-processing industry has been using mostly microbial or fungal β-D-galactosidase enzymes for lactose hydrolysis; however, their cost of production is extremely high, and they are not easily available locally in developing nations such as Sri Lanka. Tomatoes (*Solanum lycopersicum*), grown widely in Sri Lanka and often wasted upon bumper harvests, have been observed as a natural source of β-D-galactosidase (β-GALs). Thus, this study aimed to explore the potential of tomato fruit crude enzyme (TFCE) extract as a low-cost, plant-based alternative enzyme source for milk lactose hydrolysis. Crude enzyme extracts were prepared from four varieties of tomatoes (Padma, Lankan Cherry, Lankan Savor, and HORDI Hybrid 3) using phosphate buffered saline based homogenization, centrifugation, and partial purification techniques. Thirty-five milliliters of pasteurized milk was treated with different levels of crude enzyme extracts (0.5, 1.0, 1.5, and 2.0 mL) using the lyophilized enzyme extract, and efficiency of lactose hydrolysis was determined by iodometric titration and compared with an automated lactoscaner. Findings indicated that activity of TFCE was significant ($p<0.05$) and there were significant differences at variety levels. Highest lactose hydrolyzation (55.62±3.82) was observed in milk treated with crude enzyme extract from Padma variety. Overall, the findings confirm the feasibility of tomato fruit crude enzyme extract as a cost-effective and environmentally friendly source for lactose hydrolyzing enzymes.

Keywords: Tomato fruit crude enzyme, Lactose intolerance, Lactose free dairy products, β-D-galactosidase(β-GALs)

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Evaluation of Physicochemical Characteristics of Selected Cocoa (*Theobroma cacao*) Genotypes Grown in Kandy Area

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Cocoa, also known as cacao (*Theobroma cacao* L.), is one of the most commercially important crops in the world. The physical and, chemical changes that take place in fourteen genotypes of Sri Lankan cocoa after the three main post-harvest processing stages fermenting, drying, and roasting were examined in this study. Genotypic differences in physical characteristics, sphericity, surface area, volume, and colour factors, as well as changes in these characteristics throughout processing, were evaluated. Physical evaluation showed that structural densification during heat treatment resulted in a significant decrease ($p < 0.05$) in sphericity, surface area, and volume from the fresh to roasted stages due to moisture loss and bean shrinkage. Superior shape stability throughout processing was shown by the higher volume and surface area retention of genotypes 4, 6, 12, and 13. Analysis of proximate composition revealed significant ($p<0.05$) genotypic variations. All genotypes had very low total sugar contents (1.62 to 1.02%), although genotypes 4, 5, 8, 9, 12, and 14 had increased crude fat (16.57 to 49.66%) and protein contents (17.20 to 27.95%). Both drying efficiency and genotype had a substantial impact on the moisture and ash contents. The total phenolic (3.86–36.69 mg GAE/100 g DW) and total flavonoid (0.35–16.27 mg rutin/100 g DW) contents varied significantly ($p < 0.05$) among the genotypes. The highest values were seen in genotypes 9, 10, and 13, indicating greater antioxidant potential. The beans gradually darkened and reddened from fermentation to roasting, according to colourimetric measurements L* decreased while a* and b* increased showing Maillard browning and pigment production as important factors in the development of cocoa's distinctive colour. The study shows that the physical, and chemical characteristics of cocoa beans are strongly influenced by the genotype and the processing stage. The findings emphasize how crucial genotype-specific processing optimization is to roasted cocoa's structural integrity, bioactive chemical preservation, and desired sensory qualities.

Keywords: Genotypes, Physicochemical properties, Postharvest processing, Total phenolic, Total flavonoid

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Evaluation of Physicochemical Properties and Sensory Attributes of Fruit Leathers Developed from Banana and Papaya

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Fruits are highly perishable and susceptible to undesirable changes if stored untreated. So, it is important to process them into value-added, shelf-stable products, such as fruit leather, to reduce post-harvest losses. Fruit leathers are snack products made from fruit puree, providing a nutritious, natural option for consumers. In Sri Lanka, high postharvest losses of banana and papaya highlight the need for preservation through fruit-based products. This study aimed to develop banana- and papaya-based fruit leathers at different ripening stages and determine the best formulation based on physicochemical and sensory attributes. Fresh sour plantains (*Musa acuminata*) and papayas (*Carica papaya*) at three ripening stages (ripe, very ripe, and overripe) were pureed and dehydrated at 60 °C for 8 h and 30 min to 12–20% moisture using hot-air drying to make the fruit leather. Fruit leathers with different banana-to-papaya ratios (1:1, 1:2, 2:1, 1:3, and 3:1) were also prepared. Samples were analyzed for pH, total soluble solids (TSS), titratable acidity (TA), vitamin C, total phenolic content, β-carotene, and lycopene, and were evaluated for sensory attributes by 35 untrained panelists using a nine-point hedonic scale. Results showed that the fruit ripening stage significantly affected the physicochemical attributes. In the fresh banana, firmness decreased from 6.27 to 0.40 N, while TSS increased from 21 to 24%, and pH rose from 4.59 to 5.10 with ripening. Similar trends were observed in fresh papaya, where firmness dropped from 14.63 to 0.42 N and TSS increased from 7 to 13%. Overripe banana leathers had higher TSS (68.2%) and TA (1.58%), while overripe papaya exhibited the highest TSS (13%) and pH (5.65), whereas very ripe papaya leathers had greater color brightness (L* = 20.25) and phenolic content (3.66 mg GAE/g). Among the mixed formulations, the 1:3 banana-to-papaya ratio exhibited the highest nutritional quality, with the highest levels of vitamin C (11.66 mg/100 g), total phenolics (3.93 mg GAE/g), β-carotene (2.82 mg/100 g), and lycopene (0.57 mg/100 g). Additionally, the sensory properties, color, chewiness, mouthfeel, aroma, taste, and overall acceptability were more acceptable in the 1:3 mixed fruit leather. In conclusion, combining banana and papaya, particularly at a 1:3 ratio using overripe fruits, enhances both the nutritional and sensory qualities of fruit leather while offering an effective means to reduce fruit waste and improve value addition in local production.

Keywords: Fruit leather, Banana, Papaya, Postharvest losses, Physicochemical properties

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Evaluation of Quality Changes in Lasagna During Storage and Effect of Herb-Infused Oils on Sensory Quality.

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This study investigates the quality changes in pre-prepared chicken lasagna during storage and the impact of herb-infused oils on its sensory properties and oxidative stability. The research was conducted in two phases. Initially, the physicochemical and sensory attributes including texture, drip loss, pH, and overall acceptability were evaluated over varied storage periods under two conditions: chilled (2 ^{0}C) and frozen (-7 – -12 ^{0}C). The analysis revealed that, drip loss was escalated significantly with storage time($p=0.0001$), particularly in chilled lasagna, while pH also varied significantly over time ($p=0.0003$), showing an initial decline followed by a gradual increase due to protein degradation. Texture (hardness) changed significantly ($p=0.0008$), exhibiting an initial increase followed by softening after extended frozen storage. Sensory evaluation revealed that flavor ($p=0.001$) and overall acceptability ($p=0.046$) declined notably after seven days, indicating that flavor deterioration was the main factor affecting consumer acceptance. In the second phase, olive and sunflower oils were infused with dried oregano and bay leaves (1:10 w/v) by gently heating at 37–45 °C for 10 minutes and allowing to stand for two days. Filtered oils (4 g per 400 g lasagna) were incorporated into the samples prior to microwaving. The antioxidant capacity of infused oils was evaluated using the DPPH assay, and lipid oxidation in treated lasagna was assessed by the TBARS test. The results indicated that lasagna samples incorporated with combined oregano and bay leaf-infused olive oil exhibited the lowest lipid oxidation levels (MDA = 388 ± 31 ng/g) and the highest antioxidant activity (~70-72%). These findings demonstrate the synergistic effects of the herbal infusions and suggest that oregano and bay leaf-infused olive oil can significantly enhance the oxidative stability and sensory quality of frozen chicken lasagna, and providing a natural antioxidant for extending the shelf life and improving consumer acceptability.

Keywords: Lasagna, Oregano, Bay, Antioxidant capacity, Oxidative stability

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Evaluation of Raw Milk Acidification of Samples Supplied from Different Chilling Centers to the Highland Factory at Ambewela

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Milk is one of the most nutritionally balanced foods, which is widely used as a fresh or processed product. Thus, dairy farmers and processors are very concerned about the quality of raw milk, given the high level of perishability of milk. Acidification of raw milk can significantly affect the final characteristics of the milk product and its safety. This study was aimed to evaluate the acidification of raw milk supplied from different chilling centers to the Highland factory at Ambewela. It was conducted at four major milk chilling centers (Passara, Welimada, Gampola, and Kotagala) and the Highland Milk Factory. Milk samples collected from each chilling center and the factory were assessed for titratable acidity using standardized NaOH solution. The overall mean titratable acidity was calculated for milk from each chilling center and at the factory level. Statistical analyses were performed using a completely randomized design and analysis of variance. A significant difference was observed in the mean acidification of raw milk from different chilling centers at the factory level ($p<0.05$). The mean acidification level was highest in milk samples from Passara, both at the chilling center level (1487.50 mg/L) and at the factory level (1632.00 mg/L). Furthermore, a significant difference ($p<0.05$) was found in the acidification of raw milk between chilling centers and the factory. The findings suggest that distance of transportation and the hygienic practices during the handling of milk have a significant impact on the acidification of raw milk.

Keywords: Acidification, Ambewela Highland factory, Dairy industry, Milk.

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Evaluation of the Effects of Moisture Content, Type of Packaging Material, Oxygen Absorber and Regional Variability on the Stability of Added Flavour in Sri Lankan Flavoured Tea

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Flavoured tea quality depends on the stability of the added flavour. This study evaluated the effects of moisture content, type of packaging material, presence of an oxygen absorber, and regional variability on the stability of added flavours in Sri Lankan flavoured tea. Tea samples from Uva, Uda Pussellawa and Dimbula regions with initial moisture contents of 4, 5 and 6% were prepared. Natural jasmine and synthetic bergamot flavoured teas at concentrations of 2% and 2.5% respectively, were packed in triple-laminated aluminium and metalized aluminium foil packages with and without oxygen absorber. Seven trained panelists evaluated the sensory attributes weekly over a four-week storage period using a seven-point hedonic scale. In the selected Uva region, total plate count and volatile linalool content were determined. Selected Uva region jasmine-flavoured tea samples were kept at 25±2 °C temperature and 60%±5 humidity, and at 40±2 °C temperature and 75%±5 humidity to evaluate the storage stability. In the bergamot-flavoured tea, region and other main factors had a significant effect ($p<0.05$) on flavour, with interaction effects with storage time. Total plate count in the selected Uva region jasmine flavoured tea samples was low, with oxygen absorber and jasmine flavour, having a better microbial quality compared to the unflavoured sample. Initial moisture content and other main factors had a significant effect ($p<0.05$) on the final moisture content during storage, with interaction effects in the elevated conditions. In elevated conditions, jasmine flavoured tea with low initial moisture content, triple-laminated aluminium package, with oxygen absorber had a low moisture gain during storage.

Keywords: Flavoured tea, Flavour stability, Sensory evaluation, Moisture content

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Exploring the Potential of Nutritional Quality Enhancement in Spinach Microgreens through Foliar Application of Albert's Solution and Ascorbic Acid

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Microgreens are young, nutrient-rich edible seedlings that serve as an excellent source of vitamins, minerals, and bioactive compounds. Spinach (*Spinacia oleracea* L.) microgreens are rich in iron, folate, vitamin C, and antioxidants, providing substantial health and nutritional benefits. This study evaluated the effect of foliar application of Albert's solution and ascorbic acid, individually and in combination, on the growth and nutritional value of spinach microgreens. The experiment was conducted under controlled conditions using Completely Randomized Design (CRD) with four treatments: control, Albert's solution (100 ppm), ascorbic acid (200 ppm), and the combination of 100 ppm Albert's solution alternated with 200 ppm ascorbic acid. Foliar sprays (10 mL/tray) were applied every two days from eight days after sowing. Growth, nutritional, and biochemical parameters were measured at harvest, 21 days after seeds sowing. The combined foliar application of Albert's solution and ascorbic acid led to significant ($p<0.05$) improvements in several key nutritional parameters compared to those of individual applications and the control. Phosphorus concentration increased by approximately 61%, antioxidant capacity by 78%, and ascorbic acid concentration by 115%, compared to the control, indicating a strong synergistic effect between mineral nutrients and vitamin C toward nutritional quality enhancement. Chlorophyll a and carotenoid contents were also significantly higher ($p<0.05$) in the combined treatment. However, biomass yield (fresh and dry weight), nitrogen and potassium content, crude protein, total chlorophyll, and ash content did not show significant difference among treatments. Overall, these results demonstrate that combined foliar application of Albert's solution and ascorbic acid can selectively enhance the nutritional and antioxidant properties of spinach microgreens.

Keywords: Albert's Solution, Foliar Application, Nutritional Quality, Spinach Microgreens

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Formulation and Characterization of a Low-Alcoholic Beverage Using Fermented Star Fruit (*Averrhoa carambola*) and Pineapple (*Ananas comosus*) Juice

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The growing demand for health-conscious beverages has created opportunities for low-alcoholic (0.5-1.2% alcohol) beverage alternatives that retain the sensory and functional qualities of fermentation while reducing the health risks. Tropical fruits are rich in bioactive compounds and offer great potential for developing functional beverages with enhanced nutritional and sensory qualities. Thus, the current study aimed to develop a low-alcohol tropical fruit beverage using the Mauritius variety pineapple (*Ananas comosus*) and honey-sweet star fruit (*Averrhoa carambola*) through controlled fermentation. A range of initial experiments was conducted to identify the optimal fermentation conditions to achieve 0.5–1.2% Alcohol by Volume. The optimal fermentation conditions were identified as an initial sugar concentration of 14 °Brix, a pH range of 3.75–3.85, a yeast inoculum of 0.75 g/L, and a one-day duration, which produced a beverage with ethanol content of 1.10±0.02% Alcohol by Volume. Post-fermentation safety treatments, including pasteurization and the addition of sodium metabisulphite and potassium sorbate, ensured microbial stability and product safety, with a total plate count of 3.60±0.03 $\log_{10}$ CFU/mL and no detectable methanol content. Sensory evaluation of different fruit blend ratios using a consumer panel identified the optimal formulation as 75% v/v pineapple and 25% v/v star fruit, providing superior flavour, aroma, and overall acceptability. Physicochemical analysis of the final product indicated 22.10±1.28 mg/100 mL vitamin C, moderate residual sugar (8.45±0.53% w/w), balanced acidity (0.465±0.018% w/w), 12.06±0.12 °Brix and stable pH (3.78), contributing to a smooth flavour profile. The findings indicate that the controlled fermentation of the optimized fruit blend, followed by subsequent processing, yields a safe, nutritionally enriched and sensory appealing low alcoholic tropical fruit beverage.

Keywords: Ethanol, Fermentation, Pineapple, *Saccharomyces cerevisiae*, Star fruit

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Formulation and Evaluation of Ayurveda Inspired Sodas Enriched with Natural Ingredients for Healthy Refreshment

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This study aimed to formulate and evaluate on Ayurveda inspired soda product range based on 3 herbal formulations using coriander seeds, tamarind pulp and green apple respectively, targeting soda consumers in USA. A sensory evaluation (nine point hedonic) was conducted for each herbal formulation for the selection of the best sweetening option from 3 sweetening treatments. As the best sweetening option sugar and stevia mix was selected for each product formulation. As the physicochemical parameters pH, total soluble solids (TSS), total sugar and reducing sugar content, titratable acidity, proximate composition, Na content and carbonation level were analyzed and representing the bioactive compounds availability antioxidant activity, total phenolic content and ascorbic acid content were analyzed. For the comparison, parameters were compared with the respective parameters of "Cola" (highly consuming soda in USA). A significantly higher pH in coriander and green apple sodas ($p = 0.0012$) compared to cola beverages, significant reduction in total soluble solids and carbonation level ($p = 0.002$, $p = 0.034$, respectively) compared to colas were observed in 3 sodas. Coriander, tamarind and green apple sodas demonstrated higher values in antioxidant activity, total phenolic content and ascorbic acid content, respectively. The CFU values from total plate count method were analyzed weekly for the microbial safety of each formulation with the storage time. The pH variation of each product with the storage time at different storage temperatures (4 ℃, 25 ℃ and 40 ℃) were analyzed to estimate the shelf-life of the products. All soda formulations demonstrated a higher shelf-life at the chilling temperature (4 ℃) as 19.6 weeks (coriander soda), 18.5 weeks (tamarind soda) and 17.3 weeks (green apple soda). Clinical analysis and market acceptance among the US population should be analyzed in future studies.

Keywords: Herbal formulation, Ayurveda inspired soda, Carbonation level, Cola, Stevia

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Formulation and Functional Evaluation of Multi-Herbal Supplement for Serum Cholesterol Reduction Using Garlic, Cumin, Green Tea and Curry Leaves

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This study aimed to develop and evaluate a palatable multiherbal tablet supplement using garlic, curry leaf, cumin, and green tea powders, combined with honey, sucralose, and citric acid, for its potential to improve cholesterol and cardiometabolic risk biomarkers in adults at borderline to low cardiovascular risk. A randomized controlled trial was conducted with 26 adult volunteers, where the treatment group received two 3.5 g tablets daily for six weeks formulated with 1 g garlic powder, 1 g curry leaf powder, 0.5 g cumin powder, 0.25 g green tea powder, 0.5 g honey, 0.5 g sucralose, 0.2 g citric acid, and wheat flour binder, coated with dark chocolate. The control group received no active intervention. Biochemical parameters including total cholesterol (TC), LDL cholesterol (LDL-C), HDL cholesterol (HDL-C), triglycerides (TG), fasting blood glucose (FBG), and blood pressure were measured at baseline and post-intervention. Liver and kidney function markers (ALT, AST, serum creatinine) were monitored for safety. Physicochemical, phytochemical, microbial, and sensory analyses were performed using standard methods. The supplement demonstrated a significant reduction in TC and LDL-C ($p = 0.022$ and $p = 0.016$, respectively) with no significant changes in TG, HDL-C, FBG, or blood pressure. Liver and kidney function tests indicated no adverse effects, confirming safety. The most palatable formulation contained citric acid, honey, and sucralose, and showed favorable antioxidant activity with safe microbial quality and no detectable *Escherichia coli* contamination. Sensory evaluation favored the supplement's acceptability. These findings support this multiherbal supplement as a safe and culturally relevant alternative for cholesterol reduction and cardiometabolic risk management in adults. Further larger and longer-term studies are recommended to optimize dosage, confirm efficacy, and evaluate herb-drug interactions.

Keywords: Multi-herbal supplement, Cholesterol reduction, Garlic, Curry leaves, Randomized controlled trial

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Formulation and Quality Evaluation of a Nutritional Bar from Locally Sourced Cereals and Pulses

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Breakfast skipping is a main concern among students and working individuals, often resulting in poor nutrient intake. This study was aimed to formulate and evaluate a nutritional bar with enhanced protein content using locally available cereals and pulses as an affordable Ready-to-eat food product. 3 formulations (F1, F2, and F3) were prepared using black gram flour, green gram flour, chickpea flour and rice flour, combined with milk, sugar, sesame oil, and a pectin-based binding agent, with the addition of 9.3% rice flakes for F1, 9.3% roasted split green gram for F2 and 8.4% of each rice flakes and roasted split green gram for F3. The dry ingredients were mixed with the binding agent, moulded, and baked at 180 °C for 10 minutes. The nutrition bars were evaluated for proximate composition (standard AOAC methods), physical properties (texture and colour), and sensory parameters. The results indicated that F2 recorded the highest crude protein content (15±0.84%), F3 exhibited the highest dietary fibre content (2.12±0.07%) while the lowest moisture content (11.46±0.86) observed in F3. Crude fat percentages (≈11.5%) of the three formulations were not significantly different ($p>0.05$). However, there was ($p<0.05$) a significant difference in ash percentage among the formulations with F3 reporting the highest ash content (6.14±0.14%). Sensory evaluation revealed no significant differences ($p>0.05$) among formulations for the preference of appearance, colour, taste, texture, sweetness, and overall acceptability. In conclusion, F2 was identified as the most suitable as a protein-rich formulation, offering the highest protein content, with the crude fat content of 11.77% and a carbohydrate content of 51.72% providing 372.43 kcal/100g. The estimated cost per 75 g bar without packaging was Rs.78.15, demonstrating the product's potential affordability. Further research is required to assess the most suitable packaging material and the shelf-life at different storage conditions.

Keywords: Nutritional Bar, Pulses, Enhanced Protein, Sensory Evaluation, Pectin

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Fungal And Bacterial Isolates Associated with Grain Discoloration of Five Major Rice Varieties Cultivated Under IL Ia Agroecological Conditions

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Grain discoloration of rice has been identified as a serious threat in many of the high-yielding rice varieties introduced to Sri Lankan agriculture. Intricate interactions between rice variety and temporal and spatial environmental factors have been identified as contributory factors of grain discoloration. In-depth information on pathogens associated with grain discoloration under different cultivation conditions would be useful in planning effective management of rice grain discoloration. The present study was conducted to profile the fungal and bacterial pathogens associated with grain discoloration of five major rice varieties, namely BG352, BG366, BG360, BG300, and BG374, cultivated during the 2024/25 *Maha* season under IL Ia agroecological conditions. Percentage of discolored panicles was recorded and healthy and discolored grains were collected from each variety at their maturity stage. Fungi and bacteria on healthy and discloured grains were isolated using synthetic media. Pathogenicity of the isolated fungal and bacterial isolates was confirmed by inoculating the detached panicles, plants grown on pots and field cultivated plants. Percentage panicle discoloration was recorded as 67.92 in BG360, 45.0 in BG366, 37.1 in BG352, 34.16 in BG374 and 31.06 in BG300 variety, demonstrating the highest and lowest susceptibility by BG 360 and BG 374, respectively. Twelve distinct fungal isolates and 3 bacterial isolates were obtained which were associated only with the discoloured grains. Among them, only 5 fungal isolates proved to be infectious. Colony and spore morphology identified the fungal isolates as *Fusarium* (1), *Curvularia* (2) and *Aspergillus* (2) spp. Under the test conditions, *Curvularia* sp. was associated with BG 366. Discolorued grains of BG 300 and BG 360 reported *Curvularia* and *Aspergillus* spp. *Aspergillus* and *Fusarium* spp. were associated with BG 352 and BG 374 varieties. Findings revealed varietal differences in terms of fungal isolates associated with discoloured grains grown under same location and season.

Keywords: Grain discoloration, *Curvularia* sp., *Aspergillus* spp., *Fusarium* sp., Pathogenicity test

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Guar Gum (Edicol®) as a Replacement for Citrus Fiber in Emulsion-Type Chicken Sausages

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This study evaluated the potential of guar gum (Edicol®) fiber as a cost-effective and readily available alternative to citrus fiber in emulsion-type chicken sausages. Four sausage formulations were developed with varying levels of citrus fiber replacement by guar gum fiber: T1 (100% citrus fiber), T2 (50% citrus fiber replaced with guar gum fiber), T3 (75% citrus fiber replaced with guar gum fiber), and T4 (100% citrus fiber replaced with guar gum fiber). Physicochemical, microbial, proximate, and sensory properties of sausages were analyzed to assess product quality and stability. Physicochemical parameters, including pH, cooking loss, water-holding capacity, hardness, thiobarbituric acid reactive substances (TBARS), and color attributes (L*, a*, b*), were evaluated during refrigerated storage (4 °C) on days 1, 7, and 14, while cooking loss was measured on day 0. Total plate count (TPC), *Escherichia coli*, and *Staphylococcus aureus* counts of sausages were determined on days 1, 7, and 14 during storage. Sensory evaluation of sausages (appearance, mouthfeel, juiciness, flavor, and overall acceptability) was conducted on day 0. No significant differences ($p > 0.05$) were observed in physicochemical parameters among formulations containing citrus or guar gum fiber during storage. The TPC values did not differ ($p > 0.05$) among treatments during storage, while *E. coli* and *S. aureus* were undetected on days 1 and 7 but appeared in all sausages on day 14. Sensory evaluation revealed that the formulation containing 100% guar gum fiber achieved the highest scores across all sensory attributes. In conclusion, guar gum fiber can effectively and fully replace citrus fiber in emulsion-type chicken sausages without adversely affecting physicochemical or microbial quality while enhancing sensory characteristics.

Keywords: Guar gum fiber, Citrus fiber, Sausages, Physico-chemical properties, Sensory attributes

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Immunomodulatory Potential of Sri Lankan Spices and Silver Tip Tea Extracts: An *in vitro* Assessment

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This study explores the antioxidant and immunomodulatory potential of five plant extracts, namely turmeric (*Curcuma longa*), cardamom (*Elettaria cardamomum*), garcinia (*Garcinia quaesita*), cinnamon (*Cinnamomum verum*) and silver tip tea (*Camellia sinensis*) with the aim of building the groundwork for future plant-based nutraceuticals. Hot water extracts were used to assess antioxidant capacity via DPPH radical scavenging, total phenolic content (TPC), and phytochemical screening. Further, their ability to modulate nitric oxide (NOx) production in peripheral blood mononuclear cells (PBMCs) was tested. Silver tip tea showed the highest antioxidant activity ($EC_{50} = 5.36 \pm 1.43$ µg/mL) and phenolic content (95.52 ± 5.63 mg GAE/g DW), while cardamom showed the lowest antioxidant activity (714.78 ± 63.57 µg/mL) and phenolic content (1.21 ± 0.17 mg GAE/g DW), which may indicate the potential contribution of polyphenolic compounds to the antioxidant activity. All the extracts showed the presence of saponins, flavonoids, and terpenoids when using qualitative phytochemical screening. Of the extracts tested, increased NOx production was observed for cinnamon, turmeric, and cardamom while decreased NOx production was observed for silver tip tea and garcinia (values are below the detection level), which may indicate anti-inflammatory potential. Some combined treatments of the above extracts showed statistically significant ($p < 0.01$) enhancement of both increased and decreased antioxidant values with different combinations of extracts compared to expected theoretical values. However, NOx donor screening was below the detection limits, highlighting the need for more sensitive assays. With the observed antioxidant level, the findings highlighted that spices and silver tip tea used in this study may have a potential to act as immunomodulators under *in vitro* conditions. This study offers scientific evidence for developing plant-derived nutraceutical supplement which contains immunomodulatory properties from the tested materials while indicating further immunological studies.

Keywords: Immunomodulator, Nutraceuticals, Nitric Oxide, Antioxidant, Peripheral Blood Mononuclear Cells

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Impact of Bunch Covering on Postharvest Quality and Shelf Life of *Ambul* Banana in Sri Lanka: Evaluating Cover Colour and Timing of Application

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Ambul banana, a popular dessert variety in Sri Lanka, has a short postharvest life that limits its export potential. This study evaluated the effects of bunch cover colour and application timing on fruit quality and shelf life. A 2-factor factorial experiment in a Completely Randomized Design tested blue, white, and transparent covers applied at two stages as early (after bell emergence, before bract lifting) and late (≈14 days after bell emergence), alongside uncovered control. Cover colour influenced microclimate, with transparent covers recording the highest temperature (32.2±2.1 °C) and white the lowest (31.4±1.7 °C), while blue maintained moderate conditions with suitable light filtering. Transparent covers hastened maturity (9 weeks after flowering) but gave the shortest shelf life (6 days), whereas no-cover and early blue-cover treatments prolonged maturity and achieved the longest shelf life (12 days). Early blue-cover applications reduced weight loss, delayed softening, and maintained stable soluble solids content, titratable acidity, and pH during storage. Sensory scores were highest for early, blue-covered fruits. Overall, early application of blue bunch covers is a simple, low-cost practice to enhance fruit development, preserve quality, and extend the shelf life of *Ambul* banana.

Keywords: *Ambul* banana, cover colour, postharvest quality, shelf life, timing of application

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Impact of Manure Application on the Prevalence of Antibiotic Resistant Bacteria in Coconut Cultivated Soils

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Soil management practices significantly influence microbial communities and the proliferation of antibiotic resistance. This study investigated the effects of long-term (>15 years) application of organic (poultry manure with compost) and chemical fertilizers and no fertilization on soil physicochemical properties and the prevalence of antibiotic- resistant bacteria (ARB) in coconut cultivated soils. Soil samples were collected at 0-15 cm depth from manure circles (MC) and center squares (CS) in three replicates from two estates, representing organic-fertilization (OF), chemical-fertilization (CF), and no-fertilization (NF) practices. Soils were analyzed for bulk density (BD), pH, electrical conductivity (EC), permanganate oxidizable carbon (POXC), abundance of total culturable bacteria, and bacteria resistant to amoxicillin (10 ppm) and sulfamethoxazole (15 ppm). Fertilization treatment (FT) significantly influenced ($p<0.05$) soil pH and EC. The total culturable bacterial population was significantly higher in OF (6.67 ± 0.07 $\log_{10}$ CFU/g) compared to CF (6.01 ± 0.17 $\log_{10}$ CFU/g). The abundance of two ARB groups was not significantly different ($p>0.05$) between FT, but their prevalence was higher ($p<0.05$) in CF than other treatments. The abundance of amoxicillin and sulfamethoxazole-resistant bacteria was significantly greater ($p<0.05$) in MC than in CS in both CF and OF. Soil BD had significant correlations with the abundance of total bacteria ($r= -0.375$, $p=0.029$), amoxicillin-resistant bacteria ($r= -0.398$, $p=0.002$), and sulfamethoxazole-resistant bacteria ($r= -0.462$, $p=0.006$). In conclusion, FT affected the abundance of soil bacteria and the prevalence of bacteria resistant to amoxicillin and sulfamethoxazole in coconut cultivated soils. Although OF enhanced total bacterial populations, it has not contributed to increase the prevalence of ARB in the soils of the studied coconut plantations.

Keywords: Amoxicillin, Antibiotic resistance, Organic fertilizer, Poultry manure application, Sulfamethoxazole

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Importance of Initial Steps of Tea Processing for Producing High Quality Black Tea

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Tea (*Camellia sinensis* L.) is a crop with global demand for premium-quality orthodox black tea continues to rise, making consistent improvement in manufacturing quality a national priority. In orthodox tea processing, the initial steps, leaf standard selection, withering, and pre-conditioning, are considered fundamental determinants of final tea quality. However, limited research has been conducted to quantify how variations in these early-stage parameters influence the physical quality parameters during rolling, specifically the formation of flakes, which negatively affect the market value and the grade recovery. Therefore, this study aimed to evaluate the impact of different leaf standards and withering conditions on flake percentage during two-stage rolling in black tea manufacturing. The research was conducted in a Sri Lankan orthodox tea factory using categorized green leaf fractions: best leaf percentage, below best leaf percentage, and boiled leaf percentage. Withering conditions were classified as over-withering, soft withering, and good withering. Leaf samples from each category were subjected to rolling by Roller 1 and Roller 2, sequentially and the flake percentage was calculated for each treatment. Data analysis was performed using ANOVA procedure to determine the treatment effects. Results revealed that increasing the proportion of the best leaves significantly reduced the flake percentage, demonstrating that tender leaf standards improve rolling efficiency and reduce leaf fragmentation. Conversely, increasing below the best leaf percentage caused a rise in flake percentage in Roller 1 but a reduction in Roller 2, indicating uneven maceration due to coarse material. Over-withering resulted in increased flake formation in both rollers, while soft withering reduced flake percentage, highlighting the importance of maintaining proper moisture levels. Boiled leaf increased flake percentage in Roller 1 but decreased it in Roller 2 due to structural leaf weakening. Good withering increased flake percentage in Roller 1, while Roller 2 remained unchanged.

Keywords: Black tea processing, flake formation, leaf standard, withering percentage, rolling efficiency

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Incorporation of Yoghurt Drinks with Pumpkin Puree: Development of A Functional Dairy Beverage

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The present study investigated the development of a functional yoghurt drink fortified with pumpkin puree (*Cucurbita moschata*) to enhance its nutritional and functional properties. Four formulations containing 0% (control), 5%, 10%, and 15% (v/v) pumpkin puree were prepared and evaluated for their physicochemical, microbiological, proximate, and sensory characteristics during refrigerated storage at 4 ± 1°C for 21 days. The experiment was conducted under a Completely Randomized Design (CRD) with 3 replicates/treatment, and statistical analyses were performed using one-way ANOVA followed by Duncan's Multiple Range Test (DMRT) at a 5% significance level. Results revealed that increasing levels of pumpkin puree significantly ($p<0.001$) affected the key physicochemical parameters. The mean pH declined from 4.60 in the control to 4.50 in the 15% formulation, while titratable acidity increased from 0.806 ± 0.002 to 0.822 ± 0.002 g/100 mL. Solids-not-fat (SNF), total solids (TS), and specific gravity (SG) increased proportionally with pumpkin addition ($p<0.001$), confirming the enrichment of the yoghurt matrix with non-fat solids. Fat content decreased significantly (from 2.67 ± 0.004% to 1.19 ± 0.004%) due to the dilution effect of the puree. Microbiological analysis showed that total plate count (TPC) of all treatments declined gradually over storage. Yeast and mold counts were minimal (≤1.6 log CFU/mL), and coliforms were absent in all treatments, confirming microbiological safety. Proximate analysis indicated that pumpkin fortification significantly ($p < 0.05$) improved ash, crude fiber, and carbohydrate content while enhancing β-carotene contribution. Sensory evaluation using a 7-point hedonic scale revealed that the 10% pumpkin treatment achieved the highest overall acceptability (mean score = 6.37 ± 0.12), particularly for colour, taste, and texture, while the 15% level was less preferred due to excessive vegetal flavour. The results of this study revealed that fortification of yoghurt drinks with 10% pumpkin puree (v/v) optimally balances nutritional enhancement, microbiological stability, and consumer acceptability, resulting in a low-fat and microbiologically safe functional dairy beverage that has the potential to contribute to vitamin A intake and support public health nutrition goals.

Keywords: Functional dairy beverage, Physicochemical properties, Pumpkin puree, Sensory evaluation, Yoghurt drink

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Influence of Aging Time and Blends of Stabilizers and Emulsifiers on Quality Attributes of Gelato Ice Cream

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This study aimed to evaluate the influence of aging time and different blends of stabilizers and emulsifiers on the quality characteristics of gelato ice cream. Three types of commercial stabilizer-emulsifier blends and two aging times were used to produce gelato ice cream. Palsgaard® ExtruIce 278, Palsgaard® ExtruIce 294 and Palsgaard® ArtisanIce 980 were used as commercial stabilizer-emulsifier blends and 4 hours and 12 hours were used as aging times of gelato ice cream mixes. The properties of gelato ice cream, including pH, melting rate, overrun, viscosity, hardness and sensory attributes were studied. Results revealed that the Palsgaard® ExtruIce 294 stabilizer-emulsifier blend exhibited the lower ($P<0.05$) melting rates (2.83 ± 0.00 and 2.87 ± 0.00 g/min) in both 4 hours and 12 hours of aging time, indicating improved structural stability. The 12-hour aging time resulted in higher ($P<0.05$) overrun values (47.0 ± 0.6, 47.8 ± 1.7 and 45.8 ± 0.7 %) than 4-hour aging in all three types of stabilizer-emulsifier blends. Palsgaard® ExtruIce 278 with 4 hours of aging time and Palsgaard® ExtruIce 294 with 12 hours of aging time included treatments were selected as most preferred ($P<0.05$) samples in sensory evaluation. Based on both physical and sensory properties, Palsgaard® ExtruIce 294 with 12 hours of aging was identified as the most suitable combination for gelato production. This combination is recommended for achieving improved product quality and enhanced consumer acceptability in gelato manufacturing.

Keywords: Ice cream, Gelato, Stabilizer-emulsifier, Aging time

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Isolation, Identification and Selection of Gamma Amino Butyric Acid (GABA) producing Lactic acid bacteria for the development and characterization of Functional set-yoghurt.

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This study aimed to isolate and identify high Gamma-Amino Butyric Acid (GABA) producing LAB (Lactic Acid Bacteria) from freeze-dried culture collection and develop a GABA-enriched functional set-yoghurt. Twenty LAB isolates were screened using a spectrophotometric method and quantified by Ultra Performance Liquid Chromatography (UPLC). LAB 11 (25.43 mg/L), LAB 12 (24.65 mg/L), and LAB 9 (24.38 mg/L) showed higher ($P<0.05$) GABA production and were used for set-yoghurt preparation. The set-yoghurt with LAB 11 showed the highest ($P<0.05$) GABA level (32.57 mg/100 mL) on day 2 of storage. Although GABA content slightly decreased during 7 days of storage, it remained stable. Physicochemical and textural properties were within acceptable ranges, while GABA-enriched set-yoghurts received higher sensory scores than the control. These findings indicate that GABA-enriched set-yoghurt developed using selected LAB strains possesses desirable physicochemical, textural, and sensory characteristics with added functional benefits, exhibited strong potential as a novel health promoting dairy product.

Keywords: Gamma-Amino butyric acid (GABA), GABA-enriched set-yoghurt, Lactic Acid Bacteria (LAB)

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In-silico Screening of *Boerhavia diffusa* Compounds as ICP11 Protein Inhibitors to Disrupt White Spot Syndrome Virus Assembly in Shrimp

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White Spot Syndrome Virus (WSSV) is one of the major viral pathogens of crustaceans, such as shrimp, and continues to cause huge economic losses in global aquaculture. Currently, there are no effective antiviral treatments, and disease control depends on biosecurity measures, which are often inadequate. This study focused on an *in-silico* approach to identify potential antiviral compounds targeting ICP11, a viral protein that mimics host DNA and disrupts nucleosome assembly. Inhibiting this protein could effectively block viral replication and disrupt the assembly of viruses. Phytochemicals from the medicinal plant *Boerhavia diffusa* (Hog Weed) were screened through an extensive literature review up to 2025, identifying 64 bioactive compounds. 17 compounds satisfied drug-likeness and ADMET (Absorption, Distribution, Metabolism, Excretion, and Toxicity) criteria, adhering to Lipinski's rule of five. The ICP11 protein model was generated using AlphaFold3 and structurally refined, followed by structural validation and molecular docking to predict ligand-binding affinity and interaction stability. Notably, the compound 1,6-bis(4'-Chlorophenyl)-3-methylpyrazolo[3,4-b] pyridine exhibited the highest binding affinity, of −9.435 kcal/mol. To further validate binding stability, molecular dynamics (MD) simulations of 100 ns were performed, confirming structural stability with the protein RMSD stabilized between 3.0– 4.8 Å and the ligand RMSD between 1.0– 2.0 Å, while most residue RMSF values ranged from 1.0– 3.8 Å, throughout the simulation. MM-GBSA analysis revealed a binding free energy of −73.86 kcal/mol, indicating strong thermodynamic favorability of complex formation. The compound formed stable hydrogen bonds and hydrophobic interactions with key residues of the active site, supporting its role as a potential inhibitor of ICP11. Overall, this study identifies 1,6-bis(4'-Chlorophenyl)-3-methylpyrazolo[3,4-b] pyridine as a promising candidate for the prevention of WSSV infection in shrimp. Further *in-vitro* and *in-vivo* evaluations will be essential in validating their pharmaceutical potential and verifying their protective efficacy against WSSV.

Keywords: White Spot Syndrome Virus, ICP11 Protein, *Boerhavia diffusa*, Molecular Docking, Molecular Dynamics Simulation.

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Long-Term Effects of Different Fertilizer Practices on Trace Element Accumulation in Rice (*Oryza sativa* L.) Grown in a Low Humic Gley Soil

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Rice serves as the staple food for Sri Lankans, contributing significantly to national food security and livelihoods. This study assessed the effect of different fertilizer practices on accumulation of micronutrients and potentially toxic trace elements (PTEs) in long-term in the Bg 358 rice variety. Four treatments, *i.e.*, no fertilizer (NF), chemical fertilizer (CF), organic fertilizer (OF) and organic and chemical fertilizer (OF+CF) were implemented with three replicates per each treatment in a Randomized Complete Block Design. The field has been maintained with same treatments in same plots for 22 years. Fertilizers were applied according to the recommendation of Department of Agriculture, Sri Lanka. Soil samples were collected from 0-15 cm depth at 0, 3, 59, and 80 days after transplanting of rice seedlings and analyzed for pH, electrical conductivity, organic matter content, available phosphorus, total and bioavailable trace element (Fe, Mn, Cu, Zn, Cd, and Pb) concentrations. Vegetative parts and grain samples were collected in the harvesting stage and analyzed for total trace element concentrations. Soil was slightly acidic to neutral throughout the growing season. Higher Fe and Mn accumulations were observed in shoots, whereas Zn and Cu showed comparatively higher accumulation in grain. Moreover, Cd and Pb concentrations were low in grains and higher in the vegetative parts, indicating limited translocation of PTEs to grain. Pb concentration ranged from 19.7±1.2 to 23.7±4.2 mg/kg in vegetative parts and from 9.7 ± 0.3 to 11.7 ± 1.4 mg/kg in grains, with no significant differences among treatments. However, OF+CF showed significantly high Cd accumulation in vegetative parts. The CF treatment had higher Cd concentration in grains than maximum permissible level of Cd recommended by the FAO/WHO CODEX Alimentarius (*i.e.*, 0.2 $mg\,kg^{-1}$), highlighting potential food safety risks. These results emphasize that integrated fertilizer management ensures optimal micronutrient uptake and limits potentially toxic trace element accumulation in rice, supporting food safety and sustainability.

Keywords: Bioavailability, Heavy metals, Human health, Micronutrients

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Manipulation of Soaking and Steaming Conditions to Optimize Partial Parboiling of Paddy and Prediction of Rice Quality Parameters Using Response Surface Methodology

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This study was conducted to optimise partial parboiling conditions of Nadu rice by manipulation of soaking and steaming parameters and to predict rice quality using Response Surface Methodology (RSM). The effects of soaking time (4–12 h) and steaming time (2–12 min), each tested at 3 levels, based on head rice yield (HRY), hardness, lightness, colour, gelatinization percentage, and cooking time were determined, with R^2 values of 0.92, 0.91, 0.94, 0.89, 0.87, and 0.98, respectively. Models developed for each parameter showed significant ($p < 0.05$) predictive capability. Hardness, HRY, cooking time, and colour increased with process severity, while lightness decreased, although HRY decreased after reaching a maximum. Optimization revealed one set of conditions to achieve maximum HRY (soaking 8.5 h, steaming 12 min, overall desirability = 0.868). Three optimum partially parboiling conditions were identified by targeting different gelatinization percentages, 60%, 65% and 70%. Sixty percent gelatinization was obtained by soaking for 4.2 h and steaming for 3.5 min (overall desirability = 0.8765), while 65% by soaking for 5 h and steaming for 6.4 min (overall desirability = 0.870), and 70% was obtained by soaking for 7.2 h and steaming for 7.5 min (overall desirability = 0.890). The findings demonstrated that precise manipulation of soaking and steaming times can effectively control the extent of gelatinization while maximizing the HRY and maintaining desirable cooking qualities. The optimised parameters generated by RSM provide valuable guidance for the rice processing industry to achieve quality consistency and enhanced consumer acceptability through partial parboiling practices.

Keywords: Partial parboiling, Soaking, Steaming, Head rice yield, Response surface methodology

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Molecular Detection of Nuc Virulence Gene in Staphylococcus aureus Isolated from Goat Milk in Kandy District, Sri Lanka.

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*Staphylococcus aureus i*s one of the major causative agents of clinical and sub-clinical mastitis in dairy ruminants. This bacterium produces a variety of extracellular toxins and virulence factor, mainly thermonuclease *(nuc)*, which contribute to its pathogenicity. This study was designed to identify *S. aureus* in clinical and sub-clinical mastitis goat milk samples collected from the Kandy District of Sri Lanka and to determine the prevalence of the *nuc* gene.A total of 43 milk samples were collected from goats with clinical and sub-clinical mastitis. *S. aureus* was isolated using standard bacteriological methods. Initially cultured on blood agar and selective Mannitol Salt Agar, followed by observation of colony morphology and Gram staining. Presumptive isolates were then confirmed using biochemical tests, including the coagulase test, Voges-Proskauer (VP) test, oxidase test, and catalase test. DNA was extracted from these confirmed isolates and analyzed for the presence of the *nuc* gene using Polymerase Chain Reaction (PCR). Among the 43 samples, 3 (7.0%) were from clinical mastitis, 24 (55.8%) from sub-clinical mastitis, and 16 (37.2%) were identified as mastitis-free. Based on bacteriological and biochemical profiling, 15 samples (34.9%) were confirmed as *S. aureus*. The *nuc* gene, a species-specific marker, was detected in 7 of the 15 isolates (46.7% of *S. aureus* positives). These findings demonstrated a significant prevalence of toxigenic *S. aureus* strains in mastitic goats within the region. This study provides important insights into the molecular epidemiology of goat mastitis in Sri Lanka and highlights a potential public health concern due to the risk of toxin transmission through milk. The results warrant the necessity of effective mastitis management strategies and further surveillance of virulence factors in local goal populations.

Keywords: *Staphylococcus aureus*, goat mastitis, *nuc* gene, PCR, biochemical characterization

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Molecular Docking and *In Silico* Analysis of Phytochemicals from Green Tea, Black Tea, and Cinnamon Tea for their Potential to Inhibit Key Digestive Enzymes Associated with Diabetes

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Although current antidiabetic drugs that inhibit α-amylase and α-glucosidase are effective, they often cause gastrointestinal side effects. Therefore, safer and naturally derived alternatives are needed. Green tea, black tea, and cinnamon tea are widely consumed beverages, rich in phytochemicals with potential antidiabetic activity. This study aimed to evaluate the inhibitory effects of the phytochemicals present in the above food materials against key digestive enzymes related to diabetes, to predict their pharmacokinetic and toxicity profiles through *in silico* approaches. Twenty phytochemicals were selected based on their documented abundance in tea and cinnamon infusions, relevance to glucose metabolism, and structural diversity. Molecular docking was performed using AutoDock 1.5.7 against α-amylase (PDB ID: 1HNY) and α-glucosidase (PDB ID: 5NN8) to evaluate ligand–enzyme interactions. Ligands were optimized using OpenBabel and Avogadro, and binding interactions were analyzed with Discovery Studio Visualizer. SwissADME, pkCSM, and Osiris Property Explorer were employed to assess pharmacokinetic and toxicity profiles. Each ligand underwent ten docking runs, and the conformation with the lowest binding energy was selected for comparative analysis. To validate their efficacy, results were compared with metformin, a commonly used standard antidiabetic drug. All selected ligands showed negative minimum binding energy values, indicating potential inhibitory interactions with the target enzymes. Among them, theaflavin-3′-gallate and epigallocatechin gallate (EGCG) exhibited the strongest binding affinities with α-glucosidase (–8.34 kcal/mol) and α-amylase (–7.23 kcal/mol), respectively, comparable or superior to metformin (–8.26 and –6.99 kcal/mol). Both compounds were predicted to be non-toxic, non-carcinogenic, and non-mutagenic, confirming their safety for potential therapeutic use. Overall, the findings suggest that the above phytochemicals possess significant enzyme inhibitory effects as potential antidiabetic drug candidates.

Keywords: Molecular docking, α-amylase, α-glucosidase, Diabetes, *in silico*

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Morinda citrifolia Fruit Proteolytic Enzymes Can be Used as a Novel Plant-Based Coagulant: Effects on Gouda Cheese Manufacturing Efficiency and Quality Attributes

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Cheese manufacturing traditionally relies on animal rennet for milk coagulation; however, supply shortages and ethical concerns have increased interest in plant-based and microbial alternatives. This study evaluated the potential of *Morinda citrifolia* (Noni) fruit proteolytic enzymes as a substitute for animal rennet in Gouda cheese production, focusing on their effects on yield, compositional quality, texture and sensory properties. Ripe Noni fruits were blended with sodium phosphate buffer, filtered, and centrifuged, with the supernatant collected as the crude enzyme extract. Pasteurized milk was cooled, inoculated with starter culture (CHN-11), pre-ripened for 30 minutes, then coagulated by adding $CaCl_2$ and either rennet (control) or varying concentrations of Noni enzyme extract (0.5%, 1.0%, or 2.0%; (v/v) as treatments. Results demonstrated that the inclusion of Noni extract significantly ($P<0.05$) influenced several physicochemical and textural attributes. Crude protein content increased in cheese coagulation with the addition of 1% Noni extract, suggesting enhanced protein retention and curd firmness due to optimal proteolytic balance. The higher enzyme level (2%) caused excessive proteolysis, resulting in weaker gel structures, reduced hardness, and increased syneresis. No significant differences ($P>0.05$) were observed in the composition of Gouda cheese. Color analysis showed that increasing extract concentration decreased brightness (L*) while maintaining the characteristic yellow–green hue (a* and b* values) of Gouda cheese. pH progressively declined during ripening, especially in Noni-treated samples, reflecting increased titratable acidity and enhanced lactic acid activity stimulated by Noni compounds. Textural profile analysis confirmed that 1% Noni extract exhibited superior hardness, cohesiveness and chewiness values comparable to the control, while 2% Noni extract displayed notable softening. Sensory evaluation further validated that 1% Noni extract achieved the highest overall acceptability in terms of flavor, texture and appearance. Together, the results indicated that *M. citrifolia* fruit extract at 1% (v/v) concentration offers an ideal enzymatic activity for milk coagulation, yielding Gouda cheese with desirable texture, structure and sensory quality indicating that Noni extract is a promising, eco-friendly and economically viable alternative to animal rennet in sustainable Gouda cheese production.

Keywords: *Morinda citrifolia*, Noni, Gouda cheese, Plant-based coagulant, Sensory evaluation, Texture profile

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Nutrient, Bioactive and Toxicological Profiles of Raw and Cooked Forms of Two Underutilized Seaweeds in Sri Lanka: *Sargassum polycystum* and *Padina antillarum*

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This study investigated the nutrient, bioactive and toxicological profiles of raw and cooked forms of two underutilized Sri Lankan seaweeds, *Sargassum polycystum* and *Padina antillarum*. Seaweeds were collected from Jaffna, Sri Lanka. Dried seaweed powders were subjected to proximate, mineral and heavy metal (ICP-OES) analysis. Water extracts were assessed for anti-diabetic potential (α-amylase inhibition assay) and cytotoxicity (Brine shrimp bioassay). Antioxidant activities of water and ethanol extracts were assessed as Total Phenolic Content (TPC), ABTS radical scavenging capacity (ABTS), DPPH radical scavenging capacity, Ferric Reducing Antioxidant Power (FRAP) and Oxygen Radical Absorbance Capacity (ORAC). *P. antillarum* contained higher ($p < 0.05$) ash ($36.0 \pm 0.53\%$ dry matter basis) and crude fiber ($26.22 \pm 0.96\%$ dry matter basis) contents. *S. polycystum* exhibited higher ($p < 0.05$) fat ($1.48 \pm 0.10\%$ dry matter basis) content. The crude protein content was comparable in two species ($p = 0.079$). Both species possessed substantial antioxidant capacities, with *P. antillarum* exhibiting superior radical-scavenging and reducing activities. Cooking influenced antioxidant properties ($p < 0.05$), particularly increased phenolic levels and antioxidant capacity in certain assays, depending on the solvent used. The α-amylase inhibition assay indicated moderate antidiabetic potential in both species, with cooked *S. polycystum* showing the highest inhibitory activity ($IC_{50} = 3.81 \pm 0.28$ mg/mL; $p < 0.05$). ICP-OES analysis confirmed the presence of essential minerals (Na, K, Ca, Fe, Zn, Cu, and Mg) and trace levels of heavy metals, while Cd and Pb concentrations in both species remained within WHO-permissible limits. The brine shrimp lethality bioassay indicated no cytotoxic effects up to 4,000 ppm in both raw and cooked samples of the two species. Overall, *S. polycystum* and *P. antillarum* exhibited promising nutritional quality, notable antioxidant and antidiabetic potentials, and acceptable safety profiles, supporting their potential use as functional ingredients in food and nutraceutical applications.

Keywords: *Sargassum polycystum*, *Padina antillarum*, Bioactivity, Toxicological profile, Thermal processing

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Optimization of Parboiling Process of *Keeri Samba* Paddy and Quality Improvement

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Rice (*Oryza sativa* L.) is the staple diet and culture in Sri Lanka. *Keeri* Samba is a developed variety with aroma and texture, but parboiling can alter these traits. While the process enhances yield and nutrition, improper conditions reduce quality. The research on *Keeri* Samba is limited, thus the effects of soaking temperature, soaking time, and steaming duration on the texture, color, and aroma of parboiled Keeri Samba were identify to optimize the processing conditions. *Keeri* Samba paddy collected from Maho and Pelwehera was processed at CIC Dairies, Dambulla, using a standard parboiling method: soaking (55–60 °C, 45–50 min), steaming (20–25 min), and drying (105 °C, 12–13 h). Quality traits—color, texture, aroma, flavor, and appearance—were evaluated using a colorimeter (ATO-CM-NR110) and sensory tests by 30 trained panelists. For the second experiment, Maho paddy (20 kg) was processed under different soaking temperatures (45, 60, 70 °C), soaking times (40, 50, 60 min), and steaming times (5, 6.5, 8 min), totaling 27 treatments (n = 81). Data were analyzed using Minitab 22.2. Colorimetric analysis showed Pelwehera samples were brighter, reddish, and slightly bluish, while Maho samples appeared darker with yellowish-green tones. Pelwehera rice was significantly preferred for texture ($p = 0.000059$), aroma ($p = 0.000325$), and flavor ($p = 0.000059$). Binomial and Chi-square tests confirmed significant differences ($p < 0.001$) between sources. Controlled cultivation in Pelwehera likely enhanced quality. In the second experiment, soaking temperature ($p = 0.191$), soaking time ($p = 0.209$), and steaming time ($p = 0.920$) did not significantly affect elongation ratio. However, soaking temperature ($p < 0.001$) and its interaction with steaming time ($p = 0.03$) significantly influenced color. Soaking temperature also affected texture ($p = 0.029$), aroma ($p < 0.001$), and flavor ($p = 0.045$). Treatment T16 (60 °C, 60 min, 5 min) showed highest brightness and panelist acceptance, suggesting these parameters optimize sensory and physical quality of parboiled *Keeri* Samba rice.

Keywords: *Keeri Samba*, Parboiling, Sensory quality, Colorimetric analysis, Soaking temperature

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Optimization of Processing Conditions for Dried Mango Strips with Enhanced Organoleptic and Nutritional Properties

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Mango (*Mangifera indica* L.) is an important tropical fruit in Sri Lanka, known for its unique taste, colour, and nutritional value. However, it is a seasonal and highly perishable fruit, causing large postharvest losses during the peak season. Thus, the current study aimed to develop dried mango strips with improved sensory and nutritional quality by optimizing drying conditions and pre-treatments. TJC mango variety at 70% ripening stage was used in this study. Preliminary studies identified, dipping mango slices in 0.5% citric acid for 10 minutes followed by 1000 ppm sodium metabisulphite (SMS) solution for 30 minutes as the best pretreatment combination to retain the original colour with a low residual sulfur level. After pretreatment, mango slices were dried until 15% moisture using three methods: hot air drying at 50 °C for 1 h and at 60 °C (T1), 85 °C for 1 h and 70 °C (T2), and osmotic dehydration with 50 °Brix sugar syrup + 0.05% citric acid + 1000 ppm SMS for 6 h followed by drying at 60 °C (T3). The results showed significant differences ($p < 0.05$) among treatments for total soluble solids, pH, titratable acidity, hardness, and nutritional parameters. The osmotic dehydration method (T3) produced dried mango strips with highest vitamin C (143.90 mg/100g), total phenol (945 mg/100g), and β-carotene (5.04 mg/100g) contents. It also had a higher consumer acceptability with respect to colour, flavor, and chewy texture compared to other treatments. High temperature drying (T2) caused more nutrient loss, while mild drying (T1) needed longer time and reduced the product quality. Microbiological analysis showed that the final product was within the safe limits. In conclusion, osmotic dehydration followed by hot air drying at 60 °C is the most suitable method to produce good quality dried mango strips with high nutritional and sensory qualities for commercial production.

Keywords: Mango, Osmotic dehydration, Sodium metabisulphite, Drying method, Sensory quality

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Optimizing Preharvest Bagging Time to Enhance Postharvest Quality of 'ToMEJC' Mango (*Mangifera indica* L.)

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This study evaluated the influence of preharvest bagging at different fruit developmental stages on the postharvest quality of 'TomEJC' mango (*Mangifera indica* L.). Fruits were bagged at 5, 6, 7, 8, and 9 weeks after fruit set, with non-bagged fruits serving as the control. Harvesting was conducted at 80–90% maturity, and fruits were assessed under ambient storage conditions (29±2 °C; 60–70% RH). Physical attributes (fruit weight, size, peel and pulp color, firmness, and physiological weight loss), chemical parameters (soluble solids content, titratable acidity, ripening index, and pH), and sensory characteristics were evaluated. A key challenge addressed in this study was premature fruit drop, which was notably higher when bagging was applied at early developmental stages (5–6 weeks after fruit set). Conversely, bagging at later stages (7–9 weeks after fruit set) significantly minimized immature fruit drop. Results demonstrated that bagging improved postharvest quality, compared to non-bagged fruits. Bagging between 7 and 9 weeks after fruit set enhanced peel and pulp coloration, maintained greater firmness, reduced physiological weight loss, and desirable levels of titratable acidity and soluble solids content. These improvements resulted in superior ripening behavior and sensory acceptability relative to early bagging and non-bagged treatments.

Keywords: Fruit retention, *Mangifera indica*, Preharvest bagging, Postharvest quality

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Phenotypic and Genotypic Characterization and Assessment of Antifungal Resistance of *Candida* Species Associated with Bovine Udder Infections

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Bovine Udder infections/ mastitis conditions, pose a common threat to the dairy sector worldwide. *Candida* species have been highlighted as the most common fungal pathogen in the bovine udder. In Sri Lanka, no studies have been published on characterization and assessment of antifungal resistance patterns of *Candida* species associated with bovine udder infections. Thus, the current study aimed to characterize *Candida* species associated with bovine udder infections both phenotypically and genotypically and to assess their antifungal resistance. The study methodology involved enrichment of *Candida sp*. from bovine milk samples collected from farms around Kandy and Matale districts using Sabouraud Dextrose Agar (SDA) and specific isolation on Chromogenic agar. Molecular identification was conducted by ABC genotyping for *C. albicans* and non *albican* species, employing the restriction digestion of amplified fragments of ITS region of the isolates (PCR-RFLP). Fifteen *Candida* isolates were isolated from 36 milk samples classifying 9 isolates as *C. albicans* (60%) and 06 isolates (40%) as non *albicans* species. Furthermore, ABC Genotyping revealed that pathogenic *C. albicans* genotype A was the only genotype appeared among *C. albicans* isolates. Culturing isolates on chromogenic agar revealed that there were 9 *C. albicans*, 3 *C. krusei*, 2 *C. glabrata* and 1 *C. parapsilosis* isolate. Seven sensitive and 8 resistance isolates were identified from antifungal susceptibility tests conducted with Nystatin. The presence of *Candida* species in subclinical cases highlights the potential role of fungal pathogens in the early stages of udder infection. Although most commercially available mastitis treatments are designed primarily against bacterial pathogens, the study emphasizes the necessity of developing combined formulations that incorporate antifungal components to prevent future *Candida*-associated udder infection risks.

Keywords: ABC Genotyping, *C. albicans*, Restriction Digestion, ITS region, Chromogenic Agar

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Risk Factors Associated with High Somatic Cell Count (SCC) and the Effect of Herbal Mineral Coating on SCC in Bovine Milk

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Mastitis remains a major economically important costliest disease in dairy cows. This study aimed to investigate the risk factors associated with elevated bulk milk somatic cell count (SCC) and to evaluate the efficacy of a low-cost herbal-mineral udder coating as a preventive measure against mastitis in a group of cows kept in small and large-scale operations. Bulk milk samples, representing pooled milk from all lactating cows in each smallholder farm delivered to chilling centers, were analyzed. Management data were collected through a structured questionnaire, while SCC, California Mastitis Test (CMT), and Total Plate Count (TPC) were determined using standard laboratory methods and statistically analyzed by ANOVA and correlation tests. Results showed that most management and hygiene variables, including udder washing, hand washing between cows, use of separate cloths, and teat dipping, were not significantly associated with SCC ($p > 0.05$), which accounts for the insufficient sample size. However, SCC tended to be higher in Friesian crossbreeds and late-lactation cows, although differences were not significant. A strong positive correlation was observed between SCC and CMT score ($r_s = 0.858$, $p < 0.001$), whereas TPC values ranged from 1×10^3 to 4×10^7 CFU/ml and were not correlated with CMT ($p = 0.519$). As a remedy to reduce SCC, an application of herbal-mineral udder coating significantly reduced SCC from $2334.33 \pm 975.32 \times10^3$ cells/ml before treatment to $253.00 \pm 191.13 \times10^3$ and $101.33 \pm 70.81 \times10^3$ cells/ml on Days 1 and 21, respectively ($F(2,4) = 13.701$, $p = 0.016$, $\eta^2 = 0.873$). These findings further confirm the contribution of poor milking practices to elevated SCC. Application of herbal-mineral mixture as a coating is a potential remedy to reduce elevated SCC.

Keywords: California Mastitis Test, Mastitis, Risk factors, Sri Lanka, Total Plate Count

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Root Cause Analysis for Packaging Defects, Determination of Laminate Wastage in Coconut Milk Powder Plant and Mitigation Approaches

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The flexible laminated packaging of dry coconut milk powder plays a crucial role in preserving product quality, extending shelf life, and maintaining a competitive advantage. However, frequent packaging defects, particularly vertical seal misalignment, have resulted in significant laminate waste, production downtime, and quality rejections. This study aimed to identify and reduce the root causes of these defects using a Root Cause Analysis (RCA) approach. Data were collected over three months through production records, defect logs, visual inspections, and operator interviews. A Pareto analysis revealed that vertical seal misalignment was responsible for the largest share of total defects. To further investigate, Fishbone (Ishikawa) diagrams and the Five Whys method were employed to uncover the underlying causes. Key factors identified included mechanical wear, misalignment of forming components, inconsistent operator setup, variations in laminate film, and inadequate temperature and alignment control. Based on these findings, several corrective actions were proposed, including condition-based maintenance, enhanced operator training, standardisation of setups, supplier monitoring, and implementation of statistical process control. Additionally, the exploration of sustainable alternatives, such as cardboard-based pouches and more advanced filling systems, were recommended. Overall, this study underscores that targeted corrective measures and process standardisation can significantly reduce packaging defects and laminate waste, thereby improving operational efficiency and sustainability in food packaging.

Keywords: Vertical Form-Fill-Seal machine, Flexible laminated packaging, Packaging defects.

Acknowledgement: Nestlé Lanka Limited P.O. Box No. 01, Makandura, Gonawila (NWP).

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Rosemary Extract (NaSure 17®) as a Natural Alternative to Sodium Nitrite in Chicken Sausages

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This study investigated the potential of a commercial rosemary extract (NaSure 17®) as a natural alternative to synthetic sodium nitrite in chicken sausages. Four sausage formulations were prepared with varying levels of rosemary extract: 0.08% nitrite salt with no rosemary extract (control); 0.06% rosemary extract with 0.02% nitrite salt; 0.08% rosemary extract with no nitrite salt; and 0.10% rosemary extract with no nitrite salt. Physicochemical characteristics, Thiobarbituric Acid Reactive Substances (TBARS), and microbiological parameters of sausages were evaluated on days 1, 7, and 14 of storage at 4°C, while sensory evaluation was conducted on day 1. Sausages containing 0.08% and 0.10% rosemary extract exhibited lower ($p < 0.05$) TBARS values on days 7 and 14, indicating reduced lipid oxidation compared with sausages with nitrite salt. Total plate counts did not differ ($p > 0.05$) among treatments throughout storage; however, 0.08% and 0.10% rosemary extract effectively inhibited *Escherichia coli* and *Staphylococcus aureus* growth, whereas the control sausages and sausages with 0.06% rosemary extract and 0.02% nitrite salt showed proliferation of these microbes by day 14. Colour attributes (L*, a*, b*) of rosemary-incorporated sausages remained comparable to the nitrite control across the storage period. Rosemary extract groups demonstrated improved ($p < 0.05$) pH stability and reduced cooking loss, suggesting enhanced moisture retention and product quality. No significant differences ($p > 0.05$) were observed in hardness or water-holding capacity among treatments. Sensory evaluation indicated superior flavour and overall acceptability for sausages containing 0.08% rosemary extract. In conclusion, NaSure 17® at 0.08% effectively replaced synthetic nitrite in chicken sausages, ensuring oxidative stability, microbial safety, and desirable sensory and physicochemical properties consistent with clean-label production standards.

Keywords: Chicken sausage, Physico-chemical properties, Rosemary extract, Sensory attributes, Sodium nitrite

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Storage Life Extension of Minimally Processed B'Onion (*Allium cepa*) Slices

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Minimally processed onion slices are highly perishable due to rapid physiological, chemical and microbial deterioration after processing, leading to reduce consumer acceptance and postharvest losses. This study aimed to extend the shelf life of minimally processed B'onion (*Allium cepa*) slices up to seven days under refrigerated conditions (4 °C) while maintaining their physiochemical and sensory quality. Two sequential experiments were conducted to determine the most effective packaging method for preserving product quality. In the first experiment, onion slices were prepared under hygienic laboratory conditions following standardized procedures including raw material selection, trimming, peeling, washing, slicing to a uniform thickness (3-4 mm), and draining. Samples were packaged using three types of packaging materials (polyethylene, polypropylene, and nylon low-density polyethylene) under two packaging conditions (atmospheric and vacuum packaging) and stored at 4 °C for seven days. Quality parameters such as weight loss percentage, color (L*, a*, b*), moisture content, total soluble solids, pH, titratable acidity, ascorbic acid content, microbial load, and sensory properties were analyzed at one day intervals. Results indicated that packaging material significantly ($p < 0.05$) affected weight loss, color (L*), moisture content, and sensory quality. Other parameters such as TSS, pH, ascorbic acid content, and titratable acidity were significantly influenced only by storage duration. Among all treatments, vacuum-packed nylon low density polyethylene exhibited the lowest weight loss, highest moisture retention, and best sensory acceptability, demonstrating superior ability to maintain product quality. Based on these findings, vacuum-packed nylon low density polyethylene was selected for a second experiment to evaluate the effect of different vacuum strengths (0.1 MPa for 7 s, 10 s, and 13 s). Moisture content and sensory quality were significantly affected ($p < 0.05$) by vacuum strength, with moderate vacuum (0.1 MPa for 10 s) showing the most desirable results. The findings demonstrate that, vacuum packaging using nylon low density polyethylene under moderate vacuum conditions effectively maximized moisture retention and maintained sensory quality, thereby extending the shelf life of minimally processed B'onion slices up to seven days at 4°C.

Keywords: B'onion, minimally processed, vacuum packaging, shelf life, storage duration, sensory evaluation

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Study on Nutritional and Antioxidant Properties of Different Parts of Nutmeg (*Myristica fragrans* Houtt.) at Two Maturity Stages

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Nutmeg (*Myristica fragrans* Houtt.) is one of Sri Lanka's most valuable spices, contributing substantially to the national economy through both domestic trade and export. Despite its high economic potential, limited scientific research has explored how fruit maturity affects the nutritional and antioxidant composition of its major botanical components: mace, seed, and pericarp. In current practice, immature and mature fruits are harvested simultaneously, reducing overall product quality, export value, and farmer income. The pericarp, which accounts for approximately 80–85% of the total fruit mass, is commonly discarded, representing a significant underutilised bioactive resource. This study aimed to comparatively evaluate the nutritional composition and antioxidant potential of M. fragrans at two distinct maturity stages to support value addition, waste reduction, and sustainable utilisation. Samples collected from the Kandy District were analysed for proximate compositions and antioxidant activity. Nutritional characteristics were determined following AOAC standard procedures, while antioxidant parameters were evaluated using total phenolic content (TPC), total flavonoid content (TFC), and DPPH, ABTS, and FRAP assays. Both maturity stage and anatomical part significantly ($p < 0.05$) influenced nutritional and antioxidant characteristics. The pericarp exhibited the highest moisture and fibre contents but the least crude fat, indicating its suitability as a low-fat ingredient in moisture-retaining food applications. The seed and mace recorded higher crude fat and protein levels, consistent with their physiological storage functions. Antioxidant analyses revealed that immature seeds demonstrated the greatest overall antioxidant potential, with the highest TPC (202.55 ± 6.59 mg GAE/g) and TFC (3.56 ± 0.58 mg QE/g), lowest IC_{50} values for DPPH and ABTS, and highest ferric-reducing power (162.13 ± 8.57 mg TE/g). These findings emphasise the attractiveness of immature nutmeg and pericarp for developing functional foods and natural antioxidants, promoting circular economy principles, and strengthening Sri Lanka's nutmeg industry through innovation, value addition, and sustainable agri-food development.

Keywords: Nutmeg, Maturity Stage, Proximate Composition, Antioxidant activity, Functional food

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Studying the Effect of the Culturing Method and the Packaging Material on Sensory Attributes of Buffalo Curd under Refrigerated Storage Using a Trained Sensory Panel

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This study aimed to determine the effects of the culturing method and the packaging material on sensory attributes of buffalo curd under refrigerated conditions, using a trained sensory panel. Fifteen candidates were screened for normal sensory acuity and subsequently trained to rate the intensity levels of 6 sensory attributes of curd: sour taste, colour, surface smoothness, mouth coating, firmness, and fermented milk odour. Curd were prepared in triplicate by fermenting buffalo milk (fat:5.7%, protein:3.7%, lactose: 3.5%, pH: 11.61 at 21.6 °C) using two culturing methods: starter culturing (by directly adding freeze-dried lactic culture) and back-slopping (inoculating the milk with curd prepared on the previous day using the same freeze-dried culture). Each batch of curd obtained from the two culturing methods was separately packed in clay pots and polypropylene containers and stored under refrigerated conditions. A descriptive sensory evaluation was carried out by the trained panel to assess the intensities of the six sensory attributes using a 150-mm line scale (0–150 mm, with increasing intensity from left to right) at 3 storage intervals (1st, 3rd, and 5th day) and data were statistically analyzed using three-way factorial multivariate ANOVA by SPSS Statistics 22 software ($p \leq 0.05$). None of the sensory attributes were demonstrated a significant change during the assessed storage period, regardless of the culturing method or the packaging material. The culturing method had a significant effect only on surface smoothness and firmness, exhibiting a higher smoothness in starter-cultured curd and a higher firmness in back-slopped curd, irrespective of the packaging type. The curd preparations from both culturing methods stored in polypropylene containers showed significantly higher intensities of sour taste and fermented milk odour than those stored in clay pots, indicating a packaging effect. Intensity of mouth coating was not affected by either the culturing method or the type of packaging, whereas colour was significantly affected by both factors.

Keywords: Trained sensory panel, buffalo curd, culturing, packaging, sensory evaluation

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The Effect of Variety, and Hormone Application on Growth, Yield and Fruit Quality of Gherkins

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Gherkin (*Cucumis anguria* L.) which belongs to the family Cucurbitaceae, is exported in both semi-processed and processed forms. Gherkins are mainly used to produce the pickle-type gherkins in Sri Lanka and have expanded over several agro-ecological regions. Firmness is the most important quality parameter in pickle-type gherkins. One of the major problems encountered by the export-oriented gherkin pickle industry is softening of stored gherkins, especially the fruits grown and harvested in the *Yala* season in the Dry Zone of Sri Lanka. Calcium is a major nutrient that strengthens the cell wall for keeping the firmness of gherkin when pickled. This study examines the impact of hormonal application of Salicylic acid and Gibberellin on the growth, yield and nutrient uptake of two varieties of gherkin. The two gherkin varieties (Keerthi and Chandini) were exposed to two hormone application of Salicylic acid (0.3 g/L), and Gibberellin (0.01 g/L) in ten-day intervals, keeping no-hormonal application as the control. The plant height, stomatal density and number of nodes were significantly higher ($p<0.05$) in both varieties grown under hormonal application. The leaf potassium and phosphorus were gradually reduced and fruit potassium and phosphorus were increased with time. The leaf calcium under the hormonal application was significantly higher ($p<0.05$) and increased with time. In contrast, fruit calcium contents reduced with time, indicating a significant difference between treatment combinations. Even though the hormonal application increased the calcium uptake, yet there had been a problem of transporting Ca^{2+} ions from leaves to fruits in gherkin.

Keywords: Firmness, Calcium, Gibberellin, Pickle gherkin, Salicylic acid,

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Theme 4

Community, Environment and Management

A Comparative Evaluation of Good Agricultural Practices in Tea - A Case Study in Two Smallholder Groups in Kalawana Region

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Smallholders account for over 75% of Sri Lanka's tea production, with more than half located in the low-country. The productivity in these areas has declined over the years, largely due to inadequate adoption of good agricultural practices (GAPs). This study assessed the adoption of agronomic, environmental, and management practices among two smallholder groups in Kalawana, Ratnapura. One group supplied green leaf to the New Vithanakanda (NVK) Tea Factory, known for high auction prices and a dedicated private extension service, while the control group supplied other factories without similar support. Structured questionnaires were administered to 76 randomly selected growers from each group. In addition, soil samples were collected from 15 randomly selected fields per group and analyzed for pH, total nitrogen, exchangeable phosphorus and potassium, and organic carbon (OC). Data were statistically analyzed using t-tests, ANOVA, and Chi-square tests in SPSS. Mean soil pH, nitrogen, phosphorus, potassium, and OC levels were significantly higher in NVK lands compared to control lands ($p < 0.05$ except K). NVK growers applied U709, U1625, and T750 fertilizer mixtures in 4–6 annual splits, whereas >65% of control growers applied fertilizers in 2–4 splits. NVK growers also concentrated on minimizing post-harvest losses by using lightweight leaf bags and organized transport methods ($p < 0.001$), resulting in higher-quality green leaf delivered to the factory. Consequently, NVK growers achieved substantially higher monthly incomes per acre (Rs. 86,000) than control growers (Rs. 32,500), highlighting the positive economic impact of improved GAP adoption on smallholder livelihoods. Despite NVK's structured system, gaps remain in soil management and certain cultural practices, indicating the need for further systematic interventions. Strengthening extension support and promoting comprehensive GAP adoption can enhance productivity, profitability, and sustainability within Sri Lanka's smallholder tea sector.

Keywords: Good Agricultural Practices, Smallholders, Soil fertility, Sustainability, Tea industry

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A Study on Captive Behaviours and the Influence of Enrichments on the Behaviours of Jaguars *(Panthera onca)* at the Dehiwala Zoo

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Captive animal welfare is closely linked to behavioural diversity and activity levels, both of which can be enhanced through environmental enrichment. This study aimed to examine the influence of enrichment on the behaviours of two captive jaguars (*Panthera onca*) housed at the Dehiwala Zoo, Sri Lanka. Behavioural observations were first conducted over a three-day preliminary period to develop a detailed ethogram of species-specific behaviours. Subsequent data collection followed a baseline observation phase at three daily time intervals (09:00-10:00, 11:00-12:00, and 15:30-16:30). Five types of environmental enrichments were then introduced on daily basis, and behaviours were recorded using instantaneous sampling with an ethogram to systematically quantify activity levels. Observed behaviours were grouped as active (walking, pacing, grooming, climbing) or inactive (resting, sleeping). Behavioural frequencies were compared between baseline and enrichment phases using the Chi-square test of independence. Results showed a significant increase in active behaviours and a corresponding decrease in inactive behaviours for both the male ($\chi^2 = 24.03$, $p < 0.001$) and female ($\chi^2 = 29.90$, $p < 0.001$) jaguars during enrichment compared to the baseline. These findings demonstrate that environmental enrichment had a strong positive influence on behavioural activity, promoting natural and exploratory behaviours while reducing inactivity. The study highlights the importance of systematic behavioural monitoring and enrichment programs to improve the welfare and psychological well-being of captive big cats in zoological environments.

Keywords: *Panthera onca*, Environmental enrichment, Captive behaviour, Animal welfare, Instantaneous sampling, Zoo management.

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Acute Effects of a Natural Herbal Medicine Formulation on Halitosis, Alertness and Fatigue among Undergraduate Students at the Faculty of Agriculture, University of Peradeniya, Sri Lanka

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Halitosis, daytime sleepiness, and fatigue can significantly impact university students by affecting their oral health, alertness, and overall well-being. Herbal medicine formulations are increasingly recognized as natural and safe remedies to alleviate these conditions. This study aimed to assess the prevalence and associated factors of halitosis, daytime sleepiness, and fatigue among undergraduates, and to evaluate the short-term effects of a natural herbal formulation on these parameters. A total of 400 undergraduates (60% females and 40% males) from the Faculty of Agriculture, University of Peradeniya, Sri Lanka, were recruited. Halitosis was evaluated using the 15-item Halifin's Questionnaire and Halimeter readings, daytime sleepiness by the Epworth Sleepiness Scale, and fatigue by the Fatigue Severity Scale. Associated factors were identified using chi-square tests, while pre- and post-intervention scores were compared using the paired t-test following seven days of supplementation with 1 g/day and 3 g/day doses of the herbal formulation. The prevalence of halitosis was 13.75%, and both daytime sleepiness and fatigue were observed in 20% of participants. Factors significantly ($p<0.05$) associated with halitosis included poor oral hygiene, tongue coating, dry mouth, stress, and inadequate water intake. Daytime sleepiness correlated with late-night study habits, device use, and social activities, while fatigue was linked to poor diet, emotional stress, and sleep duration below six hours. After seven days, significant reductions ($p<0.05$) were observed in all three domains, with greater improvement for 3 g/day dose. The formulation's high antioxidant capacity (87.64%) may have contributed to these beneficial outcomes. The herbal formulation demonstrated promising acute effects in reducing halitosis, fatigue, and daytime sleepiness among undergraduates, highlighting its potential as a safe, effective, and natural remedy to enhance oral freshness, alertness, and energy.

Keywords: Antioxidant capacity, Fatigue, Halimeter, Halitosis, Herbal medicine

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Agro-climatalogical Condition-Based Differences in Greenhouse Crop Production; A Case Study in Two Selected Districts

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This study evaluated the economic viability and management practices of farmers involved in protected cultivation in Kurunegala and Welimada Districts in Sri Lanka representing two agro-climatic zones through a comprehensive cost benefit analysis in 12 selected greenhouse vegetable farms from each District. Data collection was done on fixed and variable costs of cultivation, income generation, and net profits from protected culture. Descriptive statistics revealed average total seasonal costs of LKR 202,114.17 for Kurunegala and LKR 160,172.92 for Welimada, with corresponding average seasonal income of LKR 302,314.17 and LKR 303,615.67, respectively. There was a significant difference in Benefit: Cost ratio and Net Present Value (NPV) between two groups ($p<0.05$). Although Kurunegala farmers recorded numerically higher gross incomes, their overall profitability was low because of higher cost of production incurred for controlling harsher agro-climatic conditions, such as elevated temperatures and irregular rainfall, which demanded greater investments in irrigation, shading, and pest control. In contrast, Welimada farmers benefited from mild temperatures and favorable climatic conditions that reduced the input requirements and enhanced cost efficiency, resulting in a comparatively higher net profit margin. Management practices varied notably between the two Districts in aspects such as tunnel design, nursery establishment, irrigation methods, and fertilizer application, reflecting local environmental adaptations. Pest and disease management remained a major concern, with frequent infestations of mites, whiteflies, and viral infections reported in both areas. Most farmers relied on integrated pest management practices. Major challenges included high pesticide costs, labor scarcity, and structural deterioration of tunnels. Strengthening farmer training programs, improving access to durable infrastructure, and promoting climate-resilient and cost-effective management strategies are essential to enhance profitability and ensure the long-term sustainability of protected cultivation across diverse agro-climatic regions in Sri Lanka.

Keywords: Cost-benefit analysis, Integrated Pest Management, Protected cultivation, Seasonal costs, Seasonal income,

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Agronomic Management of Smallholder Tea Farmers in Yatinuwara Divisional Secretariat, Kandy

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Tea cultivation plays a vital role in the agricultural economy of Sri Lanka, yet productivity in some mid-country smallholder regions remains below the national average. This study assessed the agronomic management practices of smallholder tea farms in Yatinuwara Divisional Secretariat in Kandy, and their relationship with productivity. A structured questionnaire survey was conducted across three TI ranges: Danture, Gannoruwa, and Menikdiwela. Data were collected from 45 purposively selected farmers below two acres using the questionnaire, and triangulated with field observations and secondary records. Management aspects such as harvesting, pruning, replanting, fertilizer and agrochemical use, pest control, harvesting, and on-farm biodiversity were evaluated. Results showed significant variations among smallholder farmers related to harvesting practices, pruning frequency, replanting practices and fertilizer management. Most tea bushes were over 30 years old, with low replanting levels. Chemical fertilizers were mainly used, but application was not aligned with recommended guidelines. Average productivity remained below potential due to suboptimal practices. Long plucking rounds and delayed pruning caused by labour shortages were the major problems affecting yield. The study concludes that improving yields requires adoption of good agronomic practices such as integrated nutrient and pest management. Further, better extension and farmer training to counter inadequacy of knowledge, and providing incentives for replanting will be essential for sustaining productivity and livelihoods of small tea farmers in Yatinuwara.

Keywords: Agronomic practices, Mid country, Productivity, Tea cultivation, Yield

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An Analysis of the Impact of Bank Lending Portfolios in Housing and Business Loans on the Capital Structure and Profitability of Banking Sector

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This study investigates how the composition of bank lending portfolios, focused on housing and business loans, influence the capital structure and profitability of commercial banks in Sri Lanka. The banking sector is integral to economic growth by channeling savings into productive investments. Housing loans are typically secured and lower risk, contributing to financial stability but offering moderate returns. Business loans are riskier but yield higher returns, affecting overall bank risk and capital requirements. Using a quantitative approach with secondary data from 10 Sri Lankan banks spanning 2014–2024, this research employs multiple regression analysis to examine relationships between lending portfolio composition and key financial metrics including return on assets (ROA), return on equity (ROE), net interest margin (NIM) and capital adequacy ratio. The study controls for relevant macroeconomic variables and non-performing loan ratios. Results reveal that housing loans positively correlate with profitability measures such as NIM and ROE, while business loans show a statistically significant ($P<0.05$) negative relationship with ROE and NIM. Total loans ratio positively influences profitability. The capital adequacy ratio's relationship with portfolio mix was statistically insignificant, indicating regulatory buffers may mitigate direct portfolio effects. These findings suggest that loan portfolio diversification influences profitability more than capital structure in Sri Lankan banks. The study highlights the importance of strategic loan portfolio management balancing risk and returns to comply with Basel III requirements and sustain profitability. The conclusion calls for further longitudinal studies considering evolving regulatory frameworks and economic challenges to optimize lending strategies, enhance financial stability, and support sustained economic growth in emerging markets like Sri Lanka.

Keywords: Bank lending portfolio, Housing loans, Business loans, Capital structure, Profitability

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An Assessment of Trends, Patterns and Determinants of Female Labor Force Participation in Sri Lanka

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This study examines the trends, patterns, and determinants of female labor force participation (FLFP) in Sri Lanka within a global and regional context. Despite major progress in education and social development, Sri Lanka's FLFP rate has stagnated at around 30-35 percent from 2002-2023, indicating that economic growth alone has not increased women's labor market engagement. The analysis integrates three objectives. First, Labor Force Survey (LFS) time-series data (2013-2023) are used to analyze national trends by age, education, and residential sector. Results show a gradual shift of women from agriculture to services and a decline in participation among younger cohorts. Second, the U-shaped hypothesis between FLFP and economic growth is tested using a panel dataset of 210 countries (1990-2023) extracted from the World Development Indicators. Ordinary Least Squares estimates confirm a significant U-shaped relationship, with Sri Lanka on the downward portion of the curve. Finally, cross-sectional LFS data (2023) are analyzed using binary logit regression. The results indicate that childcare responsibilities significantly reduce female participation, while education and household wealth exert positive influences. Muslim women exhibit significantly lower participation, highlighting the role of cultural and religious norms. Expanding affordable childcare facilities and implementing flexible labor policies are critical for enhancing women's economic participation in Sri Lanka.

Keywords: Labor force participation, U-Shaped hypothesis, Sri Lanka, Labor force participation, Childcare responsibility

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An Economic Cost-Benefit Analysis of Small-Scale Seaweed Cultivation in Jaffna District

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Small-scale seaweed cultivation in Sri Lanka's Jaffna District provides a vital source of livelihood and income for coastal communities. Still, it is increasingly susceptible to climatic and weather extremes, resulting in considerable burdens on yield and profitability. This study presents a comprehensive cost–benefit analysis that integrates the expected economic damage of environmental stressors, including high temperatures, cyclonic winds, freshwater-induced salinity fluctuations, and turbidity events. Quantitative farm-level data were collected through semi-structured interviews with active seaweed farmers in Jaffna and validated with secondary data from the National Aquatic Development Authority and meteorological data to estimate revenues, costs, and profits under normal and risk-adjusted conditions. Results indicate that seaweed cultivation is economically viable with a net annual income of LKR 839,286 per acre and a benefit–cost ratio (BCR) of 1.27 in typical circumstances. However, when the costs of climatic and weather damage are considered, the revenue estimation declines by approximately LKR 337,025 per acre, showing the massive role of environmental impact. Sensitivity analysis was conducted on labour cost, market price, dry-to-wet ratios, and probability and severity of environmental parameters. The results indicate profitability is highly responsive to variation in operating and environmental factors, where temperature and turbidity have the highest levels of severity in reducing yield and revenue stability. To facilitate risk-informed decision-making, an interactive financial model was developed supporting scenario-based simulation. This allows farmers to forecast financial returns, calculate break-even points, and plan for cultivation in due time, while using weather forecasts and knowledge of climatic shocks to anticipate risks, and assists them to adapt and optimise their practices and provide policymakers with evidence to design well-targeted insurance programs, adaptation techniques, and financial services that enhance seaweed adaptation and sustainability. Overall, this study establishes a robust evidence-based platform relating environmental risks, economic performance, and adaptive practices in seaweed farming.

Keywords: Seaweed cultivation, Jaffna district, Climate risk, Cost–benefit analysis, Sensitivity analysis

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Analyzing the Responsiveness of Household Consumption Expenditure to Macroeconomic Fluctuations

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Consumption constitutes a larger part of GDP and contributes immensely in enhancing economic growth and development of a country. This study examines the responsiveness of household consumption patterns to macroeconomic fluctuations in Sri Lanka and India, aiming to identify the key macroeconomic factors that significantly influence aggregate household consumption in both countries and aims to test the validity of Engel's Law in both economies. The study utilizes annual data covering the period from 1990 to 2020. Macroeconomic variables were obtained from the World Development Indicators (WDI) and the respective Central Banks, while household consumption data were sourced from the United Nations database. The study employs the Autoregressive Distributed Lag (ARDL) estimation method with Bounds testing to analyze the relationships between macroeconomic variables and household consumption. The findings reveal that macroeconomic indicators such as inflation, interest rates, and GDP exert influences on consumption decisions. Results further indicate that the responsiveness of consumption patterns to macroeconomic fluctuations varies across consumption categories and between countries. Furthermore, analysis provides strong empirical support for Engel's Law, demonstrating a consistent decline in the budget share allocated to food as household incomes rise in both countries, with Sri Lanka food expenditure share showing greater responsiveness to income changes than India. GDP emerged as the most prominent determinant of household consumption in both Sri Lanka and India, exerting a strong positive influence across multiple consumption categories. Interest and inflation rates had varied, often negative, effects across categories. Thus, policy makers should consider the impact of macroeconomic policy changes on household expenditure and use a mix of macroeconomic policies to increase household consumption expenditure to improve living standards, simulate economic growth and development.

Keywords: Household consumption, Macroeconomic variables, Autoregressive Distributed Lag (ARDL), Sri Lanka, India

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Assessing the Effectiveness of the Community Managed Rainfall Data for Water Resource Management in Mamunugama Cascade, Kurunegala District

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The dry zone smallholder farmers in Sri Lanka rely on rainfall for agriculture and livelihoods, and receiving weather advisories in an appropriate time is crucial for effective water management under changing climate. One of the objectives of the Government of Sri Lanka initiated Climate Resilience Integrated Water Management Project (CRIWMP) is to incorporate daily rainfall data collected by community members for decision-making in irrigation water allocation in the village tank cascade systems (VTCs). Nevertheless, limited scientific evaluation exists regarding the accuracy and effectiveness of community-collected rainfall data. This study aims to assess the effectiveness of utilizing community-managed rainfall records in the Mamunugama cascade system in Kurunegala district for water resource management. The methodology involved comparison of daily rainfall data from a) community-managed non-recording type rain gauges, b) automated rain gauge, and c) satellite-based rainfall product–CHIRPS (Climate Hazards Group Infrared Precipitation with Station data). The statistical relationships were built using metrics such as RMSE (Root Mean Square Error), NSE (Nash-Sutcliffe efficiency), and correlation coefficients. In addition, qualitative assessments were performed through key informant interviews with data collectors, water controllers, farmer organization leaders, and technical staff in the study region. The findings indicate variable accuracy of manual rain gauge data when compared to reference datasets and highlight the important role of community-managed records in guiding daily, weekly, and seasonal water management decisions. Their consistency was lower than that of the corrected satellite estimates, indicating the need for periodic calibration and standardized maintenance practices to improve field data reliability.

Keywords: Community-managed rainfall data, water resource management, accuracy assessment, CHIRPS, Mamunugama cascade

Acknowledgement: CRIWMP Staff Members, Mamunugama

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Assessing the Financial Viability of Climate Smart Soil Conservation Practices for Smallholder Tea Farmers in Climate Vulnerable Agro-Ecological Zones of Sri Lanka

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Climate-smart soil conservation practices are agricultural techniques designed to improve crop productivity, enhance soil health, and mitigate climate change impacts. This study assesses the financial feasibility of climate-smart soil conservation practices in smallholder tea cultivations in highly vulnerable agro-ecological zones of Sri Lanka. These zones were represented by Thawalama (WL1a) in the Galle district, Udunuwara (WM2b) in the Kandy district, and Hanguranketha (IM3c) in the Nuwara Eliya district. Cost data, yield estimates, and green leaf price were obtained through key informant interviews with experienced farmers and extension officers in the three areas. A financial cost-benefit analysis was conducted for one acre of tea land, considering 20 years period, comparing scenarios with and without climate-smart agricultural practices for each area. Financial performance was assessed using Net Present Value (NPV), Benefit Cost Ratio (BCR), and Internal Rate of Return (IRR) under three yield scenarios (maximum, average, minimum) and discount rates of 6%, 8%, and 10%. Incremental cost-benefit analysis was used to compare practices. The result of the analysis show that without practice scenario, all study areas recorded negative NPVs at the average yield level. In Thawalama, grass planting was the most cost-effective individual practice (BCR of 1.55, IRR 19%, incremental NPV Rs. 3.03 million). Grass planting with stone bunds showed high profitability (BCR of 1.97, IRR of 29%, incremental NPV Rs. 5.26 million). In Hanguranketha, the lock and spill drains achieved a BCR of 1.50, an IRR of 16%, and an incremental NPV of Rs.4.17 million. In Udunuwara, the lock and spill drains recorded high incremental NPV, while their combination with grass planting generated greater profitability. It is evident that all climate-smart soil conservation practices yield financial returns. Encouraging smallholders to adopt these practices through credit schemes to cover initial investment, extension services can improve tea productivity and enhance income security in climate-vulnerable regions.

Keywords: Climate-smart agriculture, Smallholder tea cultivation, Financial feasibility, Soil conservation practices, Cost-benefit analysis

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Assessing Visitor Satisfaction and the influence of Zoo Visit Experience on Conservation Awareness: A comparative analysis of Dehiwala Zoo and Pinnawala Zoo

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Zoos play a dual role as centers for wildlife (*ex situ*) conservation and popular recreational destinations. A comparative assessment was conducted on the visitor experience and its tangible outcomes on post-visit conservation awareness between two of Sri Lanka's most prominent zoological gardens: The National Zoological Gardens of Sri Lanka (Dehiwala Zoo) and the Pinnawala Zoo. The study employed a quantitative research design, utilizing a pre-tested, structured, self-administered survey questionnaire delivered in Tamil, Sinhala, and English. Data were collected from a total sample size of 300 visitors, with 150 visitors from each zoo. The questionnaire captured data on demographics, conservation awareness, overall visitor satisfaction, and specific experience constructs. The data were analyzed using descriptive statistics and a covariance-based Structural Equation Modelling (SEM) framework to compare visitor satisfaction levels and to estimate the magnitude of the effects of the visit experience on conservation awareness in two sites. Exploratory factor analysis was conducted to identify underlying factor structures, followed by confirmatory factor analysis to validate the model. Relationships between zoo visit experiences and conservation awareness were examined, and the differences in the relationships between the two zoos were assessed using multi-group analysis. The results revealed that in Dehiwala Zoo, the interaction and facility quality and the educational programs and signage within the premises have significantly enhanced visitors' pre-conscious and conscious conservation awareness($p<0.05$), but have not exerted a significant influence on knowledge, attitudes, or affective awareness($p>0.05$). In contrast, at the Pinnawala Zoo, all experience dimensions demonstrated significant effects across all constructs of conservation awareness($p<0.05$), indicating the contrasting visitor experience between the two zoos.

Keywords: Wildlife (*ex situ*) conservation, Pre-conscious & conscious awareness, Knowledge, Attitudes, Visitor Satisfaction

Acknowledgement: National Zoological Garden, Dehiwala and Pinnawala Zoo

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Assessing Willingness and Capacity of Low Country Vegetable Farmers to Pay for Agricultural Extension Services in the Kalpitiya Region, Sri Lanka

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Agricultural extension plays a vital role in improving productivity and sustainability among Sri Lankan farmers. However, the public extension system continues to face constraints such as limited field presence, irregular visits, and low responsiveness to farmers' needs. This study examined the willingness and capacity of low-country vegetable farmers in the Kalpitiya region to pay (WTP) for agricultural extension services and identified the socio-economic, farm-level, and institutional factors influencing their decisions. Primary data were collected from 91 commercial vegetable farmers using a structured and pre-tested questionnaire. Data were analyzed using descriptive statistics, chi-square tests, and a Probit regression model with robust standard errors. Four indices—mechanization, information need, public extension, and private extension—were developed to represent farmers' technology use, information demand, and satisfaction with service quality. Results revealed that income, farm size, cropping system, information need, and satisfaction with private extension services were positively associated with WTP. The Probit regression confirmed that education, private extension engagement, and cropping system were the most influential factors, significant at 1%, 5%, and 10% levels, respectively. Farmers with moderate education levels, engaged in multiple cropping, and satisfied with private extension were more likely to pay, while higher experience and lower income reduced WTP. The most demanded service areas were plant protection and new crop varieties. Farmers showed the highest preference for extension packages that combine consulting, testing, and provision of agricultural materials, while the most preferred payment methods were seasonal subscription and payment for specific services. These findings revealed the need to develop farmer-responsive extension systems through strengthened public–private collaboration, ensuring that advisory services remain affordable, demand-driven, and economically sustainable.

Keywords: Agricultural extension, Willingness to pay, Private extension, Probit model

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Assessment of Food Security among Rice Farming Households in Sri Lanka

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Food security remains a critical concern in Sri Lanka, particularly among rice farmers who play a dual role as both producers and consumers. The economic crisis, which led the rising input costs, high food inflation, and reduced farm incomes, has heightened their vulnerability. This study assesses the food security status of rice farming households during the 2022–2024 period. Food insecurity was classified as mild, moderate, or severe using the Food Insecurity Experience Scale (FIES) estimated through the Rasch model. The analysis drew on 5,673 households in Sri Lanka. The ordered probit model was used with the severity level of food insecurity as the dependent variable, while the fractional regression model analyzed the effect of the same independent variables on the probability of being moderately food insecure. Further, this study included descriptive statistics. The econometric analysis confirmed that being a female-headed household, having a higher level of education among the household head, holding a position in a farmer organization, and participating in the market significantly ($p<0.05$) reduce the probability of falling into moderate and severe food insecurity. Paddy production, off-farm income, and chemical fertilizer usage negatively influenced food insecurity, though their effects on the likelihood of being mildly food insecure were relatively small. Household size and the loan receipt rate increased the likelihood of being moderately and severely food insecure. There were inequalities across districts in food security. Compared to the base year (2022), farming households in 2024 experienced higher levels of food security. The study recommends ensuring higher educational attainments for vulnerable groups, such as male-headed households, better family planning programs, improving local credit monitoring systems, and strengthening the institutional capacity of farmer organizations to achieve food security.

Keywords: Paddy farmers, Food insecurity experience scale, Rasch model, Ordered probit, Marginal effects

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Assessment of Nutritional Status and Dietary Patterns among Sri Lankan Hospitality Industry Employees: A Case Study in an Internationally Affiliated Hotel and a Resort

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The hospitality industry significantly contributes to a nation's economy, depending on its workforce for growth and development. Ensuring employee well-being is vital to sustaining the industry's reputation and growth. This study aimed to assess nutritional status and dietary patterns among employees in the Sri Lankan hospitality industry, examining the factors associated with the risk of overweight/obesity. A cross-sectional descriptive study was conducted among 240 hospitality industry employees aged 20-65 years working full-time at the selected two locations, using convenience sampling. Data were collected using a self-administered questionnaire, a descriptive qualitative food frequency questionnaire, a review of cafeteria menus, and anthropometric measurements, including body mass index (BMI), waist-to-hip ratio, waist circumference, hip circumference, and body fat percentage. The mean age of the sample study was 38±11 years. Most of the participants were male and working in the food and beverage preparation department with a monthly income of Rs 50,000 – 75,000. The mean BMI of the sample was 24.07±4.51 kg/m^2, with 58 % in the overweight/obesity category. The mean body fat percentage, waist circumference, and waist to hip ratio were 25.76±9.43 %, 85.68±11.33 cm, and 0.89±0.09, respectively, indicating a considerable risk of central adiposity. Beverage intake was highest among participants, with 58%. Further participants were classified into the moderate healthy food consumption category. A significant proportion of participants reported smoking and alcohol consumption, with 30% engaging in physical activity. Menu assessment revealed lower fruit and vegetable servings, frequent sugary foods, and high-oil content in meals as potential issues. Correlation analysis revealed significant associations ($p<0.05$) between BMI vs physical activity and dairy food consumption with BMI, and age with body fat percentage, risk of overweight/obesity, diabetes, and hypertension. The study revealed a high prevalence of overweight and obesity among participants, indicating the need for changes in the cafeteria menus and long-term interventions to help employees maintain a healthier body weight.

Keywords: Dietary patterns, Hospitality industry, Nutritional status,

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Assessment of a Methanol-Based Tobacco Waste Extract as a Natural Antibacterial Agent: Valorization of an Agricultural By-Product

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Bacterial infections in animal husbandry cause significant economic losses, leading to heavy reliance on synthetic chemical disinfectants. However, these disinfectants demonstrate reduced efficacy over time and pose environmental contamination and residue risks, with potential toxic effects to animals and humans. Thus, this study evaluated a Tobacco Waste Extract (TWE) as a sustainable alternative to conventional disinfectants against foodborne pathogens. The objectives were to determine antimicrobial efficacy, establish the Minimum Inhibitory Concentration (MIC), identify optimal contact time, and validate field effectiveness. TWE was prepared as a methanol extraction from tobacco industry waste. Determination of *in-vitro* MIC was performed using broth microdilution coupled with Colony Forming Unit (CFU) assessment against *Escherichia coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 29213) at concentrations of 100%, 50%, 25%, 12.5%, 6.25%, and 3.125% (V/V). Kinetic experiments were conducted to evaluate bacterial reduction at the MIC concentration, with CFU assessments at 20-minute intervals up to 120 minutes. Field trials at two commercial broiler farms were used to assess the field efficacy of the TWE against conventional disinfectant. Results showed that TWE demonstrated significant antimicrobial activity ($p < 0.05$) against both bacterial strains *in-vitro*. The MIC for both *E. coli* and *S. aureus* was 12.5% TWE. Kinetic experiments revealed 120-minute contact time achieved maximum antibacterial effect at 12.5% concentration. Field trials confirmed significant ($p < 0.05$) microbial load reduction, with normalized $\log_{10}$ CFU/m^2 reduction comparable to a commercial disinfectant. This study concludes that tobacco waste extract at 12.5% concentration with 120-minute contact time represents a viable, eco-friendly disinfectant for animal husbandry biosecurity, offering sustainable waste valorization while reducing dependence on synthetic chemicals.

Keywords: Antimicrobial activity, Field efficacy, Minimum inhibitory concentration, Natural disinfectant, TWE

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Assessment of Growth and Yield of *Paspalum atratum* in Mid Country Intermediate Zone.

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Inconsistent availability of good-quality forage is a major constraint to dairy cattle feeding in Sri Lanka. Paspalum (*Paspalum atratum)* is a promising tropical, perennial grass suitable for both grazing and zero-grazing ruminant production systems. This study evaluated the influence of seed rate and cropping pattern on the growth and yield of Paspalum under mid-country intermediate zone conditions. A field experiment was conducted at the DIMO Agri Techno Park, Lenadora, using a Randomized Complete Block Design (RCBD) in a factorial arrangement. Paspalum seeds were sown at three seed rates (12, 9, and 8 kg/ha) under two cropping patterns (row planting and strip planting). At 35 days after planting, urea, triple superphosphate, and muriate of potash were applied at rates of 20, 120, and 100 kg/ha, respectively. Forages were irrigated and weeded regularly. Plant height and the number of tillers were recorded weekly. Forages were harvested at eight weeks to determine fresh matter yield (FMY) and dry matter yield (DMY). Data were analyzed using Analysis of Variance (ANOVA). Neither seed rate nor cropping pattern had a significant ($P>0.05$) effect on the growth or yield of Paspalum; therefore, the data were pooled. Paspalum initiated tillering at four weeks. At eight weeks, the mean plant height and tiller number were 67.1 ± 0.58 cm and 11.5 ± 0.18 tillers/plant, respectively. Flowering did not occur by the eight-week harvest. At harvest, FMY and DMY were 18.3 ± 3.90 and 3.37 ± 0.44 kg/ha, respectively. Considering the cost of seed, a seeding rate of 8 kg/ha is recommended for Paspalum cultivation in the mid-country intermediate zone of Sri Lanka.

Keywords: Height, *Paspalum atratum*, Tillering, Yield.

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Auditing Post Consumer Plastic Food Packaging Waste in Rural and Urban Areas

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Plastic food packaging, particularly single-use plastics (SUPs), has become one of the major contributors to environmental pollution and waste management challenges. This study assessed and compared plastic food packaging waste generation in rural and urban communities of the Kandy District, Sri Lanka, using a brand audit approach. The main objective was to identify the quantity, composition, recyclability, and major contributing brands of plastic packaging waste, and to suggest practical recommendations for improving resource recovery and waste management practices. Data were collected through household surveys and quantitative waste audits conducted in *Kamburadeniya (rural)* and *Suduhumpola (urban)* areas. A total of 110 households participated in the questionnaire survey, and 30 households were involved in the quantitative waste assessment. The study revealed that *urban households generated a higher quantity of plastic packaging waste* (5.75g/person/day, 1.11 items/person/day) than rural households (5.11 g/person/day, 1.04 items/person/day), reflecting greater dependence on packaged foods. A one-way ANOVA test showed a significant difference in quantity of plastic food packaging waste generated among income groups ($p < 0.05$), where urban middle-income and rural low-income households produced more plastic waste compared to low-income urban households. The brand audit identified that 38–50% of plastic packages were unbranded and 20-33% were uncommon brands *while CBL, Maliban, Chello, Ratthi,* and *Highland* were identified as the leading brands occurred within the 30% of the leading brands. The recyclability analysis indicated that most packaging consisted of non-recyclable multilayer plastics, limiting material recovery. Although many respondents believed manufacturing companies should be responsible for recovering their packaging waste, awareness of Extended Producer Responsibility (EPR) mechanism remained low. Overall, improving public awareness, producer responsibility, and household waste segregation is important. Strengthening stakeholder collaboration, expanding recycling facilities, and implementing EPR-based collection systems can significantly reduce environmental impacts associated with plastic food packaging waste.

Keywords: Brand Audit, Extended Producer Responsibility (EPR), Recyclability, Waste Management

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Bopath Ella as a Natural Resource: Assessing the Contribution on Livelihood of Surrounding Villages

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Waterfalls serve as vital natural resources that contribute to ecological stability, tourism development, and rural livelihood support. Bopath Ella, located in Agalawatta village within the Keeragala GN Division of the Kuruwita DS Division in the Ratnapura District, is a prominent tourist attraction known for its distinctive Bo-leaf shape and accessibility. This study employs the Total Economic Value (TEV) framework to assess the contribution of Bopath Ella to surrounding households, focusing on consumptive use, non-consumptive use, and associated economic benefits. A quantitative research approach was adopted, and primary data were collected from 95 randomly selected households through a structured questionnaire. Descriptive analysis was used to interpret the findings. Results reveal that consumptive use is minimal, limited to small-scale extraction of firewood and medicinal plants. However, the waterfall's non-consumptive use value, primarily linked to tourism, generates substantial livelihood benefits. Notably, 79 out of 95 individuals (83.15%) derive more than 50% of their total income from waterfall-related activities, such as selling food, beverages, and souvenirs, providing transport and photography services, and engaging in small-scale hospitality. This highlights the significant role of Bopath Ella in supporting household income and promoting livelihood diversification under the direct use value component of the TEV framework. Despite these benefits, several challenges were identified, including environmental degradation, pollution, unmanaged waste disposal, soil erosion, and vegetation loss due to unregulated visitor activities. Socially, limited community participation and poor awareness of sustainable tourism practices were observed. Economically, the absence of structured business models, insufficient marketing, and weak infrastructure hinder optimal income realization. In line with the TEV framework, the study recommends adopting a community-based tourism model, implementing effective waste management, strengthening infrastructure, and enhancing entrepreneurial capacity to ensure sustainable economic benefits while preserving ecological integrity.

Keywords: Total Economic Value (TEV), Livelihood contribution, Non-consumptive Use value, Community-based tourism, Bopath Ella waterfall

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Case Study on Water Use and Water Use Efficiency among Lactating Cows in a Free-Stall Housing System at Ambewela Farm

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The Holstein Friesian dairy cattle herd at Ambewela Farm was managed under a freestall housing system. The lactating herd was divided into four distinct cow groups: fresh, super-producing (>40 L/d), high-producing (25–40 L/d), and tail-end (<25 L/d) cows. Each group was fed a total mixed ration (TMR) and was provided with free access to clean, fresh drinking water. The objective of the study was to estimate the total water use (L/cow/day) and water use efficiency for milk production (L/L) of the lactating cow groups. The experiment was arranged in a Completely Randomized Design (CRD). Direct water use for drinking, barn cleaning, milking parlor operations, and milk precooling was measured using 24 fixed flow meters installed in the cow sheds, at the milking parlor, and prior to the milk chilling tank. The water content of TMR samples was determined, and dietary water intake was estimated based on TMR intake. Daily milk production data of each functional cow group were obtained from the real-time farm recording system. Data were statistically analysed using Analysis of Variance (ANOVA) followed by Duncan's Multiple Range Test (DMRT). Drinking water intake of fresh (127.79 L/cow/d), super-producing (134.97 L/cow/d), and high-producing (114.00 L/cow/d) cows was found to be significantly ($p<0.05$) greater than that of tail-end cows (74.87 L/cow/d). Total water usage was significantly higher ($p<0.05$) for fresh (275.91 L/cow/d) and super-producing (299.20 L/cow/d) cows compared to high-producing cows (239.66 L/cow/d), while tail-end cows (169.67 L/cow/d) recorded the lowest ($p<0.05$) usage. Water use efficiency for milk production was observed to be highest ($p<0.05$) in super-producing cows (7.33 L/L), followed by high-producing cows (8.75 L/L), and was significantly lower ($p<0.05$) in fresh (9.82 L/L) and tail-end (10.62 L/L) cows. On average, total water use efficiency for milk production was estimated at 8.88 L/L. These findings confirmed that higher-yielding dairy cows utilized water more efficiently, emphasizing the importance of implementing production-based water management strategies in free-stall dairy cattle systems at Ambewela Farm.

Keywords: Drinking water intake, Holstein Friesian, Milk yield, Total mixed ration.

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Changes of Food Consumption Following Economic Crisis: A Study of Women - Headed Households in Kilinochchi District.

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A food crisis in Sri Lanka refers to the severe shortage of food availability and accessibility that arose from the recent economic crisis, which led to high inflation, currency depreciation, and import disruptions. However, limited research has examined how this crisis has affected household-level food consumption, especially among vulnerable groups. This study explores the impact of the economic crisis on the food consumption patterns of women-headed households in the Kilinochchi District, who face high food insecurity due to unstable income, high dependency levels, and limited access to resources. A cross-sectional community survey was conducted among 100 women-headed households selected with a simple random sampling procedure. Primary data were collected through face-to-face interviews with standardized questionnaires to collect socioeconomic and demographic characteristics, food purchasing behavior, dietary intake, and coping strategies before and after the economic crisis. Quantitative data were analyzed applying descriptive statistics and multiple linear regression. Pre-crisis carbohydrate consumption had the strongest positive and statistically significant effect ($p<0.05$), indicating that consumers employed staple foods as a coping mechanism during the crisis. Post-crisis protein consumption, however, had a strong negative coefficient ($p< 0.05$), indicating a sharp decline in high-nutrient food consumption such as meat, fish, and pulses. Family size ($p<0.05$) and employment status ($p<0.05$) had significant positive impacts. In addition, pre-crisis consumption of lipids ($p<0.05$) and post-crisis food acceptability ($p<0.05$) were significant, and both suggest that households with better pre-crisis diets sustained consumption levels utilizing adaptive coping strategies. The research in general suggests the important need for policy-driven interventions like income stabilization, improved market access, and nutrition-sensitive interventions to promote food security among rural Sri Lanka women-headed households.

Keywords- Food availability, Dietary diversity, Food purchasing behavior, Coping strategy.

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Comparative Performance of Weather-Index-Based and Indemnity Insurance Schemes: A Case Study from Vavuniya District

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The Northern Province of Sri Lanka is among the most climate-vulnerable regions, experiencing erratic monsoon patterns and frequent dry spells that threaten paddy cultivation. Weather Index-Based Crop Insurance (WIBCI) offers an innovative risk-transfer mechanism linking pay-outs to measurable weather parameters; However, current district-level schemes show high basis risk due to limited micro-climatic representation and reliance on long-term rainfall averages. This study developed a hypothetical rainfall index for drought-related paddy crop loss compensation in Vavuniya District during the 2022–2023 *Maha* season. Daily precipitation data (2002–2023) were obtained from NASA POWER and used to construct rainfall indices for eight Agrarian Service Centers (ASCs) as percentages of historical averages across 5, 10, 15, and 20-year baselines. The index incorporated growth-stage sensitivities vegetative (20%), reproductive (50%), and ripening (30%) reflecting paddy water requirements. Results showed that the five-year baseline best captured recent climatic variability, effectively responding to short-term rainfall shifts, with six of the eight ASCs qualifying for pay-outs. Compared with the indemnity-based insurance scheme, the developed rainfall index model identified a net overpayment of LKR 365,607 within the total claim settlement of LKR 90.24 million in the currently practiced scheme in Vavuniya, indicating minimal basis risk. While reductions in covered land extent and the number of compensated farmers can sometimes explain low basis risk due to reduced payouts, the proposed model achieved the opposite. Specifically, the number of eligible farmers increased by 9,799 (58.1%), and the eligible insured land extent expanded by 8,954.4 acres (45.9%) compared to the indemnity-based system. It is demonstrating that broader farmer participation and higher insured land coverage can be achieved while ensuring efficient resource utilization and reduced settlement expenditure. The study concludes that regionally optimized, short-term rainfall indices can enhance climate resilience and support automated drought-risk management through continuous regional calibration and validation.

Keywords: Rainfall index, Index-based crop insurance, Drought risk, Paddy farmers, Geospatial analysis

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Comparative Study on Household Food Waste Management in Urban and Rural Areas of Kandy District

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Food waste at the household level represents a growing environmental, economic, and ethical concern globally, with significant implications for food security. In Sri Lanka, where organic waste comprises 50–76% of municipal solid waste, household food waste contributes disproportionately to landfill volumes, greenhouse gas emissions, and resource inefficiency. This study presents a comparative analysis of household food waste generation and management practices in two groups within the Kandy District: the urban area of Suduhumpola and the rural area of Kamburadeniya. The research aims to quantify food waste volumes, identify socio-demographic drivers, and evaluate disposal behaviors and awareness levels across these contrasting contexts. Using a mixed-methods approach, the study captures both quantitative and qualitative dimensions of food waste. Results indicate that urban households generate an average of 0.75 kg of waste per capita per day, compared to 0.4 kg in rural households, with food waste constituting approximately 56% of total household waste. Nationally, Sri Lanka produces nearly 3,955 tons of food waste daily, with per capita household waste estimated at 76 kg/year (208 g/day). In the rural sample, 25% of households diverted kitchen food waste to domestic animals, while only 4.34% practiced composting. In contrast, urban households showed higher reliance on municipal collection services but lower rates of source segregation and organic reuse. More than 50% of rural households resorted to burning or dumping waste within household premises, contributing to environmental degradation. The study underscores the urgent need for context-specific interventions, including decentralized composting, targeted awareness campaigns, and regulatory reforms that recognize food waste as a distinct category. By bridging urban-rural data gaps and aligning with Sustainable Development Goals (SDG 12.3 and SDG 2), this research provides actionable insights for policymakers, local authorities, and development practitioners seeking to reduce household food waste and enhance circularity within Sri Lanka's waste management systems.

Keywords: Household Food Waste, Kandy District, Socio-demographic Factors, Urban-rural Comparison, Waste Management ractices

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Comprehensive Assessment of Food Waste at the University of Peradeniya

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Food waste has emerged as a critical global sustainability issue, with significant environmental, economic, and social implications. Universities in Sri Lanka, such as the University of Peradeniya, generate large amounts of food waste daily through meal preparation, consumption, and unsold leftovers in hostels and canteens. However, systematic data on food waste generation, handling, and disposal have been lacking, with management often driven by assumptions. This study aimed to comprehensively assess food waste generation and disposal at University of Peradeniya, covering 11 major dining sites (8 residential hostels and 3 common canteens). A Material Flow Analysis (MFA) using STAN2 software was conducted alongside field surveys, stakeholder interviews, and waste sample analyses to quantify food inflows and waste outflows across these sites. The campus was found to receive approximately 33,641 kg of raw food per month, of which about 674 kg per month ends up as food waste (post-consumer plate waste) and kitchen waste (preparation waste). This equates to roughly 16.5% of all purchased food becoming plate waste and 4.1% becoming kitchen waste. This study provides the first integrated MFA-based quantification of university-level food waste in Sri Lanka.

Keywords: Food Waste, Material Flow Analysis, Quantitative Assessment, University of Peradeniya

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Connecting Farmers to Global Value Chains: A Conjoint Analysis of Buyer Preferences for Pepper, Clove and Nutmeg

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The Sri Lankan spice industry, renowned globally for its unique traits, is largely driven by smallholder farmers; however, they remain weakly integrated with global value chains, creating economic inefficiencies. The study aimed to identify and analyze buyer preferences towards product attributes and contractual arrangements in the pepper, clove, and nutmeg value chains. To achieve the first and second objectives, which focused on identifying general characteristics of buyer types and examining common contractual arrangements, data were collected through a questionnaire survey administered to 40 respondents, including exporters, processors, and wholesalers selected using stratified random sampling from Kandy, Matale, and Colombo districts. Descriptive analysis revealed that all respondents had over 10 years of experience in the spice sector, yet only 10% maintained formal contracts with farmers, while the majority relied on informal arrangements. To achieve the third objective, which aimed to identify and estimate key product attributes influencing buyer preferences, a choice-based experiment was conducted with the responses of same 40 buyers, using insights from key informant interviews, and data were analyzed using conditional logit model. The results indicated that quality attributes were the most influential in buyer decision-making across all three spices, with premium grades showing the highest positive utilities, while price and contract type carried negative coefficients, suggesting buyer sensitivity to higher prices and a preference for flexible arrangements. The volume had a negligible influence. Addressing the fourth objective, all buyer types demonstrated a higher willingness to pay incremental premiums for top-quality produce compared to the lowest quality level, with exporters showing the highest willingness to pay. The study recommends training farmers to align production and grading with buyer preferences and introducing flexible, mutually beneficial contractual arrangements.

Keywords: Conjoint analysis, Part-worth utilities, Willingness to pay

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Design and Development of a Smartphone-Based Health and Nutrition Self-Management App for Promoting Independent Living and Well-Being of Sri Lankan Senior Citizens

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The rapid demographic transition towards an ageing society has created an urgent need for strategies that promote healthy ageing and nutritional independence among older adults. This study aimed to design, develop, and evaluate a culturally appropriate smartphone-based health and nutrition self-management application for Sri Lankan senior citizens. A mixed-method design following the ADDIE framework was employed in two phases. Phase I assessed health, nutrition awareness, dietary practices, and technology familiarity among 350 community-dwelling older adults (≥ 55 years) in the Kandy District using an interviewer-administered questionnaire. Focus group discussions with Sri Lankan nutritionists, nurses, and caregivers working in elderly care facilities in Australia, New Zealand, and Italy provided expert recommendations for culturally relevant content and usability. Findings revealed limited dementia awareness (70.85 %), low cognitive activity (63.14 %), moderate physical activity, dependence on assistance for healthy meal preparation (72.0 %), and uncertainty about hydration adequacy (82.8 %) among test population. Although all participants owned smartphones, only 0.57 % had used health-related apps. These insights guided the development of an age-friendly app featuring nutrition tracking, hydration and calorie monitoring, cognitive exercises, lifestyle tips, culturally adapted diet plans, local recipes, and caregiver access. Phase II evaluated the app among older adults ($n = 30$) and expert reviewers. Nutrition knowledge improved significantly (mean difference = 2.233; $p < 0.05$; Cohen's $d = 1.62$). Satisfaction was high (73.3 % very satisfied; 20 % satisfied), and qualitative feedback valued reminders and localized dietary guidance. Experts rated scientific validity (4.29 ± 0.54) and cultural relevance (4.51 ± 0.58) as highly significant ($p < 0.05$). The findings confirm the potential of user-centred mHealth tools to improve nutrition literacy and self-care among Sri Lankan elders.

Keywords: Elderly, MHealth, Nutrition self-management, Usability evaluation, Sri Lanka

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Determinants and Yield Impacts of Climate Smart Agriculture Adoption: Evidence from Vavuniya District in Northern Province

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Climate change threatens rural livelihoods by adversely affecting agricultural output, particularly in climate sensitive regions such as Vavuniya. Climate-smart agriculture has emerged as a key approach to mitigate greenhouse gas emissions, build climate resilience & improve agricultural productivity. However, limited empirical evidence exists on the impact of CSA adoption on paddy yield in Vavuniya district. This study examined the determinants of adoption of Parachute method, the only CSA intervention in Iluppaikulam, Neriyakulam, and Maruthamadu areas and its impact on paddy yield. A cross-sectional survey was conducted, collecting primary data from a stratified random sample of 90 paddy farmers (30 adopters & 60 non-adopters) using a structured questionnaire and complemented by key informant interviews with agricultural officers and relevant parties. A Binary Probit model identified the determinants of adoption, while an Ordinary Least Squares (OLS) regression assessed its impact on paddy yield. Results revealed that adopters have smaller average farm sizes (1.6 acres) than non-adopters (5.18 acres). The probit model revealed that farming experience had a significant positive impact ($p<0.05$) on adoption suggesting that experienced farmers are more aware of the potential benefits and management requirements of CSA. Whereas age ($p<0.05$) and land size ($p<0.01$) have significant negative influence implying that younger and small-scale farmers are more willing to experiment with innovative practices, whereas older and large-scale farmers may be more risk-averse or constrained by traditional methods. The OLS regression showed that adopters achieved 501.47 kg higher yield per acre than non-adopters, a statistically significant increase ($p<0.01$), demonstrating the strong positive impact of the parachute method on paddy yield. This gain is likely due to improved seedling survival, better plant spacing, and reduced transplanting shock associated with the method. Sustaining these yield improvements require continuous support for CSA adoption through integrating CSA into local agricultural frameworks, strengthening extension and training systems, and promoting community-based land management.

Keywords: Cross-sectional survey, Parachute method, Adoption determinants

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Determinants Influencing the Adoption of Responsible Consumption among Young Adults

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Responsible consumption has become an essential element of sustainable development, addressing the urgent need to balance economic growth, environmental protection, and social well-being. Despite increasing awareness of sustainable consumption in Sri Lanka, the practical adoption of responsible consumption behaviours remains low, particularly among young adults. This study aims to investigate the impact of attitude, subjective norms, and perceived behavioural control on consumers' intention to engage in responsible consumption, using the Theory of Planned Behaviour (TPB). A structured questionnaire was administered to 374 undergraduate students at the University of Peradeniya. Data were analyzed using descriptive statistics, reliability tests, and multiple linear regression to test the proposed hypotheses. Results revealed that attitude (β=0.421, p <0.001), subjective norm (β = 0.263, p <0.001), and perceived behavioural control (β= 0.292, p<0.001) significantly and positively influence responsible consumption intention. Among them, attitude showed the strongest effect. Diagnostic tests confirmed model adequacy with no multicollinearity or autocorrelation issues. The findings suggest that enhancing positive attitudes and social influence can effectively promote responsible consumption behaviour. These insights can assist policymakers and educators in designing awareness campaigns and interventions to foster sustainable consumer behaviour in Sri Lanka.

Keywords: Theory of planned behaviour, Attitude, Responsible consumption, Perceived control behaviour, Attitude

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Determinants of Adoption Behavior for Parachute Transplanting Method: Case of Nawagattegama Paddy Farmers

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This study examines the determinants influencing the adoption behavior of the parachute transplanting method among paddy farmers in the minor irrigated region of Nawagattegama, Puttalam District, Sri Lanka. Despite the method's potential to reduce labor dependency, enhance yield, and mitigate salinity stress, its adoption remains limited. Using a cross-sectional field survey and quantitative approach with 120 farmers selected via stratified random sampling, the research employs the Theory of Planned Behavior (TPB) as the analytical framework and applies a binary logistic regression model to analyze both socio-economic and psychological variables. Findings reveal that among the surveyed farmers, 70% have not adopted the parachute transplanting method, while 30% have adopted. farmers' attitudes and perceived behavioral control which measure the controllability had a significant positive impact ($p < 0.05$) on their probability of adopting the parachute transplanting method. However subjective norms had a negative partially significant impact ($p > 0.1$) on farmers' adoption behavior. Among the socio-economic factors only farming experience significantly influenced ($P < 0.05$) on the probability of adopting parachute transplanting method. The findings suggest that adoption decisions are driven primarily by psychological readiness and perceived capability rather than fixed demographic traits in the study area. To enhance uptake, interventions should prioritize hands on training, access to input materials and confidence building extension services. Moderately experienced farmers should be targeted, and peer-led demonstrations can help address normative resistance within rural communities.

Keywords: Paddy, Parachute transplanting, method, Adoption, Theory of planned behavior

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Determinants of Green Product Purchase Intention: A Consumer-Based Study in Supermarket Outlets in Kandy City Limit, Sri Lanka

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Environmental challenges, including climate change and resource depletion, highlight the urgency of sustainable consumption, Supermarkets serve as pivotal channels for promoting green products through eco-labels, recyclable packaging, and certifications. Despite their availability in Sri Lankan outlets like Keells and Cargills, consumer adoption remains limited. This study investigates factors influencing green product purchase intention among supermarket consumers in Kandy City, integrating the Theory of Planned Behavior (TPB) constructs attitude, subjective norms, and perceived behavioral control with green marketing mix elements (product, price, place, promotion), green awareness, and attribute consideration. Using a quantitative, cross-sectional design, data were collected via face-to-face interviews with 172 consumers from four major supermarkets, selected via non-probability convenience sampling. PLS-SEM via SmartPLS, alongside descriptive statistics and simple linear regression using SPSS, were used to analyze the relationships. Findings indicate that attitude has the strongest direct positive influence on GPPI ($\beta = 0.457$, $p < 0.001$), while perceived behavioral control unexpectedly exhibits a negative effect ($\beta = -0.214$, $p = 0.048$), which may be attributed to heightened consumer skepticism. The green marketing mix directly influences TPB constructs but not GPPI ($\beta = 0.218$, $p = 0.588$); however, attitude partially mediates this relationship (indirect $\beta = 0.305$, $p < 0.001$). Green awareness weakly predicts GPPI ($\beta = 0.173$, $p = 0.023$, $R^2 = 0.030$), and attribute consideration is not significant ($\beta = 0.092$, $p = 0.231$). The results highlight the primacy of psychological transformations over mere information dissemination. Theoretically, the study extends TPB by validating partial mediation in a developing retail context. Practically, it suggests that marketers build credibility to bridge the intention-behavior gap, fostering sustainable consumption. Limitations include sampling bias and the cross-sectional design; future research should employ longitudinal methods and broader sampling.

Keywords: Green product, Theory of planned behavior, Green marketing mix, Consumer awareness, Supermarket retail, Sustainable consumption

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Do Food Consumption Patterns Drive Overweight and Obesity? A Case Study among Muslim Women in Kattankudy

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Globally, the prevalence of overweight and obesity has more than doubled in recent decades. Sri Lanka also has shown a similar trend, with a rapid rise in overweight and obesity, particularly among women. Compared to different ethnic groups, Muslims show a notably higher prevalence. This study assesses food consumption patterns and their relationship with overweight, obesity, and Non-Communicable Diseases (NCDs) prevalence among Muslim women in Kattankudy, Batticaloa District, Sri Lanka. A primary survey was conducted among 216 Muslim women, comprising pregnant, lactating, and well women, in Kattankudy. Data on food consumption was collected using a Food Frequency Questionnaire (FFQ), and Body Mass Index (BMI) and medical history were obtained from Medical Officer of Health (MOH) records. The data collected from FFQ was used to compute Dietary Obesity Prevention Score (DOPS). Multiple linear regression analysis, logistic regression analysis, and Structural Equation Modeling (SEM) were used to examine the relationships among food consumption patterns as measured by DOPS, and BMI and incidences of NCDs. The findings show that meat consumption is relatively high in the sample yet diverse food consumption patterns exist with respect to cereals, fruits, vegetables, whole grains and fast foods. The overall prevalence of overweight and obesity was 58.7%, and a higher prevalence of 72.3% was evident among well women. The results of the statistical analysis revealed that DOPS is low among the older participants and those with higher income. It is evident that DOPS negatively associated with BMI, indicating that healthier dietary patterns were linked to lower BMI. Conversely, NCDs were positively associated with BMI, suggesting that individuals with higher BMI had a greater likelihood of developing NCDs. These findings underscore the importance of promoting healthy eating behaviors and implementing targeted interventions to prevent overweight, obesity, and NCDs among Muslim women.

Keywords: Food consumption patterns, Overweight and obesity, Muslim women, Body mass index

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Economic Assessment of Kandyan Home Gardens with Carbon Sequestration Benefits and Conventional Paddy Monoculture

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This study assessed the sustainability and profitability of traditional Kandyan Home Garden (KHG) systems compared to conventional paddy monoculture in the Knuckles region of Sri Lanka, integrating economic and environmental perspectives. Primary household data ($n = 60$) were used to estimate the Total Economic Value (TEV) and Return on Investment (ROI) of each system. Above-ground biomass of high-biomass tree crops was converted to carbon stock using Intergovernmental Panel on Climate Change (2006) guidelines and monetized at an international carbon price of USD 190 per tonne of CO_2 equivalent. TEV included agricultural and timber revenues plus the annual carbon sequestration value. The mean carbon sequestration of KHGs, estimated using standard above-ground biomass values from previous agroforestry studies, was 80,058.13 t CO_2 ha^{-1} $year^{-1}$. The ROI was calculated as the percentage of net profit to total cost, and differences between systems were tested using independent-samples t-tests. Results revealed that the KHGs recorded a significantly higher mean TEV (LKR 845,338 ± 152,951) compared to monoculture (LKR 626,333 ± 118,772) ($p<0.001$). The ROI was also greater in KHGs (52.10 ± 7.15 %) than in monoculture (33.03 ± 13.81 %) ($p<0.001$). Farmers reported enhanced ecosystem services such as improved soil fertility, water retention, and microclimate stability attributed to diverse vegetation. These results show that KHG systems provide higher financial returns while serving as effective carbon sinks. Promoting KHGs can improve rural livelihoods and environmental sustainability, supporting climate-resilient agriculture in Sri Lanka's humid highlands.

Keywords: Agroforestry, Sustainability, Agroecosystem services, Total economic value, Return on investment

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Economic Impact of African Swine Fever Outbreak in Gampaha District of Sri Lanka.

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African Swine Fever (ASF) is a highly contagious viral disease affecting both domestic and wild pigs, resulting in substantial economic losses due to high mortalities and the absence of effective treatments or vaccines. This study focused on estimating the economic impact of the recent outbreak of ASF on swine production in Gampaha District of Sri Lanka. Following the initial ASF cases reported in September 2024, government-imposed restrictions on pig movement, slaughter, and pork sales disrupted normal pig farm operations and affected market dynamics. Data were collected from a stratified random sample of registered farms using structured questionnaires and on-site observations, focusing on pre- and post-outbreak conditions. Results indicate that the outbreak generated notable losses across all farms. Farms experienced an average mortality rate of 97.1%. Average Herd size reduced from 81 to six pigs per farm. Farm output fell sharply on average from 613.9 kg to 39.1 kg. Monthly farm revenue decreased by over 95% despite an increase in farm-gate pork prices, which producers could not capitalize on due to slaughter bans and severely depleted herds. When analyzed separately, large-scale farms experienced higher absolute financial losses but demonstrated great technical efficiency and short (7.0 months on average) operational halts, allowing them to recover relatively quickly. In contrast, the small-scale farms faced near-total income loss with low efficiency and long downtime averaging 9.1 months, highlighting their heightened economic vulnerability. Many smallholders abandoned pig farming or shifted to alternate livelihoods due to the extensive impact. Overall, the ASF outbreak has inflicted severe economic damage on the swine industry in Gampaha District. While the large farms showed a comparatively high capacity for recovery owing to better resources, the smallholders suffered disproportionately. These outcomes underscore the urgent need for strengthened biosecurity measures, equitable compensation, and comprehensive financial support programs to ensure long-term sustainability and resilience of pig industry of Sri Lanka.

Keywords: African Swine Fever, Economic impact, Swine Production in Sri Lanka

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Effect of Corporate Social Responsibility and Sustainable Human Resource Management practices on Employer Branding: A Study in a Sri Lankan Apparel Company

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Employer branding is becoming more and more important as companies attempt to develop favorable workplace attitudes in order to attract and keep talent. Sustainable HRM Practices and Corporate Social Responsibility (CSR) are key components of creating a strong employer brand in Sri Lanka's apparel industry. Industry is marked by intense rivalry, strict international standards, and significant economic effect. This study addressed the critical gap concerning how CSR and Sustainable HRM practices collectively influence Employer Branding in the apparel industry. The study employed quantitative methods involving employees from four (4) executive grades, representing Assistant managers, senior executives, executives and junior executives (n=145). Measures of CSR was obtained using Singh et al.(2021) scale. Sustainable HRM practices were measured using E3S conference scale (2021) and Employer Branding was measured by using the scale of Tanwar and Prasad (2017). Data were analyzed using inferential statistical analyses that included the t-test, ANOVA test, and multiple linear regression analysis. Finding of the study revealed that certain CSR dimensions: Environmental and Social responsibility had a positive effect ($p<0.05$) on Employer Branding. Sustainable HRM practices: Sustainable employee well-being and Sustainable compensation and benefits had a positive effect ($p<0.05$) on employer branding. Study findings indicate that organizations developed a healthy best brand image when they focus on treating people well and caring about the environment. Having a good employer brand helps organizations compete and ensures they grow in positive way. Taking care of both employees and the outside world is the key to being seen as a great place to work.

Keywords: Corporate Social Responsibility, Sustainable HRM Practices, Employer Branding, Apparel industry

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Effect of In-Store Retail Marketing Mix on Impulsive Buying Tendency of Supermarket Customers: A Study Conducted within Kandy City Limits

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This study examines the effect of in-store environmental factors on impulse buying behavior among supermarket customers in Kandy city. The research focuses on the 6P retail marketing mix dimensions, product, price, place, promotion, people, and presentation, to understand how they affect customers' urge to buy impulsively and actual impulse buying tendencies. A survey using Systematic Random Sampling with Fixed Time Intervals was conducted with 173 supermarket customers, and the data were analyzed using Partial Least Squares Structural Equation Modeling (PLS-SEM) via SmartPLS software. Results reveal that product, price, promotion, people, place, and presentation significantly affect customers' urge to buy impulsively, fully mediating their impact on impulse buying behavior. The promotion element is identified as the most influential factor driving impulsive tendencies. This research bridges an important gap in Sri Lankan retail studies by integrating multiple environmental elements rather than focusing on isolated factors. The findings provide actionable insights for retailers to optimize store environments and marketing strategies to match local shopper behavior in Kandy supermarkets. Limitations of this study include its geographical focus and sample size, along with exclusive mediation by the urge to buy impulsively, without considering other psychological or contextual influences. Future research needs to span across regions and explore additional mediators or moderators, such as mood and peer influence, to fully capture impulse buying dynamics.

Keywords: Impulse buying, In-store environment, 6P retail marketing mix, PLS-SEM, Consumer behavior

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Evaluating Farmers Understanding of Pesticide Labels and Compliance with Regulatory Standards

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Understanding pesticide label information is vital for ensuring safe and efficient agrochemical use among farmers. This study assesses the level of farmers' understanding of pesticide labels and evaluates the compliance of agrochemical products with government labeling standards in Sri Lanka, focusing on the Kuda Oya area of the Nuwara Eliya district. Primary data were collected through a structured questionnaire administered via in-person interviews with 87 farmers. Data were analyzed using descriptive statistics and a Negative Binomial Regression (NBREG) model to identify factors influencing comprehension of label information, including pictograms and color codes. The results revealed that the overall comprehension level among farmers was moderate, with limited understanding of hazard symbols and color codes. Education level, pesticide handling experience, frequency of label reading, and age were significant determinants of label comprehension ($p < 0.05$). Conversely, farming experience showed a negative relationship, indicating that long-term farmers often rely on traditional knowledge rather than label guidance. Descriptive findings also showed that most farmers disposed of pesticide containers unsafely, highlighting gaps between awareness and practice. A qualitative review assessed the compliance of selected pesticide products with labeling standards, covering major distributors and commonly used pesticide types. Most labels met key regulatory requirements, though minor inconsistencies appeared in clarity and symbol presentation, emphasizing the need for uniform labeling and regular monitoring. Overall, the study highlights that improving farmers' understanding of pesticide labels through simplified designs, targeted training, and stronger institutional enforcement can significantly reduce pesticide misuse, health risks, and environmental hazards, contributing to sustainable farming systems in Sri Lanka.

Keywords: Pesticide labeling, Farmer understanding, Pesticide standards, Safety practices

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Evaluating the Benefit-Cost Analysis and Effectiveness of IoT Technologies in Sri Lankan Agriculture

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The adoption of Internet of Things (IoT) technologies in protected agriculture promises to enhance productivity, though empirical data on its financial viability in Sri Lanka is limited. This study bridges this gap by conducting a comparative benefit-cost analysis (BCA) of IoT adoption in greenhouse/polytunnel farms. A quasi-experimental design was employed, collecting primary data via structured surveys from 40 IoT-adopting farmers (representing 103 technology instances) and a control group of 103 non-adopting farmers. The financial performance of individual IoT technologies and the overall farm-level performance of both groups were analyzed using Net Present Value (NPV), Benefit-Cost Ratio (BCR), Internal Rate of Return (IRR), and NPV per square foot (NPV/ft²) over a 3-year period with a 10% discount rate. The results demonstrated that all individual IoT technology categories were financially viable (average BCR > 1.0). Financial performance varied significantly by crop type, with bell pepper cultivation showing the highest BCR and strawberry the highest absolute NPV. The comparative farm-level analysis provided the key finding: IoT-adopting farms (n=40) exhibited significantly higher overall profitability (NPV, BCR, IRR) and operational efficiency (NPV/ft²) than the non-adopting farms (n=103), despite incurring a substantially higher initial investment. Descriptive analysis confirmed high farmer satisfaction, linked to perceived benefits including labor savings (up to 60%) and water use reduction (up to 40%). The findings provide strong evidence that IoT adoption is a financially superior investment, enhancing both profitability and land-use efficiency. Policies aimed at mitigating the high initial investment barrier are recommended.

Keywords: Internet of things (IoT), Benefit-cost analysis, Greenhouse, Profitability, Precision agriculture

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Evaluating the Impact of Weight Reduction on Improving Insulin Sensitivity in a Middle-Aged Sri Lankan Adult Population

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Insulin resistance (IR) is a key metabolic dysfunction linked to type 2 diabetes mellitus (T2DM) and cardiovascular disease, with a rising prevalence in South Asians including Sri Lankans, who exhibit metabolic disorders at relatively lower body mass indices compared to Western populations. This prospective interventional study evaluated the effect of body weight reduction on improving insulin sensitivity and related metabolic parameters in 40 middle-aged (30-45 years) Sri Lankan adults, comprising 26 females (F) and 14 males (M). Baseline and post-intervention assessments include anthropometric indices (BMI, total body fat percentage, visceral fat percentage, skeletal muscle content and waist circumference), biochemical markers (fasting blood glucose and triglycerides) and blood pressure. Insulin resistance was estimated using the validated Triglyceride-Glucose (TyG) index. Participants received a structured, culturally sensitive lifestyle modification program over six weeks, involving nutritional education and physical activity promotion tailored to local contexts. Primary outcomes focused on changes in the TyG index reflecting improvements in insulin sensitivity while supporting data from lifestyle-related questionnaires, including the Depression Anxiety Stress Scale, International Physical Activity Questionnaire, Sleep Quality Index, and Food Frequency Questionnaire, facilitated population characterization and behavioral interpretation. Paired t-tests demonstrated significant post-intervention improvements in body weight ($P = 0.000$), waist circumference ($P = 0.003$), and BMI ($P = 0.000$). Fasting blood glucose ($P = 0.000$) and triglyceride levels ($P = 0.036$) also showed significant reductions, resulting in a markedly improved TyG index ($P = 0.000$), indicating enhanced insulin sensitivity. Similar improvements in insulin sensitivity following modest weight reduction have been reported in intervention studies from other countries. However, this study is among the first in Sri Lanka to demonstrate such effects using the TyG index. These findings validate weight reduction as an effective, non-pharmacological approach in improving insulin sensitivity and mitigating metabolic syndrome risk in middle-income South Asian populations.

Keywords: Insulin Resistance, Metabolic Syndrome, TyG Index, Type 2 Diabetes, Weight Reduction

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Evaluation of Awareness on Provisions in Animals Act No. 29 of 1958 among Stakeholders in Eastern Province of Sri Lanka and Critical Analysis of Gaps in the Act: A Comparative Study with International Animal Legislation

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Sustainable livestock production relies on enacting contemporary legal framework and promoting adequate awareness of those legislations among stakeholders. The current study was designed to examine the awareness of various provisions in the Animals Act No. 29 of 1958 of Sri Lanka among livestock stakeholders in Eastern Province and to critically analyze the limitations in current provisions of the act and to compare the legal provisions of the act with international animal legislation to suggest necessary improvements. Primary data were collected from a simple random sampling of 193 livestock farmers from 4 veterinary divisions namely Kaluwanchikudy, Arayampthi, Kokaddisolai, and Thumbankerny in Batticaloa Districtn Eastern province. Veterinary Surgeons and Livestock Development Instructors of five veterinary divisions in the province were interviewed to collect additional information. Data were collected using a pre-tested structured questionnaire. Descriptive statistics, chi-square test, and non-parametric analyses were employed to analyze the collected data. The results indicated that although the majority with high awareness on branding (96%), transport permit regulations (98%), trespass penalties (100%), and slaughtering (95%) the awareness on the aspects of castration remained low (3%). Veterinary officers were aware of the provisions of the act but did not consistently translate into enforcement of the actions. Gender and experience significantly influenced the awareness ($p < 0.05$), where male respondents (90%) and those with more than 10 years of experience showed a high level of awareness. The existing legislative framework was found to be inadequate as it focuses primarily on administrative controls and lacks comprehensive welfare standards and enforcement mechanisms. Comparative analysis with international legislation highlighted that there is an urgent need to amend the Animals Act of Sri Lanka to comply with international livestock legislations. The present study could be considered as an initial step for policymakers to embark into livestock legislation reforms in Sri Lanka.

Keywords: Animals Act No. 29 of 1958, Stakeholder awareness, Livestock legislation Gap assessment, Comparative analysis

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Evaluation of Replanting Programs Conducted by Tea Estates in Ratnapura Region

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Tea replanting is an important practice for productivity in tea plantations and replanting involves systematic removal of old or unproductive tea bushes and their replacement with newly planted tea bushes. This study evaluated the different aspects of the replanting programs in tea which were conducted by the tea estates belong to Regional Plantation Companies (RPC), Private tea estates and Government tea estates in Ratnapura region. Data were collected related to the physical quality parameters, age, suitability class of the lands, management practices, replanting cost, plant growth measurements, yield measurements and survival rate. The replicate fields from each estate were selected from the Land Suitability Assessment reports available at the Advisory Division of the Tea Research Institute (TRI). Plant growth measurements, yield measurements, and survival rate were analyzed by using ANOVA. Mean differences of plant height, crown diameter, number of primary branches, stem diameter, number of leaves, number of pluckable active buds were significant ($p<0.05$) among estate samples and number of pluckable *banji*, number of *arimbu* and survival rate were not significant ($p > 0.05$) among the estate samples. The survival rate of TRI 2026 cultivar decreased with increase of gravel content. According to the observations, high gravel content was the main reason for the higher casualties in the tea fields in the Ratnapura region. Findings indicate that most TRI recommended lands are moderately suitable for tea replanting. Hence, it is very important to adopt good agricultural practices such as thatching, shade planting, adding refused tea, fertilizer application, planting *Tithonia diversifolia* and establishing proper drain systems in order to increase productivity of lands used for replanting in the Ratnapura region. The cost of replanting one ha of tea could be around Rs. 2.4 million. Further, crops such as coconut and cinnamon could be used to diversify lands unsuitable for tea replanting.

Keywords: Land Suitability Classes, Ratnapura region, Tea estates, Tea, Replanting

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Exploring the ICT Capability among Extension Officers in Western Province, Sri Lanka

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This study examines the ICT capabilities of extension officers in Sri Lanka's Western Province, focusing on the factors influencing their digital proficiency and the barriers they face. Given that effective extension delivery relies heavily on officers' ICT skills, this research addresses the limited empirical evidence in this context. A mixed-methods approach was employed, combining quantitative surveys and qualitative focus group discussions, with data collected from a census sample of 85 officers, yielding an 80% response rate. Quantitative analysis included descriptive statistics to characterize the study population. Cluster analysis using K-Means classified officers into different capability levels, and ANOVA confirmed statistically significant differences between these clusters ($p < 0.001$). To identify factors affecting ICT capability, a multiple linear regression analysis was conducted based on the UTAUT framework. The results indicated that expectancy ($b=0.8125$, $p<0.0001$) exerted the strongest positive direct effects on capability. Social influence ($b=0.2696$, $p=0.0005$) and facilitating conditions ($b=0.2626$, $p=0.0011$) also had significant direct impacts. Behavioral intention showed no significant mediation effect ($r=0.091$, $p=0.38$), while age served as a significant moderator ($p=0.0343$), influencing the strength of the relationships. The study developed an 11-item ICT capability scale, structured into three factors, with high internal consistency (Cronbach's alpha = 0.862). Descriptive results revealed that officers demonstrated high proficiency in routine operational tasks but limited innovation capacity, with 55.3% achieving moderate or high capability scores (mean=3.64). Qualitative content analysis, guided by Sen's Capability Approach, identified barriers such as financial and resource limitations, infrastructural gaps, excessive administrative workload, and communication inefficiencies in digital platforms. Overall, findings suggest that targeted interventions addressing these barriers particularly enhancing facilitating conditions and addressing infrastructural challenges are crucial to improving ICT capability among extension officers, thereby strengthening agricultural extension services in Western Province, Sri Lanka.

Keywords: ICT Capability, Extension officers, UTAUT, Capability Approach, barriers for digital transformation

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Factors Influencing Certified Seed Paddy Production Decision of Seed Paddy Producing Farmer in Polonnaruwa District

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Seed paddy certification is a vital mechanism for enhancing varietal purity, productivity, and seed quality, thereby contributing to national food security in Sri Lanka. Despite having a considerable number of farmers registered under the Seed Certification Scheme in Polonnaruwa District in Sri Lanka, the certified seed Paddy supply remains inadequate. This study aimed to identify the determinants influencing farmers' decision to produce certified seed paddy and to evaluate the financial feasibility of certified seed paddy production. Theory suggests that, socio economic factors, institutional factors, market factors, technical factors and behavioral drivers may determine the decision taken by individuals. A quantitative cross-sectional survey was conducted among 183 seed paddy farmers. The Ordered Logistic Regression analysis was used to assess these factors. The results revealed that factors such as farmer experience, access to irrigation, availability of processing machinery and storage facilities, income, land ownership, loss aversion and status quo bias were positively significant to certified seed paddy production, with 9.84% of farmers successfully obtaining certified seed paddy certification and 90.12% not completing the process. Financial analysis confirmed that certified seed paddy production is financially viable, yielding higher profits through premium prices and reduced post-harvest losses. However, delays in laboratory testing results, limited awareness, inadequate post-harvest facilities, and weak institutional coordination continue to hinder certification completion. Strengthening the Seed Certification Service (SCS) through timely lab result issuance, improved infrastructure, targeted training, and incentive mechanisms is recommended to enhance farmer to ensure farmers that can successfully complete the process and obtain certification, ensure seed quality, and promote a sustainable and efficient seed certification system in Sri Lanka.

Keywords: Seed certification service, Certified seed paddy, Behavioral drivers, Ordered logistic model, Sri Lanka

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Factors Influencing Student Engagement in Teacher Evaluations as a Mechanism of Service Co-Creation: A Study at the Faculty of Agriculture, University of Peradeniya

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This study investigates the determinants of low levels of student engagement in teacher evaluations, reframing the process through the lens of service co-creation and integrating constructs from the Theory of Planned Behavior (TPB) and Service-Dominant Logic (SDL). The objective is to identify motivational, social, and service-related factors influencing student participation at the Faculty of Agriculture, University of Peradeniya. A quantitative, cross-sectional survey was conducted among a sample of 300 students (N = 300), with data analyzed using Multiple Linear Regression and Hayes' PROCESS mediation analysis. Results reveal that the model collectively explains 45.8% ($R^2 = 0.458$) of the variance in student engagement. Intention to participate exhibits the strongest direct positive effect on engagement ($\beta = 0.507$, $p < 0.001$), emerging as the most influential determinant. Key SDL factors, service quality ($\beta = 0.289$, $p < 0.001$) and perceived behavioral control (PBC) ($\beta = 0.242$, $p < 0.001$), also demonstrate strong direct influences. Crucially, the effect of subjective norms on engagement is found to be fully mediated by intention (indirect effect = 0.180, CI = [0.101, 0.263]), while the SDL factor resource integration is not supported as a predictor ($p = 0.990$). These findings highlight that low engagement is fundamentally driven by a lack of student motivation and system-level failures. Recommendations emphasize the need to prioritize investment in improving service quality and system usability to enhance PBC, while simultaneously leveraging social reinforcement to build participation intention, thus facilitating effective value co-creation.

Keywords: Student engagement, Teacher evaluations, Service co-creation, Theory of planned behavior, Service-dominant logic

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Factors Influencing the Adoption Intention of Seaweed Farming Among Coastal Communities in the Northern Province of Sri Lanka

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Seaweed farming presents a a significant opportunity to advance Sri Lanka's *Blue Economy,* offering sustainable livelihood opportunities that support post-conflict recovery in the coastal communities of the Northern Province. This study empirically investigated the factors influencing the intention to adopt seaweed farming among coastal communities in the Northern Province of Sri Lanka, using the Unified Theory of Acceptance and Use of Technology (UTAUT) model. A quantitative survey was conducted with 195 respondents, comprising both adopters and non-adopters from Jaffna and Kilinochchi districts. The hypothesized relationships were tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). Data analysis was carried out using SmartPLS 4 and SPSS) 27. To understand the temporal pattern of adoption, the adopters were categorized using Diffusion of innovation (DOI) theory. The model demonstrated a strong explanatory power (62.5%) of the variance of Behavioral Intention (BI) ($R^2 = 0.625$). The results revealed that the strongest predictors of Behavioral Intention (BI) were Facilitating Conditions (FC) ($\beta = 0.336$), and combined construct of Effort Expectancy and Social Influence (EESI) ($\beta = 0.309$). Performance Expectancy (PE) did not exhibit a statistically significantly ($p < 0.05$) direct effect on Behavioral Intention (BI). The model remained stable across the demographic variables with no significant moderation effects ($p < 0.05$) for age, gender, education level and income. The adoption curve was skewed towards the Late Majority (52.4%). These findings suggest that, in this context, perceived benefits alone are insufficient to drive adoption. Potential adopters are more influenced by enabling environmental and institutional factors.

Keywords: Seaweed farming, UTAUT model, Behavioral Intention, Technology Adoption , PLS-SEM

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Factors Influencing the Intention to Start Businesses among Rural Women: A Case Study in the Nikaweratiya Divisional Secretariat Area

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Entrepreneurship by rural women significantly contributes to economic growth and poverty reduction by promoting income generation and empowerment. However, despite many government programmes and training to develop entrepreneurship, fewer women in rural areas like Nikaweratiya Divisional Secretariat start businesses. Understanding the factors influencing business startup intentions is vital for developing effective interventions. This study applies the Theory of Planned Behavior and push-pull motivational theories to examine psychological, social, and institutional determinants influencing rural women's business startup decisions. Data were collected through a questionnaire administered to 134 rural women, covering attitudes, subjective norms, perceived behavioral control, perceived government support, capital access, locus of control, self-efficacy, and motivational factors. Reliability tests and path analysis confirmed construct validity. Results show that subjective norms have a significant impact on business startup intentions (path coefficient 0.302, p=0.000), highlighting the key role of social and family support. Personal attitude (0.137, p=0.043), need for achievement (0.210, p=0.006), and government support (0.187, p=0.006) also significantly influence intentions. However, perceived behavioral control, capital availability, entrepreneurial self-efficacy, and push factors did not have a significant effect. Findings emphasize the importance of social context and government interventions in fostering entrepreneurship among rural women. To enhance business startups, programmes should strengthen supportive social networks, improve access to government programs, and promote positive attitudes and locus of control. Limitations include the cross-sectional design, which restricts causal inference, and focus on a single region, limiting generalizability. Future research should consider broader samples and alternative methodologies to validate these findings.

Keywords: Rural women, Entrepreneurial intention, Subjective norms, Perceived government support, Nikaweratiya

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Households' Willingness to Pay for Mangrove Ecosystem Services: Evidence from Sarasalai Village, Jaffna

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The mangrove ecosystem in Sarasalai provides vital ecosystem services that support local livelihoods. However, anthropogenic pressures and unplanned development activities have caused significant degradation of these mangroves. Fragmented land ownership, unlike in other fully protected mangrove sites in Jaffna, further hinders effective conservation efforts. This study estimates households' Willingness to Pay (WTP) and identifies the key factors influencing it, with the aim of informing sustainable mangrove conservation strategies. The study employs the Contingent Valuation Method (CVM) using a payment card approach with seven response options (0, 500, 1000, 1500, 2000, 2500, and "don't know"), determined based on the socio-economic characteristics of the sample and insights from pre-tests. Data were collected from 100 households through a pre-tested structured questionnaire and key informant interviews. An interval regression model was applied to identify the determinants of WTP and to estimate the mean WTP for the identified ecosystem services. The ecosystem services identified include climate regulation, biodiversity conservation, storm protection, recreation, and carbon sequestration. Results indicate that, on average, a household is willing to pay LKR 1,185 annually for mangrove conservation. Individuals with secondary education exhibit approximately 41.3% lower WTP than those with primary education possibly reflecting a greater expectation that conservation should be publicly funded. Conversely, respondents with private employment and higher-income households show 66% and 69% higher WTP, respectively, consistent with greater financial capacity and direct livelihood dependence on ecosystem stability. Awareness of mangrove benefits is the most influential factor, raising WTP by about 228%, emphasizing the role of knowledge in shaping pro-environmental preferences. In contrast, respondents who perceive mangrove conservation as solely a government responsibility exhibit roughly 67% lower WTP indicating a substitution effect between private and public responsibility. Based on these findings, several policy recommendations are proposed to support the sustainable conservation.

Keywords: Willingness to pay, Contingent valuation method, Payment card

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Impact of Climate Change on Agricultural Production in Sri Lanka: A Ricardian Approach

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This study examines the impact of climate change on agricultural productivity in Sri Lanka, focusing on paddy cultivation, using a Ricardian approach. Historical climate variability (2001–2024) was analyzed for paddy productivity across *Maha* and *Yala* seasons, considering monsoon periods: First Inter-monsoon (FIM), Southwest Monsoon (SWM), Second Inter-monsoon (SIM) and Northeast Monsoon (NEM). Panel data models: fixed effects and pooled OLS capture the linear and non-linear effects of temperature and precipitation on net revenue. For overall agricultural productivity, time series data (1961–2022) were analyzed using Total Factor Productivity and output-based models that include quadratic climate variables and key inputs (labor, fertilizer, irrigation). Results indicate that during *Maha*, higher SIM temperature and precipitation negatively affect net revenue per acre, while increases during NEM have positive effects. These patterns reflect the sensitivity of *Maha* paddy cultivation to excessive rainfall and temperature fluctuations during the early growth stages (SIM), which may cause waterlogging and pest proliferation, while favorable conditions during NEM enhance grain filling and yield. In *Yala*, SWM temperature and precipitation positively influence income, as moderate increases improve water availability and photosynthetic activity. However, higher FIM minimum temperature reduces income, possibly due to heat stress on seedlings, while increased FIM precipitation supports early growth and land preparation. Future projections under Shared Socioeconomic Pathways (SSP)1-2.6, SSP2-4.5, and SSP5-8.5 scenarios suggest overall declines in net revenue for 2051–2100, under SSP5-8.5, driven by more frequent extreme weather events and rising evapotranspiration. In contrast, aggregate-level analyses of total factor productivity and output indicate marginally positive responses to increased temperature and precipitation, implying that technological progress, diversification, and adaptive practices, such as improved irrigation and climate-resilient crop varieties, could offset some adverse impacts at the national level. These findings provide insights for climate-resilient policies and adaptive strategies for Sri Lanka's agricultural sector.

Keywords: Economic impacts, Paddy, Total factor productivity, Agricultural output, SSP climate scenarios

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Impact of Construction of Deduru Oya Reservoir on Net Returns of Downstream Farmers Who are Using River Lift Irrigation

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Agriculture in the Deduru Oya basin plays a vital role in sustaining rural livelihoods in the Northwestern Province of Sri Lanka. Prior to the construction of the Deduru Oya Reservoir, farmers relying on river lift irrigation faced severe water shortages, seasonal cultivation constraints, and unstable incomes. This study aims to evaluate the impact of the Deduru Oya Reservoir on the net returns of downstream farmers using river lift irrigation. The research was conducted in the Bingiriya Divisional Secretariat Division, covering three Grama Niladhari Divisions; Moleliya, Getulawa, and Pahala Thalanpola where river lift irrigation is widely practiced. Primary data were collected through a structured questionnaire from 105 farmers, while secondary data were obtained from institutional reports and published statistics. The study compared pre- and post-reservoir periods represented by the years 2014 and 2024, respectively. Cost–benefit analysis and descriptive statistics were employed to evaluate economic performance, and 2014 values were adjusted to 2024 price levels using inflation indices from the Central Bank of Sri Lanka to ensure comparability. The results reveal a remarkable improvement in water availability and cultivation intensity after the construction of the reservoir. Farmers were able to cultivate year-round and expand their cultivated land area. Moreover, due to improved water availability, many farmers have shifted from comparatively low water-requiring crops such as chili to high water-demanding crops like paddy and introduced high-value perennial crops such as pepper and cinnamon. Consequently, the extent of paddy lands increased while chili lands declined. The average benefit–cost ratio rose from 2.67 in 2014 to 3.72 in 2024, and the average net return per hectare increased from Rs. 683,658.19 to Rs. 1,294,600.59. Overall, the findings demonstrate that the Deduru Oya Reservoir has significantly enhanced the profitability, productivity, and sustainability of downstream farming systems.

Keywords: Deduru Oya reservoir, River lift irrigation, Net returns, Cost–benefit analysis.

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Influence of Job Quality and Perceived Alternative Livelihood Opportunities on Women Employees' Turnover Decisions in the Garment Industry: The Case of Palugolla GN Division, Galgamuwa Region, Sri Lanka

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This study examines how job quality and perceived alternative livelihood opportunities shape turnover decisions among women employees in Sri Lanka's rural garment industry, focusing on the Palugolla GN Division in the agricultural Galgamuwa region. Sri Lankan government policies on rural industrialization introduced garment factories into village settings as a strategic approach to absorb surplus agricultural labor, foster economic diversification, and promote inclusive growth in predominantly agro-based communities, providing essential employment for women who otherwise have limited alternatives. Despite its vital role in supporting local economies, high turnover remains a persistent challenge. This research explores interconnected factors such as workplace satisfaction, family responsibilities, and the persistent barriers to agricultural livelihoods that influence women's decisions to stay or leave. While garment factory jobs offer proximity to home and regular wages, employees frequently encounter low pay, insecure contracts, long working hours, and minimal opportunity for advancement. The feasibility of alternatives like farming or small enterprise is often constrained by technical, ecological, and resource-related challenges, reinforcing women's reliance on factory employment. Family duties, especially caregiving, also restrict women's ability to pursue other work, adding complexity to their turnover decisions. The study draws on the Unfolding Model of turnover to highlight how dissatisfaction, perceived job quality, and alternative options interact with rural socio-economic realities. Recommendations include improving workplace conditions, implementing flexible schedules, offering childcare support, and strengthening industry-agriculture linkages for inclusive growth. Enhancing these factors can contribute to better workforce retention and sustainable development in rural regions, aligning garment sector policies with the broader objectives of rural transformation and agricultural integration

Keywords: Women garment workers, Turnover decisions, Job quality, Alternative livelihoods, Family responsibilities

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Inquiring the Informal Institutional Factors Underlying Perceived Time Poverty Among Rural Women Farmers in Sri Lanka

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Time Poverty has increasingly been recognized as a critical form of inequality, particularly affecting women in rural agricultural context. This study investigates the informal institutional and cognitive determinants shaping *Perceived Time Poverty (PTP)* among rural women farmers in Mahailuppallama, Sri Lanka. Using a cross-sectional, quantitative design, data were collected from 115 respondents selected through stratified random sampling, where the strata were defined by three women farmer organizations. A psychometric *Perceived Time Poverty scale (PTPS)* was developed and validated to measure subjective experiences of time scarcity, combining distinct dimensions of personal well-being and social-family constraints into a single construct for improved conceptual consistency. Guided by institutional, social capital and social cognitive theories, the study examined the influence of social norms, social capital, social groups and mental models on perceived time poverty. Data analysis conducted using SmartPLS and SPSS revealed that social capital (β= 0.533, p= 0.000), mental models ($\beta = 0.190$, $p = 0.015$), indicating that bonding based social networks and internalized beliefs about one's role increase perceived time stress. Social norms ($\beta = 0.186$, $p = 0.011$), indicating the traditional gender norms expect women to handle most household and care giving duties, they feel greater time pressure. Social groups ($\beta = -0.040$, $p = 0.646$), indicating no significant relationship with perceived time poverty. The study concludes that perceived time poverty is shaped more by psycho social and informal institutional factors than by actual time availability. Therefore, addressing time poverty requires policy interventions that challenge restrictive gender norms, promote supportive social networks, and reshape cognitive models that normalize women's overwork and self-sacrifice.

Keywords: Time Poverty, Social norms, Social Capital, Mental models, Rural women farmers

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Interplay of Food Cravings, Dietary Habits, Psychological Well-Being, and Quality of Life in Postmenopausal Women in Kandy District: A Cross-Sectional Study

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Menopause marks the end of a woman's reproductive years, characterized by the permanent cessation of menstruation. This physiological transition can significantly influence dietary behaviors, often triggering cravings for energy-dense foods due to hormonal changes. These cravings are interlinked with dietary habits, psychological well-being, and quality of life. Thus, the present study aimed to examine the interplay among food cravings, dietary habits, psychological well-being, and quality of life among postmenopausal women in the Sri Lankan context. This cross-sectional, survey-based study included postmenopausal women (N = 80) from Kandy District, recruited through convenience sampling. Anthropometric measurements were taken using standard procedures. Food cravings were assessed using the Food Craving Questionnaire–Trait-Reduced (FCQ-T-r) and a validated Food Craving Inventory (FCI). Dietary intake was evaluated through a food frequency questionnaire and 24-hour dietary recall. Psychological well-being and quality of life were assessed using the Depression, Anxiety, and Stress Scales–21 (DASS-21) and the World Health Organization Quality of Life–Brief version (WHOQOL-BREF), respectively. The mean BMI was 27.9 ± 4.53 kg/m², classifying majority under obesity class I. The highest obesity prevalence occurred in the late postmenopausal stage. Mean waist-hip ratio of 0.893 ± 0.060 indicated central obesity. Dietary assessment revealed that cereals and equivalents accounted for 46% of consumption frequency, while fruits represented only 5%. Cravings for sweets and high-carbohydrate foods were significantly higher than for high-fat or fast-food fats. Income level showed a weak positive correlation with fruit consumption. A moderate positive correlation was found between depression and trait food cravings, while weak positive correlations were observed between depression and sweet cravings, and between stress and fast-food fat cravings. Overall, participants demonstrated a moderate quality of life. In conclusion, a larger-scale study incorporating biomarkers is warranted to further explore these interrelationships and their impact on postmenopausal health.

Keywords: Obesity, Postmenopause, Psychological well-being, Quality of life

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Introducing Green Manure Mixtures for Suppressing Weed Growth, Improving Soil Quality and Cash Crop Growth in Sri Lanka

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Soil degradation and excessive reliance on fertilizers are major challenges in modern agriculture. Green manure (GM) mixtures provide promising agro-ecological solutions for such issues in both organic and conventional farming systems. This study was conducted at the university research farm, Mahailluppallama, for assessing the potential of multi-species GM mixtures in improving land productivity, using okra (MI-5 variety) as the cash crop. A Randomized Complete Block Design was employed with three blocks and 18 treatments for the study. Different seed rates of Finger millet (FM; *Eleusine coracana* L.), Mustard (M; *Brassica* spp.) and Sunn hemp (SH; *Crotalaria juncea* L.) were used to formulate seed mixtures. The nine main treatments included three GM monocultures: (T_1) 12 kg ha^{-1} FM, (T_2) 12 kg ha^{-1} M, and (T_3) 100 kg ha^{-1} SH, four GM mixtures, (T_4) 6 kg ha^{-1} FM + 6 kg ha^{-1} M, (T_5) 6 kg ha^{-1} FM + 50 kg ha^{-1} SH, (T_6) 6 kg ha^{-1} M + 50 kg ha^{-1} SH, and (T_7) 4 kg ha^{-1} FM + 4 kg ha^{-1} M + 100/3 kg ha^{-1} SH, with two controls: (T_8) No GM + No weeding, and (T_9) No GM + weeding. Treatments T_1-T_9 were provided only with GM while T_{10}-T_{18} were the same GM mixtures + DOA recommended synthetic fertilizers for okra. The results revealed that T_3 and T_7 provided the highest ($p<0.05$) GM biomass to the soil at incorporation while T_3 provided the greatest N and P supply. All treatments with SH showed significantly greater weed suppression compared to others. In terms of okra plant height, the treatments with SH and FM combined with synthetic fertilizers showed greater results similar to T_7. The findings highlight that the three-species GM mixture could provide benefits for okra growth similar to those of treatments with synthetic fertilizer and other GM additions.

Keywords: Conventional agriculture, Cover Crop Mixtures, Organic farming, Soil health.

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Investigation of Socio-economic Conditions and Fishing Aspects of Fishermen in Maussakelle, Kotmale and Castlereigh Reservoirs

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A study was carried out to investigate the socioeconomic conditions and fishing aspects in fishing communities of some major reservoirs in Nuwara Eliya district. A pre-tested structured questionnaire was used to survey all fishermen in the fisheries societies in three randomly selected large reservoirs (Maussakelle (n=24), Castlreigh (n=19) and Kotmale (n=21)). Socioeconomic conditions of fishermen included, age, household size, dependency ratio, income from fishing, assets owned and condition of the houses (no. of bedrooms, roof type, presence of ceilings, electricity, TVs, mobile phones, and refrigerators). Fishing aspects included net types, fishing effort, catch of each fish species, and income from different species. The saving habits of fishermen and their views and suggestions were also surveyed. In comparison of the reservoirs, Chi-squre analysis was performed for categorical variables and ANOVA procedure was used for continuous variables (p=0.05). A principal component analysis was carried out using all socioeconomic variables and the first principal component was used to develop an Asset Index. Significant differences were shown among the reservoirs with respect to condition of the houses with Maussakelle showing significantly worse conditions, however, there were no significant differences with respect to Asset Index. Freshwater prawn yield was significantly higher in Kotmale (4.2 fish/day) than Castlereigh (2.24 fish/day) and Maussakelle (1.36 fish/day). Common carp catch in Castlereigh reservoir (1.4 fish/day) was significantly higher than that of Kotmale (0.4 fish/day) while Maussakelle showing an intermediate value (1.05 fish/day). Mean catches of silver carp were significantly different among the three reservoirs with Kotmale, Maussakelle and Castlereigh recording 1.8, 0.78 and 0.04 fish/day, respectively. The three reservoirs were similar in yields of Tilapia, Rohu, Catla and Mrigal species. In Maussakelle, the fishermen with a habit of saving had significantly high Asset Index mean value. Differences in suggestions among communities emphasized the need for reservoir specific management.

Keywords: Aquaculture, Asset Index, Co-management, Fisheries societies

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Molecular Identification and Phylogenetic Relationships of Squid and Cuttlefish Species Caught in Western and Northwestern Provinces of Sri Lanka

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Cephalopods include cuttlefish, squid, octopus and nautilus and are important as they are considered a delicacy with high nutritional value. Given the scarcity of information on these in Sri Lankan waters, molecular-based studies are important. The objective of this study was to use molecular biological methods to identify cuttlefish and squid species that cannot be distinguished using morphological characteristics alone. Hence, this study focused on the molecular identification and phylogenetic relationships of cephalopod species in the western and northwestern waters of Sri Lanka. Squid and cuttlefish samples were collected from Chilaw, Dehiwela and Beruwela. Morphological analysis was conducted using characteristics such as body patterns, colour, body shape, fin shape, and the fin length as a percentage of the mantle. Twenty-five key morphometric parameters were measured for each individual, along with meristic characteristics. To investigate genetic diversity and potential cryptic species, amplification and sequencing of the mitochondrial Cytochrome C Oxidase I (COI) gene was carried out. Two squid samples from Beruwela which had similar morphological features but had differing fin shapes were identified as *Uroteuthis duvaucelii*. *U. duvaucelii* and has been identified as a squid with potential cryptic variations, suggesting possible sub-species. Two cuttlefish samples with similar but small variations in the pattern on the mantle were identified as *Sepia pharaonis*. It has been reported that *S. pharaonis* is a species complex containing three or more species. The study on the phylogenetic analysis of the two squid sequences with 18 sequences taken from the NCBI database, showed the squid samples of this study clustering with *U. duvaucelii* sequences of Southern Sri Lanka and some Indian sequences. Sequences from Vietnam, Indonesia and South America formed a separate clade. This study shows the value of molecular identification combined with morphological studies and this information is important for sustainable fisheries management in Sri Lanka.

Keywords: Squid, Cuttlefish, Morphological, Phylogenetic, Mitochondrial COI

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Navigating Job Search Stress: The Case of Female Temporary Academic Staff in Broad-Discipline Faculties at the University of Peradeniya

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This study examines job search anxiety among female temporary academic staff in broad-discipline faculties at the University of Peradeniya, a leading and demographically diverse Sri Lankan university outside the main economic hub. The sample specifically targets women in Agriculture, Arts, Science, and Management, a group chosen because their academic qualifications are high, yet their career paths are ambiguous and their access to opportunities is structurally limited. The study controls for key demographic variables—faculty, region, and age—to isolate the impact of market mismatch, gendered barriers, and geographic disparities. Using a cross-sectional quantitative survey of 73 participants, standardized scales measured job search anxiety, social support, self-efficacy, and career alignment. Results reveal moderate overall job search anxiety, with respondents expressing high confidence in their abilities but reporting stress from financial uncertainty, employer expectations, and limited job-market alignment. Hierarchical multiple regression shows that greater perceived social support, job-degree match, and steady income are significant predictors of lower anxiety. The findings, underpinned by Social Cognitive Career Theory, the Transactional Model of Stress, and the Buffering Hypothesis, confirm that addressing systemic barriers—through institutional career alignment, social support programs, and improved job security—will more effectively reduce job search stress than interventions focused solely on individual coping. This research underscores that job search anxiety for this group is a rational response to external constraints, rather than a sign of personal inadequacy.

Keywords: Job search anxiety, Female temporary academic Staff, Career alignment, Work self-efficacy, Perceived social support

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Potential to Grow Mung Bean (Vigna radiata L.) in Salinity-affected Soil after Paddy Straw Incorporation

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Soil salinity is a major constraint in Sri Lankan rice-based cropping systems. This study evaluated the potential of growing mung bean (*Vigna radiata* L. var. MI 6) after incorporating paddy straw or straw-derived biochar to salinity affected rice-based cropping system. A pot experiment was conducted using a Completely Randomized Design with three salinity levels (0.02, 3, and 6 dS m^{-1}) and three organic amendments (no amendment, straw (50 g/pot), and biochar (10 g/pot)). Data on growth, physiological, yield, and soil characteristics were analyzed using ANOVA, DMRT and Pearson correlation analysis at 0.05. Results revealed that salinity stress in 3 and 6 dS m^{-1} salinity levels markedly reduced photosynthetic rate, SPAD reading, and yield of mung bean, while organic amendments enhanced plant growth and physiological performance. The performance index (Pi_Abs) showed a strong interaction between salinity and organic amendments, revealing improved photosystem II efficiency with straw and biochar. Among soil parameters, only phosphorus and cation exchange capacity significantly increased with organic amendments. Correlation analysis indicated that increasing Na^+ accumulation in roots was associated with reduced pod number (r= -0.62) and biomass (r= -0.67), whereas higher dry matter production positively correlated with pod number. (r= 0.56) These findings demonstrate that both Na^+ regulation and biomass accumulation are key determinants of yield under salinity. Notably, straw improved early growth and seed filling, while biochar enhanced root biomass, ionic balance, and sustained photosynthetic activity under higher salinity. Overall, the combined use of straw and biochar presents a practical and sustainable approach to mitigate salinity stress and enhance mung bean productivity in saline-affected rice-based cropping system.

Keywords: Biochar, Biomass–yield relationship, Paddy straw, Salinity, Soil fertility

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Recycling Temple Floral Waste into an Organic Liquid Fertilizer for Marigold (*Tagetes* spp) Cultivation

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Temple floral waste constitutes a significant organic waste stream in Sri Lanka, with potential for nutrient recycling. This study evaluated the efficacy of temple floral waste-based liquid fertilizers produced through aerobic and anaerobic fermentation on marigold (*Tagetes* spp) growth. Two fermentation methods (aerobic and anaerobic) were tested at two dilution levels (1:5 and 1:10), compared with inorganic fertilizer and control treatments in a Completely Randomized Design with six replicates. Nutrient analysis revealed that anaerobic fermentation for 30 days produced fertilizers with higher phosphorus (188 mg/L) and potassium (1684 mg/L) content, while aerobic fermentation for 14 days yielded a higher nitrogen concentration (1316 mg/L). The anaerobic fertilizer demonstrated better nutrient stability during storage, showing only 12% nitrogen loss compared to 43% in aerobic fertilizer. By ten-weeks after transplanting anaerobic 1:5 dilution (T3) significantly outperformed all other treatments, producing the tallest plants (100.0 cm), thickest stems (11.08 mm), highest number of branches (13) and maximum leaf count (141). Most notably, T3 promoted earliest flowering at 64 days, 12 days earlier than inorganic fertilizer. The aerobic 1:5 dilution (T5) showed intermediate performance, while 1:10 dilutions of both fermentation methods were found less effective. All floral waste treatments significantly surpassed the control in all growth parameters ($p<0.05$). The results demonstrate that temple floral waste processed through anaerobic fermentation at 1:5 dilution provides balanced nutrition that enhances both vegetative and reproductive growth of marigolds, offering a sustainable alternative to inorganic fertilizers while addressing temple waste management challenges.

Keywords: floral waste recycling, organic fertilizer, anaerobic fermentation, aerobic fermentation, nutrient management

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Seeing Is Believing It: Theorization of Flood Policy Support and Contextual Variables of Affected Communities in Sri Lanka

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Flood affected communities in Sri Lanka demonstrate limited support for local flood policies, constraining effective responses to recurrent floods. This study explores a critical gap in understanding the contextual factors causing flood policy support, particularly focusing on the role of visual communication methods. Traditional flood risk communication relies heavily on conventional media, which often lacks visual engagement and emotional impact. To address this limitation, the present study investigates the effectiveness of virtual reality (VR-3D) and 2D AI-generated videos in enhancing public policy support for flood management. A between-subject experimental design was employed, randomly assigning participants from *Gin* river basin in Galle to one of three groups (N=142): VR, 2D, and control. After completing demographic questions, participants were exposed to tailored flood risk communication videos, followed by surveys measuring six key variables: risk perception, negative emotions, transportation, feelings of solidarity, preparedness, and policy support. Results indicate that participants in the VR condition scored higher across all variables compared to the 2D and control groups. Specifically, the policy support was significantly higher in the VR condition (*M*=6.376, *SD*=0.829) than in the control condition (*M* = 5.789, *SD*=0.728). The serial mediation analysis revealed that the effect of VR on policy support operates indirectly through negative emotions and risk perception (BootLLCI = -0.040, BootULCI = -0.001). Another significant alternative pathway was identified, in which the effect of the condition on policy support is mediated through community solidarity and preparedness (BootLLCI = -0.0843, BootULCI = -0.008). The immersive and interactive qualities of VR enhance understanding of flood hazards, evoke stronger emotional engagement, foster informed decision-making, and preparedness behaviors. This study demonstrates that VR is an effective visual communication tool promoting community engagement and policy support to strengthen disaster risk communication strategies in Sri Lanka.

Keywords: Virtual Reality, Artificial intelligence, Risk perception, Flooding, Communication

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Spatio-Temporal Variation of Farmer-Reported Queries in the Sri Lankan Paddy Sector: An Analysis of 1920 Agriculture Advisory Service Call Records

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Paddy cultivation plays a central role in food security and rural livelihoods in Sri Lanka. Yet, the sector continues to face persistent production challenges driven by pests, diseases, input management inefficiencies, and changing climatic conditions. However, limited empirical understanding exists regarding the spatiotemporal distribution of field-level constraints encountered by paddy farmers. The extensive database of farmer queries recorded through '1920 Agricultural Advisory Hotline' operated by the National Agriculture Information and Communication Centre (NAICC) of the Department of Agriculture, Sri Lanka remains underutilized, despite its potential to provide real-time insights into information needs and problem patterns of farmers. This study aimed to investigate the spatiotemporal distribution of farmer-reported problems in paddy sector and to generate evidence-based insights for improving extension services and policy interventions. Secondary data consisting of 10,012 hotline records collected between 1st April 2023 and 31st March 2025 (two *Yala* and two *Maha* seasons) were analyzed using SAS and ArcGIS software. Frequency distributions and Chi-square tests were used to assess temporal and spatial variations, while choropleth maps and Moran's-I test were employed to visualize and evaluate spatial clustering patterns. Results revealed that pest control, fertilizer recommendation, and seed & planting material-related queries were the most dominant, together accounting for over 50% of all the queries ($p<0.05$). Query frequencies peaked during the *Maha* season (60%). Spatially, high query densities were concentrated in major paddy-producing districts such as Kurunegala and Anuradhapura (32%). In contrast, urban districts such as Colombo and Gampaha showed higher query rates per 1,000 paddy farmers, indicating a higher intensity of problems faced by them. These findings highlight the value of the NAICC 1920 database as a decision-support tool for strengthening agricultural advisory system in Sri Lanka. Enhanced data-driven planning can improve responsiveness of extension services, support targeted interventions, and contribute to sustainable development of the paddy sector.

Keywords: Farmer queries, GIS, NAICC hotline, Paddy cultivation, Spatio-Temporal analysis

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Sustainable Heat: A Comprehensive Techno-Economic and Life Cycle Analysis of Household Firewood Stoves in Sri Lanka

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This study conducted a comprehensive techno-economic and life cycle analysis of household firewood stoves in Sri Lanka, comparing traditional three-stone stoves, improved Anagi stoves, and modern Lakro/EZ gasifier stoves to identify the most sustainable cooking solution. Firewood remains the dominant cooking fuel in 78% of Sri Lankan households, yet traditional cookstoves demonstrate thermal efficiency of only 10.62%, resulting in excessive fuel consumption averaging 2.56 kg per capita daily and severe health impacts from indoor air pollution causing 4,300 annual deaths. The research employed an integrated methodology combining Water Boiling Tests for thermal efficiency assessment, techno-economic analysis using Net Present Value, Internal Rate of Return, and Benefit-Cost Ratio, and Life Cycle Assessment following ISO 14040 standards to evaluate environmental impacts over a 5-year functional unit encompassing 5,475 cooking cycles. Experimental testing involved 15 replicates per stove type under controlled conditions, with statistical analysis using the Kruskal-Wallis H-test ($P < 0.05$) and Mann-Whitney U post-hoc comparisons with Bonferroni correction. Results revealed statistically significant performance differences ($P = 7\times10^{-10}$). Thermal efficiency improved by 31% for Anagi stoves and 44% for Lakro/EZ gasifier stoves, with median boiling times of 316 s and 235 s, respectively, versus 370 s for traditional stoves. Anagi achieved an Internal Rate of Return of 33% and a Benefit-Cost Ratio of 12.10, while Lakro/EZ showed Net a Present Value of LKR 11,577 despite a higher initial investment of LKR 8,000. Lakro/EZ stoves reduced CO_2 emissions by 43.8% (3,832.5 kg), $PM_{2.5}$ emissions by 74.7%, and CO emissions by 59.6% over 5 years. The integrated sustainability assessment identified improved Anagi stoves as optimal for widespread household adoption, providing critical evidence-based insights for sustainable cooking energy transitions in Sri Lanka.

Keywords: Cookstove efficiency, Techno-economic analysis, Life cycle assessment, Sustainable cooking energy

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The Effect of Flexible Work Arrangements on Employee Performance in IT Organizations based in Sri Lanka

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Employee performance is crucial for achieving organizational success, especially in the Information Technology (IT) industry, where innovation and efficiency rely on motivated and engaged employees. Flexible Work Arrangements (FWAs) have emerged globally as a strategic means to boost productivity by allowing employees greater autonomy over when, where, and how they work. This study aimed to examine the impact of FWAs on employee performance in IT organizations in Sri Lanka, focusing on the mediating role of job engagement and the influence of demographic factors. A quantitative research design was adopted, and data were collected through a structured self-administered questionnaire from 180 IT professionals in the Colombo District. FWAs were measured using the Flexible Work Options Questionnaire (Albion, 2004), work engagement through the Utrecht Work Engagement Scale (Schaufeli et al., 2006), and performance using the Individual Work Performance Questionnaire (Koopmans et al., 2014). Data analysis was conducted using descriptive statistics, hierarchical linear regression, and Hayes' PROCESS Macro (Model 4). The results indicated that FWAs significantly and positively influenced both employee performance ($\beta = 0.698$, $p < 0.001$) and job engagement ($\beta = 0.721$, $p < 0.001$). Job engagement also showed a strong positive relationship with performance ($\beta = 0.875$, $p < 0.001$). The mediation analysis confirmed a partial mediation effect, as the indirect impact of FWAs on performance through engagement was significant ($\beta = 0.4549$, 95% CI [0.3564–0.5574]). Demographic variables had no significant effect ($p > 0.05$). Overall, the findings highlight that flexible work arrangements enhance both employee engagement and performance, offering valuable insights for IT organizations in Sri Lanka to improve motivation and productivity through effective flexibility practices.

Keywords: Employee Performance, Flexible Work Arrangements, Job Engagement.

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The Food Environment Exposure and Factors Affecting Dietary Behaviors among Students at the University of Peradeniya

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The transition from home to university marks a critical stage where young adults encounter new food environments that shape their dietary behaviors and health outcomes. This study examined food environment exposure and the factors influencing dietary behaviors among undergraduates at the University of Peradeniya, Sri Lanka. A descriptive cross-sectional quantitative design was employed, combining an objective assessment of 70 on- and off-campus food outlets using Nutrition Environment Measures Survey (NEMS-R and NEMS-CS) tools and a structured questionnaire administered to 304 students. Results revealed that the university food environment is predominantly unhealthy, with 32.9% being commercial food outlets and limited availability of fruits (17%), vegetables, and healthy staples (28%). Institutional factors like food availability, affordability, accessibility, and promotion had the strongest correlation on dietary behaviors ($\rho = 0.807$, $p < 0.001$). Socio-cultural factors, including peer influence, family guidance, and cultural food practices, showed moderate associations ($\rho = 0.563$, $p < 0.001$), while individual factors such as cooking skills and food preferences exhibited weaker yet significant effects ($\rho = 0.363$, $p < 0.001$). Significant differences in dietary behaviors were observed across academic year and monthly income. Hierarchical regression indicated institutional factors as the strongest predictors ($\beta = 0.304$, $p < 0.001$), explaining 10.8% of the variance. The findings emphasize the need to enhance the nutritional quality, affordability, and availability of healthy foods in university settings. Implementing nutrition-sensitive policies, promoting healthy food options, and improving student awareness and cooking skills are recommended to foster sustainable dietary behaviors across Sri Lankan universities.

Keywords: Food environment, Dietary behaviors, Nutrition environment measurement tools, Socio-ecological model, Students of University of Peradeniya, Sri Lanka.

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The Impact of Parental Attitudes toward Fast-Food Consumption of Children in Kinniya, Trincomalee District

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Fast-food consumption among children has become a growing concern in Sri Lanka, raising questions about its implications for health, nutrition, and lifestyle. Despite awareness of these issues, children's fast-food consumption continues to rise, largely influenced by parental attitudes, beliefs, and practices. Considering this, the study aimed to examine the impact of parental attitudes on children's fast-food consumption, identify the factors shaping these attitudes, and determine how such attitudes affect the frequency and type of fast food consumed. The study was conducted through a household survey in the Kinniya area of the Trincomalee district, covering a representative sample of parents with school-aged children. The data were analyzed using descriptive statistics, mean comparisons, and regression analysis. Findings revealed that parental attitudes significantly influence children's fast-food consumption patterns, with factors such as convenience, affordability, cultural preferences, and perceptions of nutritional value playing important roles. However, the study also found that while some parents expressed awareness of the health risks associated with fast food, this did not always translate into restrictions on their children's consumption. The results further indicated that parental beliefs about the balance between home-cooked meals and fast food are critical in shaping children's dietary behavior. When designing awareness campaigns and interventions to reduce unhealthy fast-food consumption, it is important to recognize that parents often prioritize convenience and children's preferences alongside health concerns. Therefore, effective strategies should emphasize both the long-term health impacts and the economic benefits of healthier food choices to motivate parents to adopt and sustain positive dietary practices.

Keywords: Parental attitudes, Fast-food consumption, Children, Dietary behavior, Nutrition awareness

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The Influence of Livelihood Assets on Food Security among the Resettled Fishing Community of Palaly, Jaffna

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Resettled communities in Sri Lanka, particularly in Northern and Eastern Provinces, have experienced severe disruption to their livelihoods. Most areas in these provinces are coastal, and consequently, fishing communities were among those most affected due to resettlement. Conflict-induced displacement and resettlement disrupt access to land, livelihoods, and food, causing significant food insecurity. In particular, the displaced communities in Palaly, Jaffna, have been resettled only in recent years. This study examined the influence of livelihood assets on household food security among the resettled fishing community of Palaly, Jaffna, based on the Sustainable Livelihood Theory. The objectives were to (1) identify and categorise the main livelihood strategies adopted by the resettled fishing community, (2) quantify the latent dimensions of livelihood assets - human, physical, natural, social, and financial, and (3) analyze the influence of each asset on household food security. A cross-sectional household survey was conducted among 161 households selected from a total of 275 in the Palaly North Grama Niladhari Division. Primary data were collected through a structured questionnaire covering socio-demographic characteristics, livelihood assets, strategies, and food security measured using the Household Food Insecurity Access Scale (HFIAS). Descriptive statistics, Multiple Correspondence Analysis (MCA), and Ordinal Logit Regression were employed for analysis. Results revealed that only 32% of households were food secure, while 68% experienced some level of food insecurity, with 44% moderately and 18% severely food insecure. Financial assets and human assets showed a significant negative association with food insecurity access ($P<0.05$). The study concludes that improving financial assets and human assets are essential to ensure food security among resettled fishing households in post-conflict areas.

Keywords: Food security, Livelihood assets, Livelihood strategies, Resettled communities, HFIAS

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Understanding the Reasons for the Decline of Grape Cultivation in the Jaffna Peninsula: A Study of Crop Shifts and Farmer Livelihoods

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Grape cultivation in the Jaffna Peninsula was historically a profitable and promising activity, supported by a favorable dry climate, reaching about 240 hectares in 1990. However, the area under cultivation has severely declined by nearly 54% from 130 hectares in 2015 to 60 hectares projected for 2025, signaling serious sustainability issues. This decline is not due to low profitability, as grapes remain the most profitable crop in the region with the highest annual net income (Rs. 4.15 million) and Benefit-Cost Ratio (BCR) of 2.63. This study aims to identify the factors driving this shift away from grape cultivation and explore pathways for revival. A mixed-method approach was employed, utilizing a structured questionnaire survey (quantitative) and semi-structured interviews (qualitative). The study sampled 90 farmers in the Jaffna Peninsula, split equally between current grape cultivators and those who have shifted to other crops. Binary Logistic Regression was used to identify significant determinants of a farmer's decision to shift away from grapes. The significant factors driving the decline and prompting crop shifts are production and sustainability challenges, not economic factors. The Binary Logistic Regression analysis identified severe pest severity ($p<0.05$), total land holding ($p<0.05$), farming experience ($p<0.05$), and import competition ($p<0.05$) as significant determinants for a farmer shifting away from grape cultivation. Farmers are adopting diversified cropping patterns like banana, chili, and brinjal as a risk-management strategy, favoring their shorter production cycles and regular cash flow over the high one-time income of grapes. Pest problems, specifically, are a critical constraint limiting grape participation and expansion. Reviving grape cultivation requires policy interventions that focus on enhancing pest control (e.g., Integrated Pest Management), strengthening extension services, and improving the access to quality inputs to address the key production challenges identified.

Keywords: Benefit-Cost Ratio, Extension Services, Farming Experience, Pest Severity

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Welfare Aspects of Household Dogs in Beligala Grama Niladhari Division, Kegalle: A case study

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Animal welfare encompasses both physical and psychological well-being, including freedom from hunger, discomfort, pain, fear, and the ability to express natural behaviors. Although concern for companion animal welfare is increasing, few studies address household dogs in rural Sri Lankan communities. This study investigated the welfare of household dogs in Beligala Grama Niladhari division, Kegalle district. The objectives were to identify owner and dog demographic characteristics and evaluate feeding, housing, health, and behavioral aspects. Information were gathered from 74 households with 89 dogs, using a structured questionnaires and direct observations. Only 11% of dogs reached their senior age, suggesting a reduced lifespan due to various diseases. Among surveyed dogs, despite with 98% water access, 54% of the dogs were underweight, which might link to once-daily feeding and feeding rice-scrap diets lacking in balance nutrients, resulting in malnutrition and compromised immunity. Freedom from discomfort was well met, with 93% housed in dry, draught-free shelters with 81% living in clean resting areas posing only mild risk. Freedom from pain, injury and diseases was severely compromised. Of the surveyed population, 31% were ill and 27% suffered from scabies. Vaccination coverage was 84%, however, 81% of owners relied on self-treatment with incomplete vaccination and rare veterinary care. Freedom to express normal behaviour was restricted with low levels of exercise (57%), complete tethering (35%) and lack of toys (49%), limiting social and physical activity. Freedom from fear and distress was compromised with 85% dogs showing stranger-directed aggression or anxiety, indicating stress despite owner-perceived confidence. Owner education levels with feeding frequency, timing of veterinary care, exercise duration and supplement feeding showed had no significant correlations. The study highlights the need for interventions to improve welfare of rural household dogs through extension programs.

Keywords: Dog welfare, Household dogs, Housing conditions, Health, Rural Sri Lanka

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Women Labor Force Participation Decisions and Care Work Responsibilities within Households: The Case of Godawa Village, Matara District

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Although Sri Lankan women possess high educational achievements, their labor force participation rate is comparatively lower than men, largely due to the unequal distribution of care responsibilities on women. Employing a mixed methods approach, including quantitative surveys and qualitative interviews, the purpose of this paper is to explore how the heavy care burden affects women's employment decisions and its overall impact on the household economy, specifically in the semi-urban area of Godawa Village, Matara District, Sri Lanka. The findings reveal that household duties act as a major barrier to women's labor force participation than caregiving. Despite this, women contribute to the household economy directly through formal work and self-employment, and indirectly through unpaid care that allows other household members to earn. The study also shows that women make job market decisions based on the flexibility of self-employment and family work, which helps them balance income generation and care duties simultaneously. Although women play an important role in household economies, much of their work is undervalued and unrecognized. The study concludes that heavy unpaid care burdens remain a key barrier to women's economic empowerment in Sri Lanka. To address these challenges, policies should focus on redistributing unpaid care responsibilities, enhancing access to flexible employment, and promoting shared household roles to strengthen women's labor force participation and the overall economic well-being of households.

Keywords: Women's labor force participation, Care work responsibilities, Household economy

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Women's Labour Force Participation and Income-Generating Activities in the Thiraimadu Coastal Fishing Community, Sri Lanka

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Women's participation in the labour force is critical for household welfare and community livelihoods, particularly in coastal regions where economic opportunities are closely tied to natural resources and seasonal activities. However, the influence of socio-economic factors, household responsibilities, and individual capacities on women's economic engagement in coastal fishing communities remained under-explored. This study aims to determine the rate of women's labour force participation and the nature of income-generating activities in the Thiraimadu fishing community, and examine how human capital factors and household factors influence women's labour force participation. The study is guided by the Bargaining model of the household and supported by human capital theory, which together explain how socio-economic conditions, personal skills, and decision-making power shape women's economic involvement. A mixed-methods approach was used, combining data from 90 structured questionnaires and semi-structured interviews to capture both quantitative and qualitative insights. The findings show that the overall labour force participation rate was 51.1%. Engagement was concentrated in informal and self-employed activities, while clam/mussel gleaners comprised only a small proportion. Binary logistic regression identified female headship, health status, and vocational training as significant determinants of participation. The findings reveal that women's participation patterns were shaped by socio-economic background and personal capacities but constrained by household responsibilities and care duties. The study concludes that enhancing women's vocational skills, health, and decision-making power within households can improve labour force participation and strengthen livelihood security. Providing support mechanisms such as training linked to income opportunities and flexible arrangements could further enable women to increase engagement in income-generating activities. These findings provide insights into the interplay of human capital, household factors and household roles in shaping women's economic participation in coastal fishing communities.

Keywords: Female labour force participation, Income-generating activities, Thiraimadu fishing community

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Yield and Income Effects of Climate-Smart Agriculture Adoption among Smallholder Farmers in Flood-Prone Areas: A Case Study from Batticaloa District, Sri Lanka

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Agricultural productivity and livelihood of smallholder farmers have been adversely affected by climate change and frequent floods in the Batticaloa district in Sri Lanka. Although numerous studies have emphasized the importance of Climate-Smart Agriculture (CSA) for enhancing productivity and resilience, there is limited empirical evidence from flood-prone regions of Sri Lanka, especially for Other Field Crops (OFC) such as groundnut. Therefore, this study aims to identify the determinants and impacts of adopting CSA practices among smallholder groundnut farmers in flood-prone areas. Primary data were collected from 100 farmers, 50 adopters and 50 non-adopters, using a pre-tested questionnaire. Descriptive statistics, Probit and Poisson regression models, and Ordinary Least Squares (OLS) estimation were used for data analysis. According to the Poisson model, gender, education, farming experience, farmer group membership, and labour use significantly influenced the number of CSA practices adopted ($p <0.05$), while the Probit model indicated that age, gender, education, total farm extent, and labour use have a significant impact on the decision to adopt CSA practices ($p < 0.05$). Two separate OLS regression showed that compared to non-adopters, CSA adoption enhanced groundnut yield by 13% and farm income by 37%. These findings suggest that CSA adoption is an effective and integrated strategy for increasing farm productivity, income and climate resilience among smallholder farmers in flood-prone regions of Sri Lanka. The results provide strong empirical support for scaling up CSA interventions to strengthen livelihood resilience and promote sustainable agricultural development in the Sri Lanka.

Keywords: Livelihood resilience, Probit, Poisson, Adoption determinants, Sustainable development

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Spike-Topped Apple Snail (Pomacea diffusa) Meal as an Alternative to Fishmeal in Guppy (Poecilia reticulata) Diets
Coauthors: Weththasinghe P., Jayawardana B.C, Withanage P.M.

1st Runner-up **H.D.S. Himasha**
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Coauthors: Weerasinghe L.K., Thilakarathne O. and Dissanayaka, H.D.M.A.C.

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Coauthors: Weththasinghe P., Jayawardana B.C., Samarakoon R., Jayawardene L.P.I.N.P., Singh S. and Konthasinghe K.H.M.N.B.

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Coauthors: Mendis B.E.P., Nissanka S.P., Jayawardena K.A.M.K.,Samarasinghe M.D. and De Silva E.I.C.

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Co-authors: Vidanarachchi J.K., Bandaranayake P.C.G. Rajapaksha G.D.S.P., Adassooriya N.M., Chamara H.K.B.S., Priyashantha H., and Jayarathna S.

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Winner **K.K.M.M. Dhamsara**
Spike-Topped Apple Snail (Pomacea diffusa) Meal as an Alternative to Fishmeal in Guppy (Poecilia reticulata) Diets
Coauthors: Weththasinghe P., Jayawardana B.C, Withanage P.M.

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Coauthors: Mendis B.E.P., Nissanka S.P., Jayawardena K.A.M.K., Samarasinghe M.D. and De Silva E.I.C.

1st Runner-up **K. K. M. M. Damsara**

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Coauthors: Weththasinghe P., Jayawardana B.C, Withanage P.M.

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Coauthors: Somaratne G.M., Wimalasiri K.M.S., Didulanga A.G.K.C., Bandara A., and Shiwantha H.T.L

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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
Co-authors: Somaratne G.M., Senevirathna H.P.R.I. and Konara K.M.S.L.

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Co-authors: Somarathne G.M., Rathnayake A.J.R.P., Dharmarathne N.S., Prasanna W.C. and Samarasekara M.A.

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Winner **R. D. I. S. Jayathissa**
Development and Characterization of Active Bioplastic Film From Carrageenan, Chitosan, and Modified Starch: A Sustainable Alternative for Petroleum-Based Plastics Packaging
Co-authors: Vidanarachchi J.K., Bandaranayake P.C.G. Rajapaksha G.D.S.P., Adassooriya N.M., Chamara H.K.B.S., Priyashantha H., and Jayarathna S.

1st Runner-up **R. D. D. R. C. Jayarathna**
Quantifying the Carbon Footprint of Intensive Dairy Farming in Upcountry Sri Lanka: A Data-Driven Approach
Co-authors: Vidanarachchi J.K., Silva G.L.L.P., Nissanka S.P. and Kodithuwakku S.P.

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Co-authors: Perera M.D.A.M., Athauda A.R.S.A., Rusarani T.M.R., Kumarawansha M.G.D.M., Suriyagoda B.M.L.D.B, Beneragama C.K., Damunupola J.W., Kim J.G. and Kumarihami H.M.P.C

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Co-authors: Somaratne G.M., Wimalasiri K.M.S., Didulanga A.G.K.C., Bandara A., and Shiwantha H.T.L

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Co-authors: Rajapakse R.P.N.P.

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Co-authors: Somaratne G.M., Wimalasiri K.M.S., Didulanga A.G.K.C., Bandara A., and Shiwantha H.T.L.

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2nd Runner-up **J. A. N. P. Jayampathi**
Computational Analysis of Breynia androgyna Constituents for Druggability against Influenza A Virus Neuraminidase
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