35th PGIA ANNUAL CONGRESS

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HANTHANA ESSENCE

PGIA CONGRESS IN BRIEF

Gearing Agricultural Research Towards Economic Development

University of Peradeniya
Sri Lanka

Postgraduate Institute of Agriculture (PGIA) , University of Peradeniya, Sri Lanka

35th PGIA ANNUAL CONGRESS

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Message from the Director

It is with great pleasure I send this message as the Director of Postgraduate Institute of Agriculture (PGIA) on the occasion of the Institute publishing, for the third consecutive year, the Hantana Essence, a journal that is designed for disseminating information of research findings of the Institute to the general public. Since its establishment in 1976, the PGIA has been actively taking the responsibility of human resource development as the national leader of postgraduate education in Agriculture in Sri Lanka.

The Institute has so far produced over 5000 graduates in almost all disciplines in Agriculture. Presently, following the Guidelines of Sri Lanka Qualification Framework (SLQF), the PGIA offers 30 one year Masters programs (SLQF level 9), 30 two year MSc programs with one year research (SLQF level 10), MPhil programs with two year research (SLQF level 11), two MBA programs (SLQF levels 9 & 10) and, PhD and DBA programs of three year research (SLQF level 12) with about 1700 students actively engaged in course work and research. Though most of these advanced studies are being published in subject specific scientific journals, the important scientific breakthroughs, innovations and inventions of those are not accessible to the general public in palatable and understandable manner. As development of agricultural sector depends on swift adaptation of the new technologies, dissemination of the valuable findings to the agribusiness sector and general public has been the vital link missing in agricultural research at least at the level of postgraduate studies. Publication of Hantana Essence journal is one of the most effective steps taken by the PGIA to bridge this crucial gap between researchers and agriculture practitioners.

It is wonderful to see that the Hantana Essence journal is produced in a very vivid and attractive manner for the third consecutive year with text that is comprehensible and joyful to the reader. All scripts were written by the postgraduate students and it has been a quite different and rewarding experience for them, far from their training in research manuscript writing. I would like to congratulate all involved including the Congress Coordinator, Chief Editor and the Editorial Board, and the students for accomplishing such a wonderful task of bringing the journal to the present attractive state.

I sincerely hope the new volume of Hantana Essence, coming out at the dawn of the 35th Annual Congress of PGIA, would be the much awaited colourful bridge for the knowledge gap between the postgraduate research community of the PGIA of year 2023 and the general public.

Prof. C.M.B. Dematawewa
Director/PGIA

Message from the Coordinator

On behalf of the organizing committee, it is my great pleasure to provide this message to the Hantana Essence magazine arising from the Annual Congress of the Postgraduate Institute of Agriculture (PGIA), University of Peradeniya, Sri Lanka. Over the years, the Annual Congress has gradually evolved into being the main glamorous event of the PGIA and has become a main event of the annual calendar of the institute.

The Annual Congress of PGIA provides a platform for the postgraduate students to blend with the local and international professionals and students, and showcase their talents, improve knowledge, extend their networks, and jointly explore current and future research directions. The Research Briefs submitted by the students based on their postgraduate research target to communicate complicated research findings in a simple language to the general public. These Research Briefs are evaluated by an eminent panel of judges and the best write-ups are selected. All Research Briefs submitted by the students are published in the Hantana Essence magazine. Agriculture has gained unprecedented prominence than ever today due to the necessity of assuring food security of the nation amidst many challenges presented by climate change, socio-political instabilities, fuel crisis, pandemics and natural disasters, etc. around the world. As the pioneer in postgraduate education in Agriculture and research in Sri Lanka, the PGIA, University of Peradeniya, is very much concerned about the connection between tertiary agricultural education and the needs of the country. Thus, the Hantana Essence magazine is an important publication that communicate the research conducted by the postgraduate students with the general public.
I wish to thank the editor, members of the judging panel, authors, the graphic designer and the members of the Congress Office of PGIA for their invaluable contributions for publishing the magazine. I wish to congratulate the activity coordinator, Prof. Chandrika Perera, and I wish all the success to the authors who contributed to the Hanthana Essence Magazine this year.

Prof. Warshi S. Dandeniya
Congress Coordinator, 2023

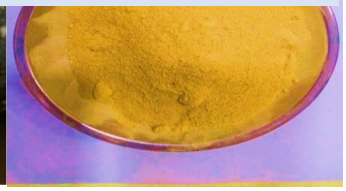
01. EFFECTS OF WHEAT FLOUR REPLACEMENT WITH PUMPKIN POWDER ON PHYSICAL AND SENSORY PROPERTIES OF BISCUITS

K.A.T.K. JAYALATH

Biscuits and Pumpkin

Biscuits is a type of confectionery popular among all age groups and it can be changed into good food with necessary nutrients added easily. Pumpkin is a nutritious vegetable that has huge post-harvest losses in Sri Lanka. Fresh pumpkins are very susceptible to attack by pathogenic microbes during the period between harvesting to consumption due to high moisture level and other improper post-harvest practices. Value-added products are currently gaining popularity among consumers and can be a great solution for reducing food waste. Producing bakery products without wheat flour can be a big challenge as it contains gluten protein that gives proper texture for the products. Therefore, wheat flour may be replaced only partially by other flour types to meet the expected properties.

ANK-Ruhunu



Pumpkin Powder

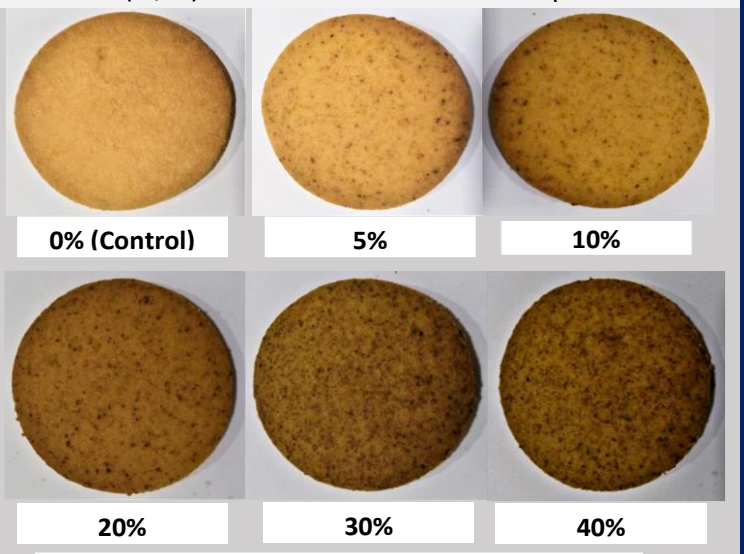
This study reveals the proximate composition of pumpkin powder and effects of pumpkin powder on physical and sensory properties of biscuits.

Protein	5.2
Fat	1.2
Ash	3.4
Crude fiber	4
Carbohydrate	77.7

This table shows the basic composition of pumpkin powder according to the proximate analysis.

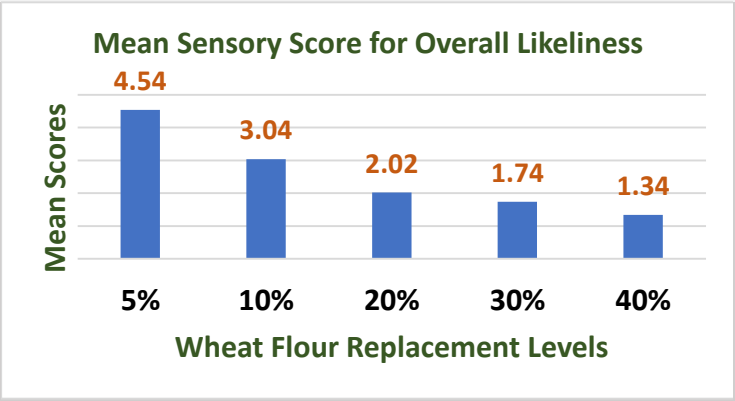
Effects of Pumpkin Powder on Biscuit Properties

pumpkin powder at different levels as 0, 5, 10, 20, 30, and 40% (w/w) in the standard biscuit recipe.



Biscuits made from Pumpkin Powder

When the percentage of pumpkin powder gradually increased, the biscuits thickness and moisture were decreased and hardness was increased compared to the 0% level. However, the biscuit diameter was not changed compared with the 0% level. When surface lightness was reduced gradually, Redness and Yellowness were increased accordingly. Except the color, other physical properties were not changed significantly between control (0%) and 5% level.



Color, Flavor, texture, and overall acceptability were evaluated as sensory qualities. According to the sensory evaluation, 5 % (w/w) was the most preferred replacement level and it has the potential to be used in biscuit applications.

02. ANTIOXIDANT, ANTI-DAIBETIC, AND ANTI-INFLAMMATORY ACTIVITIES OF *Passiflora foeitda* GROWN IN SRI LANKA

P.G.N. Hansani Dharmasiri

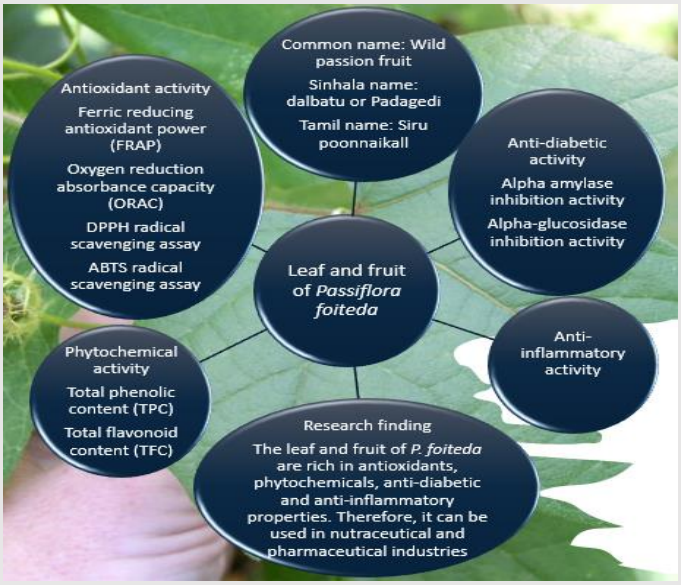
In Sri Lanka, numerous underutilized fruit crops play a crucial yet often overlooked role in addressing the persistent challenges of hunger, malnutrition, and poverty. While the island nation is renowned for its tropical fruits like mangoes and bananas, several lesser-known and underutilized fruit species possess remarkable nutritional value and resilience to local climates. These wild fruits have the potential to diversify diets, enhance nutrition, and provide livelihood opportunities for rural communities. However, limited research, market access, and awareness have hindered their full potential. To combat hunger, malnutrition, and poverty effectively, it is essential to recognize and promote the untapped potential of these underutilized fruit crops, not only in Sri Lanka but around the world.

Wild passion fruit (*Passiflora foetida*)

Passiflora foetida, commonly known as the "wild passion fruit", "stinking passionflower," or “Dalbatu” is a hidden gem in the green landscapes of Sri Lanka. This remarkable vine not only adds a vibrant touch to the country with its beautiful, exotic flowers but also offers a plenty of benefits. Its small, round fruits are a source of delightful surprises, with a tangy, and tropical flavor. What's even more fascinating is the plant's remarkable resilience, thriving in Sri Lanka's diverse climates and elevations. Despite being lesser-known, wild passion fruit's potential for nutrition and economic growth is undeniable. It is time for this charming vine to take its well-deserved place in the spotlight, offering a unique and fruitful future for Sri Lanka.

Nutritional status of leaves and fruits of wild passion fruit (*Passiflora foetida*)

In the heart of Sri Lanka's nature’s bounty, *Passiflora foetida*, or the "wild passion fruit," stands as a hidden treasure. These little wonders are packed with a powerful punch of health benefits. Our research findings showed that, fruits and leaves of wild passion fruits are rich in antioxidants, phytochemicals like phenols and flavonoids, and valuable alkaloids. Further more, wild passion fruit offers potential anti-diabetic and anti-inflammatory properties, making them a true gift from nature.



Passiflora foetida	Leaves	Fruits
Total phenolic content (TPC) (mg GAE/g of extract)	21.46±1.56	18.99±1.16
Total flavonoid content (TFC) (mg QE/g of extract)	4.25±0.23	2.50±0.21
Total alkaloid content (TAC) (mg/g of extract)	4.37±6.50	3.50±0.15
FRAP (mg TE/g of extract)	11.85±1.45	6.47±0.31
ORAC (mg TE/g of extract)	46.23±3.58	29.90±1.43
DPPH radical scavenging activity (IC_{50} mg/ g of extract)	10.91±1.29	11.13±1.83
$ABTS^{+}$ radical scavenging activity (mg TE/g of extract)	105.80±18.6	127.84±14.9

It's time for Sri Lankan society to embrace these remarkable fruits, not just for their exotic appeal but for their potential to enhance our health and vitality.

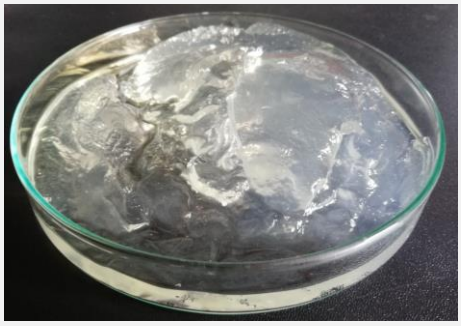
03. THE HIDDEN WONDER OF THE SEAWEED COLOUR

G.D.S.P. Rajapaksha

A seaweed, commonly known as Doty, scientifically identified as *Kappaphycus alvarezii* is available in three distinct colours - red, brown, and green. It was introduced to Sri Lankan water over a decade ago and is commonly found in brown, and green colours.

Brown morphotype Green morphotype

Doty seaweed is a well-known source of food thickening agent, carrageenan. It is used in Medicines, Cosmetics and Foods such as Ice cream, Yoghurt, Jelly, Sausages, etc. Therefore, this is an economically very important seaweed species.



Extracted carrageenan gel

Industry believes that both brown and green morphotypes of Doty possess similar properties and are currently cultivated as mixed cultivations. Previous studies have shown that most of the growth rates and carrageenan yields are similar. We also found the same in Sri Lankan water.

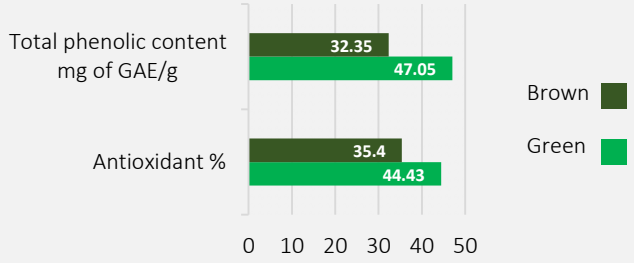
However, we further assessed those two types using biochemical properties and antimicrobial activity against pathogenic microbes and found clear differences between green and brown morphotypes.

We found that the green colour morphotype possesses comparatively higher natural antimicrobial defense properties against selected human pathogenic bacterial strains more than the brown type. It has never been reported before.

Underwater photos of two morphotypes

Our analysis also showed very good antioxidant properties in the green type compared to the brown colour morphotype. These antioxidants can help to protect cells from damages caused by free radicals, contributing to overall health and well-being.

Interestingly, the green colour morphotype is rich in total phenolic compounds. Phenolic compounds are known to have anti-inflammatory and anti-cancer properties and are potent compounds known for their health-boosting benefits.



Our exciting data shows how fundamental in-depth research could contribute to the decision-making in commercial cultivation. We suggest commercial growers to cultivate those two ecotypes separately and plan for product development accordingly.

04. NAVIGATING THE PUZZLE OF CHRONIC KIDNEY DISEASE OF UNKNOWN AETIOLOGY (CKDu): A GIS STUDY IN BADULUPURA VILLAGE

Sampath Marasinghe

Let us dive into a crucial health issue that has affected parts of the Dry Zone of Sri Lanka – Chronic Kidney Disease of unknown aetiology (CKDu). This enigmatic condition has baffled experts for years. By employing spatial data analysis through Geographic Information System (GIS), we can examine how the disease is spread in the Badulupura area, allowing us to identify patterns and potential factors contributing to its prevalence. This is an approach to using digital technology to solve a health puzzle.

CKDu: A Global Health Crisis

CKDu, a perplexing global health crisis, affects the kidneys, potentially leading to kidney damage and failure. First documented in the 1990s in El Salvador and Sri Lanka, it has been particularly prevalent in Sri Lanka's dry zone. Recent studies have connected this condition to environmental factors, geography, and hydrology, prompting a quest to understand its origins.

The Puzzle of Badulupura Village

Situated in the Badulla District of Sri Lanka, Badulupura village is a CKDu hotspot, affecting approximately 30% of its population. What sets Badulupura apart is its heavy reliance on groundwater, with 98% of the population sourcing their drinking water from shallow regolith aquifers.

Uncovering Spatial Patterns

To comprehend the disease's distribution, our research team analyzed geographical data of households and wells in Badulupura village. Using advanced tools, we uncovered interesting patterns:

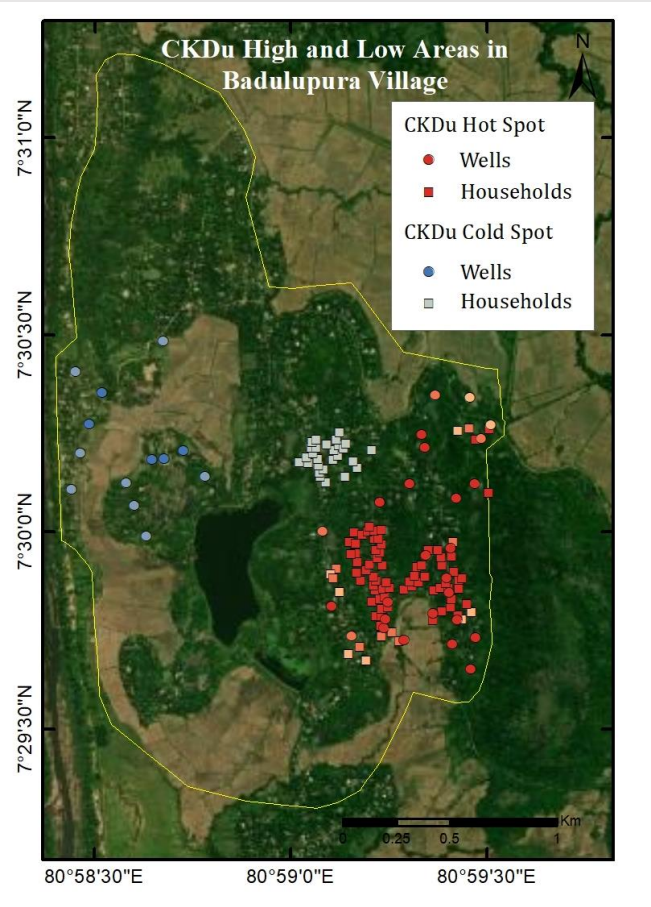
1. Association with wells used for drinking purposes: CKDu-affected households and wells used by these households exhibited a clustered - pattern, indicating drinking water as a probable cause for the disease's prevalence.

2. Elevation Matters: The analysis revealed that CKDu hotspots were concentrated in high-elevation areas, with low-elevation regions displaying cold spots, signifying the significance of elevation in the disease's distribution.

3. Topography's Role: The study delved into slope and proximity to watershed boundaries. Surprisingly, the findings showed a strong link between elevation and CKDu but no significant association with slope or distance to watershed boundaries.

Why Our Results Matter..?

Understanding these spatial patterns is not just a scientific curiosity; it holds the key for further investigations to resolve this mystery.



05. UREA INTERCALATED BIOCHAR HAS THE POTENTIAL TO REDUCE AMMONIA VOLATILIZATION FROM LOWLAND RICE SOILS

M.K.N.W. Jayarathna

Ammonia Volatilization (AV) in rice growing soils is one of the major pathways for lower use efficiency of added N fertilizers. Direct broadcasting of urea facilitates AV by increasing the availability of NH_4^+ ions which converts into NH_3 gas. Therefore, we conducted a closed chamber experiment to quantify the effects of locally produced urea intercalated biochar on ammonia volatilization losses in lowland rice growing soils.

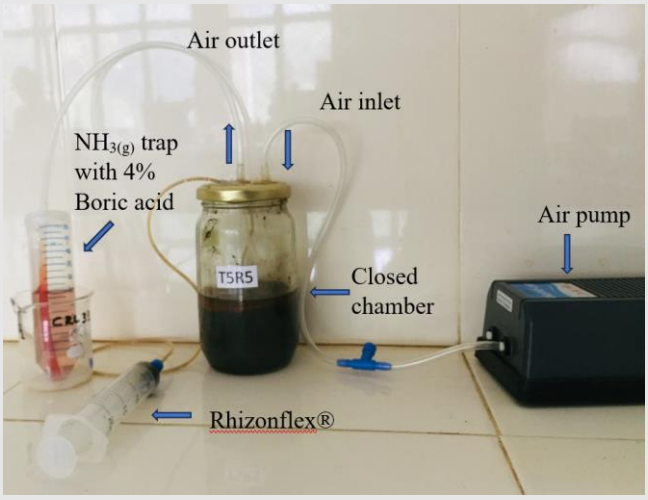
Urea Intercalated Biochar

Urea intercalated biochar (BC_U) is a novel technology that could improve N use efficiency by reducing the releasing rate of N from the fertilizer pellet.

(Urea intercalated biochar pellets)

Measuring Ammonia Volatilization

conducted to measure ammonia gas.



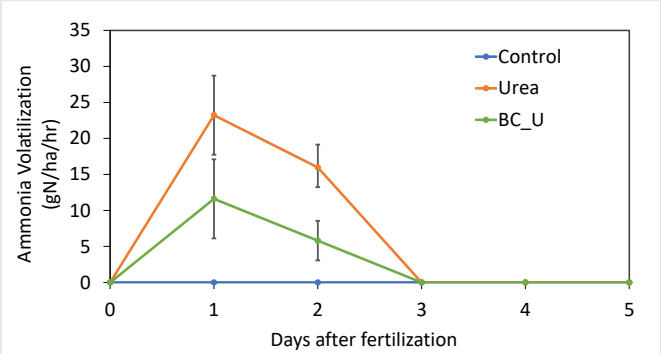
(Experimental set up for trapping volatilized ammonia)

Treatments were consisted with No-N (control), urea (U) and BC_U pellets added at a rate of 23 mg N kg soil^{-1} and measured AV for two weeks.

Two sets of pots were maintained under saturated conditions (without flood water layer) and under flooded conditions (with 1 cm flood water layer).

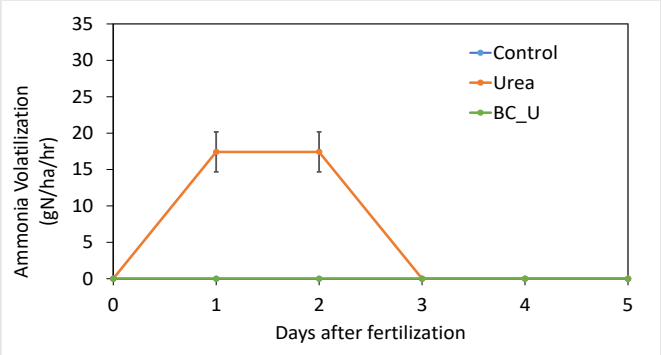
Findings of the Study

Under saturated conditions: AV was significantly higher in Urea added (2.72%) and BC_U added (1.21%) than in the Contral (0%).



(AV under saturated conditions)

Under flooded conditions: Only U had a significant AV (2.42%) and the emission of BC_U has suppressed.



(AV under flooded conditions)

Application of Urea triggers the AV by increasing the NH_4^+ availability and BC_U has further reduced it. But the overall AV is a cumulative effect of factors such as pH, depth of flood water, soil urease activity and pH buffer capacity.

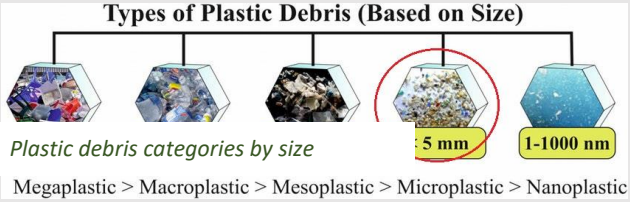
Conclusions

urea application, it could be further reduced by application of urea as BC_U pellets and/or maintaining a flood water layer for few days after urea application.

06. "Microplastic": Emerging Pollutant in the Composting

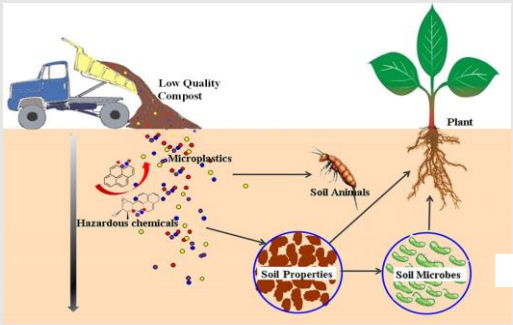
Yasara Pradeep Ranasingha

Recently, plastic has become a major contaminant, polluting the natural ecosystem. Particularly the impact caused by microplastic is spreading to all ecosystems. Microplastic is "any synthetic solid polymeric particle, size ranging from 1 µm to 5 mm, which is insoluble in water". Microplastics remain in the natural environment and affect its natural balance.



Plastic debris categories by size

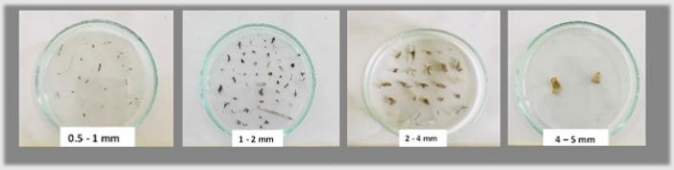
Another hazard of microplastics is that they can absorb various organic pollutants and toxic elements (heavy metals), affecting the distribution of these pollutants in the environment. As an emerging pollutant, microplastic should be extensively studied for its accumulation and dispersion in the environment. Microplastics pose more significant environmental risks to soil quality; plastic fragments can have various impacts, such as changes in soil functions, and influence the soil's physical, chemical, and biological properties.



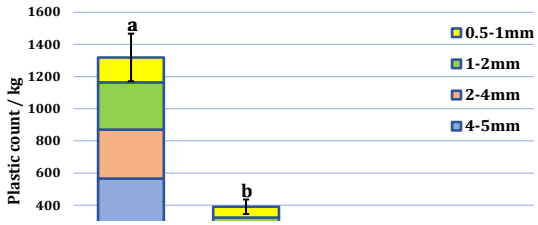
By identifying the mechanisms that microplastic enters to the agro-ecosystem, necessary steps can be taken to prevent microplastic contamination. Hence, this study was conducted to find out whether microplastic is added to the soil with the application of locally produced compost.

Samples were taken from commercial scale agricultural and municipal solid waste composting facilities to represent the whole country and were tested for the amount, mass, and characteristics of microplastic contained in compost.

The study revealed that microplastics are present in agricultural and municipal solid waste compost. Also, compost could function as a source of microplastics to agricultural lands. The amount of soft plastic content was higher than the hard plastics.



Different sized microplastic found in compost



Average microplastic count in different producer categories with their size and type variation (MSWC –Municipal solid waste compost, AWC – Agricultural waste compost, SF-Soft microplastic, HD-Hard microplastic)

Municipal solid waste compost contains more microplastic than agricultural waste compost mainly because the municipal solid waste used to produce compost is mixed with various plastic debris.

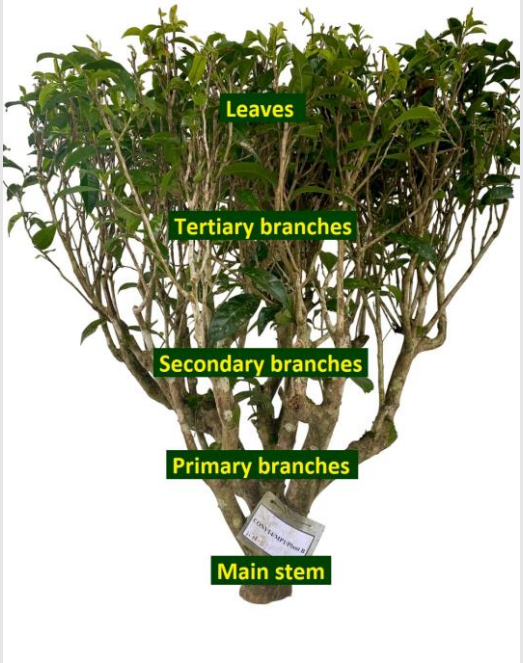
With the result of this study, it can be recommended that quality standards should be implemented to minimize the microplastic content in composts and should develop mitigation strategies to control microplastic contamination to safeguard the quality of agro-ecosystems. Thus, it is important to separate organic and inorganic waste at the source of waste generation to manufacture compost without microplastic contamination.

07. A RAPID METHOD TO ESTIMATE THE BIOMASS OF A TEA BUSH

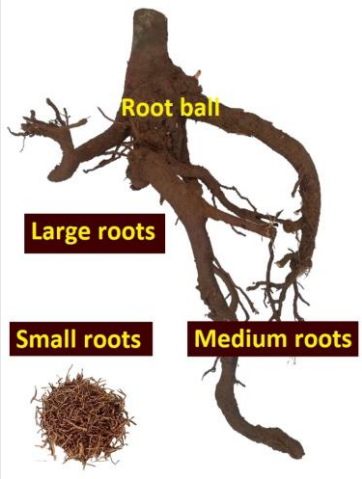
R. A. A. S. Rathnayaka

Tea

Tea is a popular beverage crop in the world and a cash crop bringing foreign exchange to Sri Lanka. This is a small tree trained as a bush. The above-ground section of a typical tea bush consists of leaves, tertiary branches, secondary branches, primary branches and the main stem.



The below-ground section of a tea bush consists of a root ball, large roots, medium roots and small roots.



What is the biomass of a tea bush?

The total dry weight of the above-ground section of a tea bush is defined as above-ground dry biomass. Similarly, the total dry wight of the below-ground section is defined as below-ground dry biomass. The total dry weight of both above- and below-ground sections is referred to as total biomass.

What is the importance of knowing the biomass of a tea bush?

Above-ground, below-ground and total biomass are basic information required to quantify a lot of other information such as growth, uptake of nutrients and the amount of stored carbon captured from the atmosphere.

Classical approach to quantifying the biomass of a tea bush and its drawbacks

Tea bushes are uprooted, separated into different parts, then oven-dried to a constant weight, and biomass determined. However, uprooting of tea plants is not always possible and acceptable.

Introduction to our research

We tried to predict the above-ground, below-ground and total biomass of a tea bush using easily measurable plant measurements and by developing mathematical relationships. Circumferences and length of main stem, number of primary branches, length and circumference of primary branches were considered to be easily measurable plant measurements.

Our research findings

Circumference of main stem is the best plant measurement to predict biomass. The developed mathematical models explain that above-ground and total biomass increase rapidly when the main stem circumference of a tea bush increases. Below-ground biomass increases proportionally to the main stem circumference of a tea bush. The actual biomass values were comparable to the predicted biomass values by the developed mathematical relationships, confirming the accuracy of the developed mathematical relationships.

08. DOES THE ENVIRONMENT MATTER..? PERFORMANCE OF TOMATO VARIETIES UNDER CHANGING ENVIRONMENTAL CONDITIONS

I.N.S. Dewapriya

Tomato is a globally cultivated crop, rich in nutrient properties, which gives multiple health benefits. Tomatoes and tomato-based products are rich sources of vitamins, minerals, beneficial carotenoids such as lycopene and antioxidant properties.

As global temperatures rise, it is important to figure out how different crop varieties currently in use perform in changing environmental conditions.

We conducted a study in mid-country wet zone of Sri Lanka to explore how two tomato varieties available in the global market adapt to different environmental conditions provided by the locally developed IoT driven greenhouse conditions. Two Tomato varieties used were,

1. Variety **'Sylviana'** (A greenhouse hybrid)
2. Variety **'Belsano'** (A dual purpose variety) recommended for greenhouse and open field

EXPERIMENTAL SETUP

Three greenhouse conditions were compared

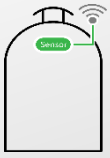
1)Intensive control greenhouse with a double-layered polythene roof and automated exhaust fan and misting system. This system was fully assembled in Sri Lanka with a very low cost.

2)Semi-intensive greenhouse with a single hard plastic roof and a timer-controlled misting system imported from Israel

3)Less-intensive greenhouse with a single polythene roof (with top vent), with natural ventilation

Intensive control greenhouse

Semi intensive greenhouse



Less intensive greenhouse

All three systems consist of IoT driven automated monitoring system with a user-friendly navigation system through a mobile phone.

	Average Temperature(°C)	Average Relative Humidity
Intensive control greenhouse	28 - 33	45 – 90% with fluctuations
Semi intensive greenhouse	29 -35	
Less intensive greenhouse	28 -36	

FINDINGS

- Variety 'Sylviana' performed well in all three greenhouses.
- The best fruits in terms of weight and size came from the intensive-controlled greenhouse.
- Variety 'Belsano' gave more fruits in the intensive-controlled greenhouse, while 'Sylviana' was consistent in fruit production.
- The most antioxidant activity was found in the intensive-controlled greenhouse and the highest total phenolic content was found in the semi intensive greenhouse for 'Sylviana'.

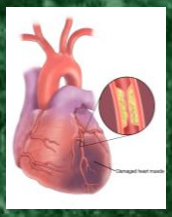
This study emphasizes the role of microenvironmental factors in influencing not only growth and reproductive traits but also the nutritional quality of tomatoes. These findings are exciting for developing new tomato varieties and guiding farmers on which tomatoes to grow in different climates.

- The Hybrid variety performed well under different greenhouse environments than the dual-purpose variety.
- Variety 'Sylviana' seems to be a better choice for different environmental conditions.
- The top-quality tomatoes are harvested from the intensive-controlled greenhouse.

09. COLOMBO CITY ADOLESCENTS' DIET WAVES HANDS FOR A BURDEN OF DISEASES

A.D.D.C. Athauda

Adolescent obesity

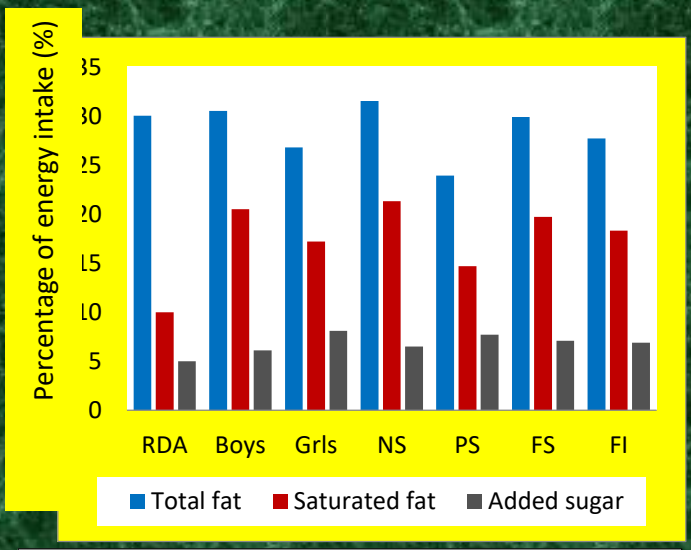


The highest incidence of adolescent obesity in Sri Lanka was reported among 11-13 years old children in Colombo city over decades. Even though previous studies found their energy intake was inadequate, their diet has not been analyzed for non-communicable disease risk factors such as fat and sugar.

Study

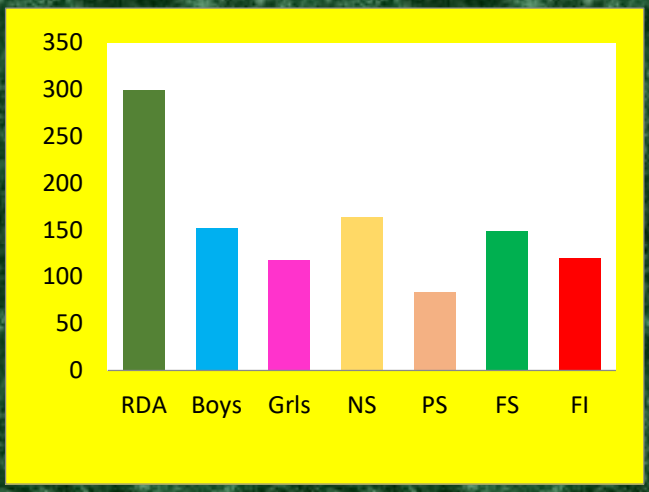
A team of researchers carried out a study in Colombo city to find out the total fat, saturated fat, added sugar and cholesterol intake among this age group. A count of 634 children in this age group from 12 government schools were participated for the study. Each child was given a diet diary and they recorded all food and beverages consumed in two weekdays and one weekend day. The diet intake was analyzed using FoodBase 2000 software. In addition, children were classified into two groups as food secure and food insecure using a 18 item household food security/ hunger questionnaire.

Unhealthy fat and added sugar intake



NS – National School ; PS – Provincial School
FS – Food Secure ; FI – Food Insecure;
RDA – Recommended Dietary Allowance

Cholesterol intake



Saturated fat and added sugar intake was above the upper limit while cholesterol intake was well below the upper limit, regardless the gender, food security status and school type. Boys and national school children had an intake of total fat above the upper limit, while girls, provincial schools, food secure and food insecure children had total fat below the recommendation. Boys consumed a diet high in total fat, saturated fat and cholesterol than girls, while girls had more added sugar compared to boys. Food Secure children's diet was high in total fat than food insecure children's diet. Provincial school children had less total fat and saturated fat than national school children.

Therefore, 11–13 years old adolescents' diet in Colombo city is high in saturated fat and added sugar. Further, boys and national school children consume diet high in total fat. However, their cholesterol intake is within the accepted level.

As per the findings of the study, the children aged 11-13 years in Colombo city are at a greater risk of developing non-communicable chronic diseases such as diabetes, heart diseases and cancers due to high intake of unhealthy fat and added sugar. Therefore, government should take an immediate action to correct their diets.

10. IMPACT OF ECONOMIC CRISIS ON FOOD SECURITY OF RURAL HOUSEHOLDS IN VAVUNIYA NORTH DIVISION IN VAVUNIYA DISTRICT

N. Sathyaruban

Introduction

The current social, political, and economic crisis in Sri Lanka is the worst, country has ever experienced. The people of Sri Lanka have been dealing with serious problems since March 2022, and these issues are still present today to varying degrees and intensities.

Objectives

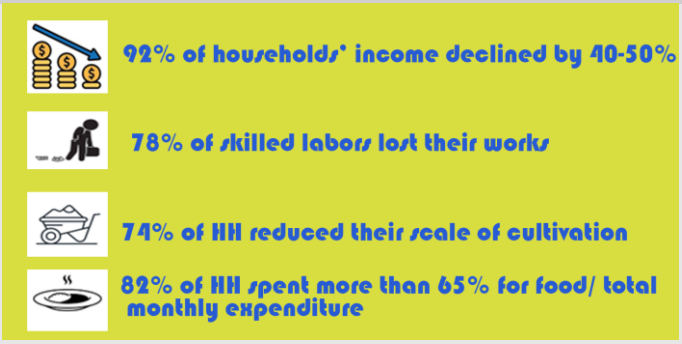
To analyze the impact of economic crisis on food security of rural households in Vavuniya North and to find out the factors influencing the food security of rural households during the economic crisis.

What is Food Security…?

When everyone, everywhere, has physical and financial access to enough, safe, nourishing food that satisfies their dietary needs and food choices for an active and healthy life, that is when food security is achieved.

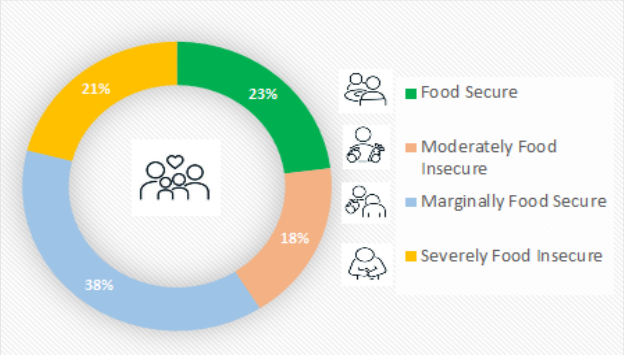
Impact of Economic Crisis on Rural Household.

Rural households are often quite resilient to shocks and can manage their food needs. However, the financial crisis resulted in the loss of jobs for both skilled and unskilled workers working in the construction and agricultural sectors. As a result, family income fell down from the previous year. Farmers in agriculture experienced difficulties in obtaining high-quality seeds, fertilizer, and other inputs.



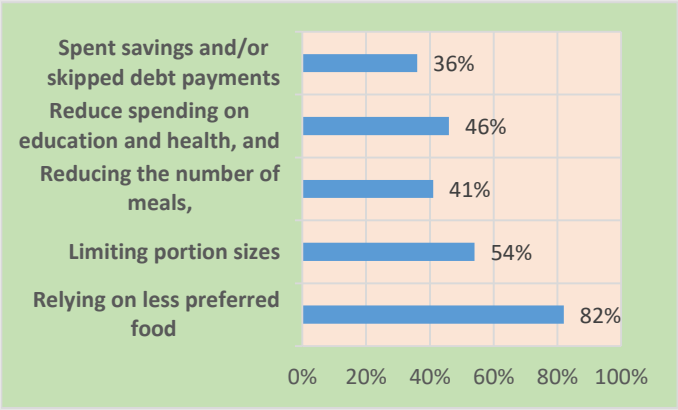
Impact on Household Food Security

Results show, 39% of families experience severe or moderate food insecurity while 21% of households only have slightly enough food.



Households are compelled to rely on both food based and livelihood coping mechanisms to put food on the table in order to lessen the effects of the food shortages or safety issues.

Food Based Coping Strategies



Livelihood based coping strategies.

The majority of households have turned to livelihood-based coping strategies to deal with the shock brought on by the epidemic. This is a serious danger as families may not be able to protect themselves from the negative impacts of an economic crisis and are becoming more susceptible to shocks and crises in the future.

Key Recommendations

- The government must guarantee that farmers can obtain timely inputs for their cultivation.
- Promote to establish community-based seed bank and encourage farmers to utilize organic fertilizer, pesticides, etc.
- Prioritize the development of a comprehensive national agriculture strategy based on the local requirements.

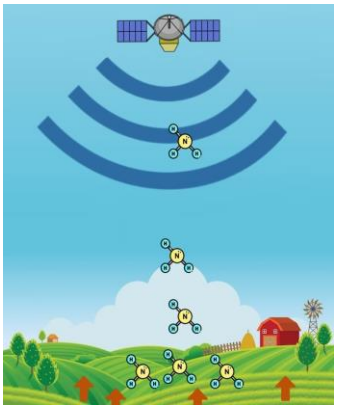
11. SPATIOTEMPORAL TRENDS IN ATMOSPHERIC AMMONIA LEVELS IN DIFFERENT CLIMATIC ZONES OF SRI LANKA

B.M.B. Weerakoon

As a reactive Nitrogen (Nr) compound, ammonia (NH_3) has a significant contribution to human health, environment, and climate directly and indirectly.

Agricultural practices (synthetic fertilizer usage, livestock management) are the main anthropogenic source of NH_3 in the atmosphere.

Two main approaches used to measure atmospheric NH_3 levels are the bottom-up approach and the top-down approach. The bottom-up approach is based on surface measurements and the top-down analysis is based on the satellite observations.



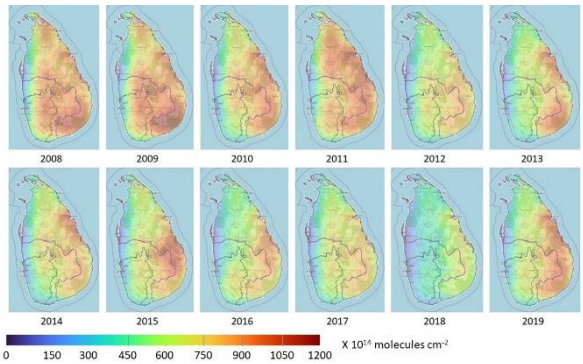
This study uses the NH_3 data obtained from IASI satellite over 12 years (2008–2019) to derive decadal trends of NH_3 levels in Sri Lanka.

There is a decreasing linear trend in annual average NH_3 concentration for the studied period. The change in NH_3 concentration from 2008 to 2019 was –15.33%. A positive correlation was identified between the NH_3 concentration and fertilizer usage.

All three climatic zones (wet, dry and intermediate) had shown the same decreasing pattern as the country.

The NH_3 concentration in wet zone was significantly lower than dry and intermediate zones. However, dry zone and intermediate zone did not shown a significant difference in NH_3 concentration.

A significant difference in NH_3 concentration was



identified between the two cropping seasons. Interestingly, *Yala* season recorded higher NH_3 concentration than the *Maha* season. Wet deposition is the main process that NH_3 deposit away from the source, while dry deposition is more common close to the source. However, the emitted NH_3 is deposited to the ground by wet deposition due to the high rain fall in *Maha* season.

In Sri Lanka, agricultural lands adjoining the forest habitats are common, while forest ecosystems enclose rich biodiversity. The negative impacts of NH_3 on biodiversity are globally identified. Close monitoring of these habitats will explore the real adverse impact of NH_3.

Therefore, this study highlights the importance of NH_3 ground measurements and studies to understand the impacts of high atmospheric NH_3 levels on biodiversity, especially using bio-indicators such as lichens. Also, it reveals the necessity of a national mechanism for sustainable nitrogen management.

12. RESEARCH REVEALS POTENTIAL BENEFITS OF INSOLUBLE FIBER FROM CEYLON CINNAMON SPENT BARK WASTE ON NILE TILAPIA FINGERLINGS

A sustainable dietary solution for fish

Cinnamon spent bark waste refers to the residual bark left over after the essential oil has been extracted from cinnamon bark. This waste can still have some potential uses and applications. It was found that this waste is loaded with "insoluble dietary fiber". In fact, it's almost 79% pure fiber, with very little of the soluble kind (only 0.84%).

Tilapia, a fast-growing and hardy fish species, has gained significant popularity among Sri Lankan farmers and is a key contributor to meet the nation's growing demand for affordable protein sources. These researchers wanted to see if this cinnamon bark waste fiber could be a useful ingredient in the diets of Tilapia fingerlings. Four different diets were prepared, each with a varying amount of the extracted dietary fiber as 0% (the control group), 0.5%, 1%, and 1.5%. Then, these diets were fed to the fish for 12 weeks. The study evaluated several parameters commonly used to assess fish health and growth.

A healthy surprise

The results of the growth parameters showed no significant differences among the experimental groups, suggesting that the inclusion of insoluble dietary fiber from cinnamon spent bark waste did not negatively affect the growth of fish. However, the study did uncover some notable findings. At the 1.5% fiber supplementation level, there was a significant increase in the total aerobic bacteria population in feces, indicating a potential impact on gut microbial populations. Additionally, at the 0.5% and 1% fiber supplementation levels, coliform counts in feces were significantly lower than in the control group. The research also noted an increase in red blood cell count at the 0.5% fiber supplementation level and an increase in white blood cell count in the blood following insoluble dietary fiber supplementation.

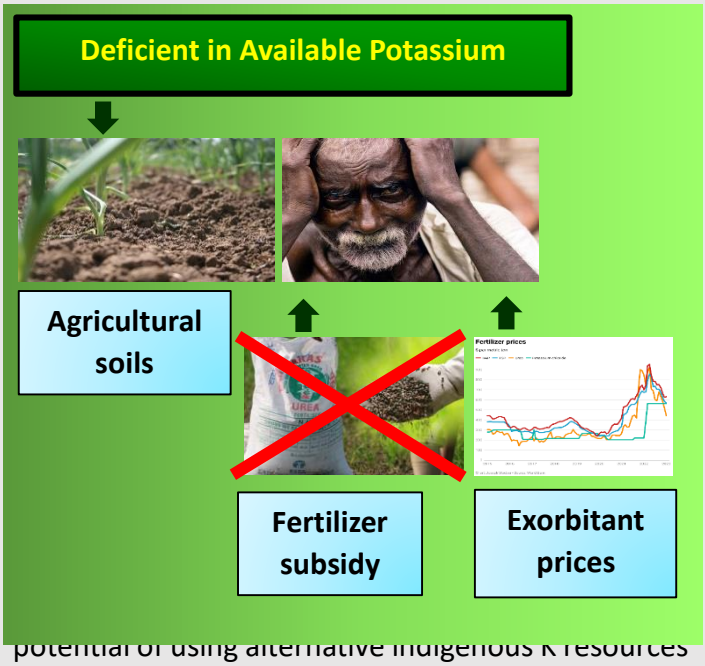
While these findings are intriguing, the study's authors emphasize that further investigations into gut microbiology and hematology are necessary to fully understand the implications of using insoluble dietary fiber from cinnamon spent bark waste as a functional ingredient in fish diets.

13. CAN THE K AVAILABILITY OF LOCAL K-BEARING MINERALS BE IMPROVED BY CO-PYROLYZING WITH POULTRY LITTER?

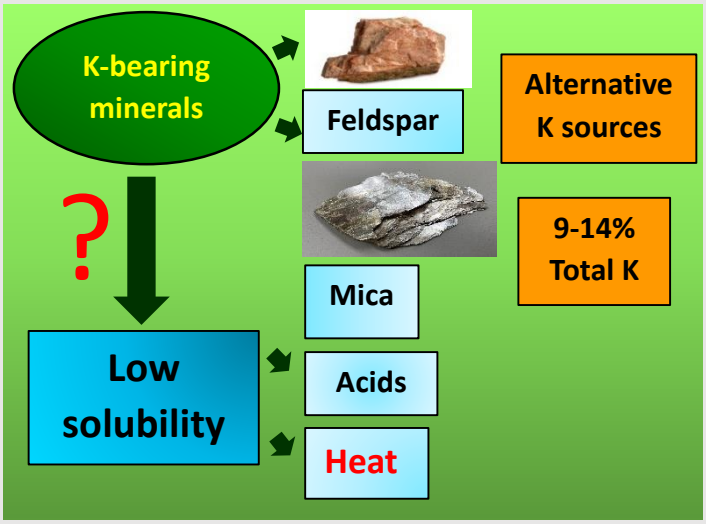
P.O. Sarachchandra

Present situation of K use in agricultural soils

Potassic fertilizers are essential for obtaining maximum yields in most crop production systems. Sri Lankan farmers are currently grappling with an economic crisis which had severely affected their cultivation due to exorbitant prices of K fertilizers in the market and removal of fertilizer subsidy.



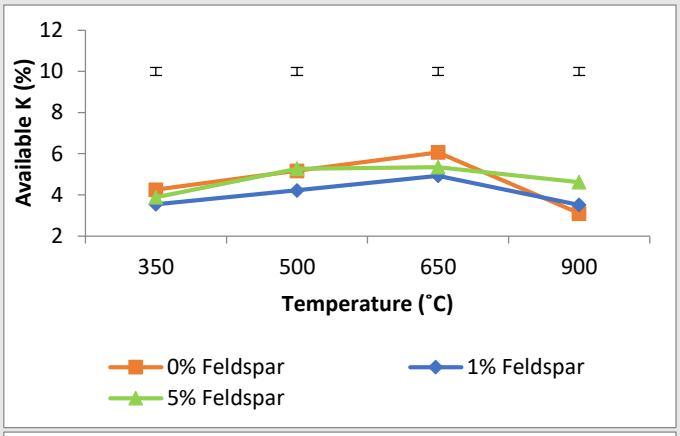
potential of using alternative indigenous K resources for the production of K fertilizers. Sri Lanka has feldspar and mica reserves that have not been exploited to be used as K fertilizers due to low solubility. Heating them could increase the plant available K contents.

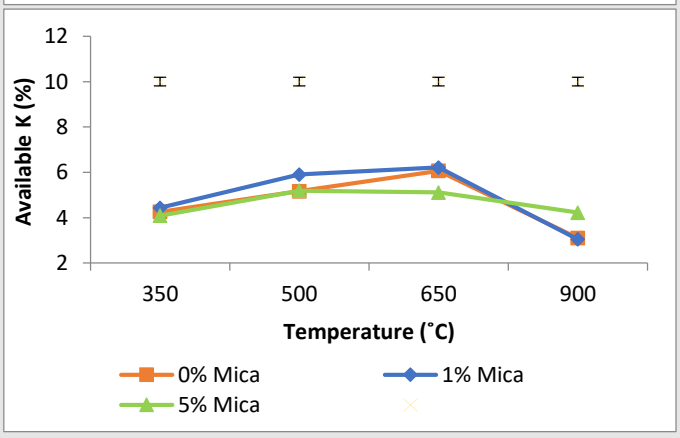


What was the research focus?

We evaluated total and available K contents in feldspar and mica after subjecting them to direct heating or heating with poultry litter (co-pyrolyzing) at different temperatures and at different ratios.

The present study confirms that temperature has a strong impact on total and available K contents in K-bearing minerals, poultry litter biochar (PLB) and co-pyrolyzed PLBs. Increasing pyrolysis temperature up to 650 °C will increase the total K contents in K-bearing minerals and available K contents in co-pyrolyzed PLBs. Heating raw materials at 900 °C decreases total and available K contents to levels that are lower than their unheated counterparts.





Effect of temperature on available K contents in the co-pyrolyzed biochar

Even though co-pyrolyzing locally available Feldspar and Mica minerals with poultry litter up to 500 °C can increase total K contents, heating cannot be considered as a potential technology to increase their effectiveness as a sources of K fertilizer because heating did not increase the available K contents.

14. A Cue to Enhance Resilience: How Root Morphology Foretells Rice Responses to Salinity

K.I.S. Thamali

Rice serves as a staple for billions of people around the globe. This humble grain has fed generations, but its journey from field to plate is not without challenges. Soil salinity; the presence of excess salts in the soil is one of the biggest problems in rice fields. Soil salinity has become a major challenge in the recent era, as harmful impacts of climate change have accelerated its spread. Rice breeders have reached a time point where it has become crucial to find ways to breed the rice crop to be more resilient against soil salinity.

Seedling stage salinity stress

Rice is sensitive to soil salinity at all growth stages. However, the impact on the seedling stage is much higher, where salt injury symptoms such as leaf withering, tip burning, reduced shoot and root growth or complete death of the seedlings are much more prominent.

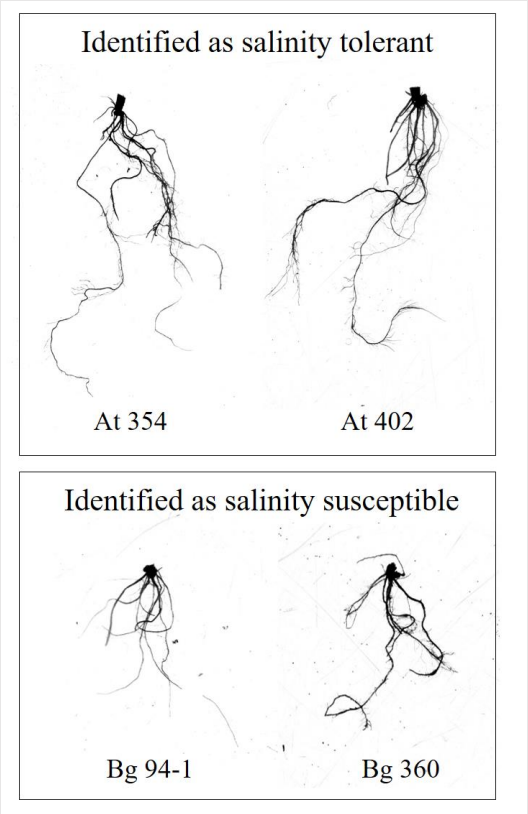


Figure 1: Scanned root images of rice accessions identified as tolerant and susceptible to salinity stress

The degree of these symptoms differ from rice variety to variety depending on their ability to withstand salinity stress. Certain varieties which are identified as "salt-tolerant" can better stand up in saline environments by minimizing the impact of salinity using various avoidance and tolerance mechanisms, while "salt- susceptible" varieties fail to do so.

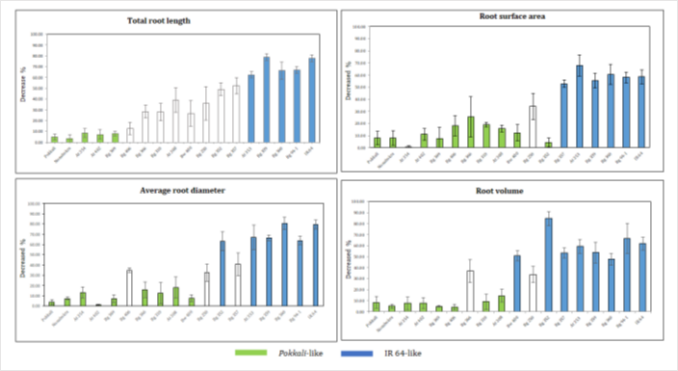


Figure 2: Variation of macro root morphology parameters among the selected Sri Lankan rice accessions under salinity stress at seedling stage (*Pokkali*: a known saline tolerant accession and IR64: a known saline susceptible accession)

Roots helps to screen "Survivors" from "Victims"

Macro root morphology parameters change in response to salinity stress and impact the survival of rice plants under salinity stress. Longer, thicker roots with higher volume will ensure better survival of rice seedlings in saline soils.

Considering the root morphology parameters, total root length, average root diameter, root volume, and root surface area and salinity survival response, Sri Lankan rice varieties At 354, Bg 369 and At 402 were identified as salinity tolerant varieties while Bg 94-1, Bg 359, Bg 360 and At 353 as salinity susceptible varieties during seedling stage.

Therefore, though hidden beneath the soil, root morphology can be used to predict salinity responses and hence is an important plant characteristic to focus when enhancing the resilience of rice to fight against soil salinity.

15. PRESENT SCENARIO OF ORGANIC AGRICULTURE IN JAFFNA PENINSULA, SRI LANKA

Anusiya Muralitharan

The agricultural industry is a prominent sector in the Jaffna Peninsula. Particularly, individuals residing in the Jaffna Peninsula are part of the traditional agricultural society. The predominant economic and social foundation of their society is mostly centered around agriculture. The practice of organic farming in Sri Lanka has a long-standing history, dating back to pre-historic times. Agricultural professionals bear a significant burden in nourishing the expanding global population, given the escalating food requirements resulting from population growth, all while confronting the constraint of limited arable land. The utilization of synthetic chemicals has become prevalent due to the growing need to produce larger quantities of food within a restricted geographical space. In contemporary times, the global deterioration of ecosystems has garnered significant interest from agricultural experts, who are increasingly focusing on the development and implementation of sustainable agricultural systems. The practice of organic farming has been widely recognized as a commendable approach within the realm of sustainable agriculture.

Data were collected from a sample consisting of 100 farmers who have experience in application of organic inputs using stratified random sampling technique. The findings of the study conducted between March and June 2023 revealed that more than 70% of farmers operate on average farm land for cultivation between 1-4 ha. Specifically, a minority of farmers in Jaffna 12%, used solely organic inputs for crop cultivation as a means of practicing chemical-free farming (Figure 1). The majority, constituting 88% of the farmers, adopted an integrated strategy by utilizing both organic and synthetic inputs in their cultivation methods.

Causes for moving towards farming using organic inputs: The governmental restrictions on the importation of synthetic chemicals (78%), subsequent rise in their prices (82%) and realization of the bad impacts of modern farming (69%) were the major reasons for undergoing a transition towards an environmentally conscious and sustainable agricultural framework. This shift is being facilitated by the promotion and support of organic farming practices throughout the nation.

Reasons for cultivating the crop in an integrated manner instead of chemical free manner: While, there is a growing inclination among farmers towards organic farming, several variables pose challenges to its widespread adoption. These concerns include the complexities associated with pest and disease management, as well as the superior performance of crops when exposed to conventional fertilizers.

Farmers' attitudes towards organic farming: The farmers focus on human and environmental health aspects. The beneficial influence of farmers' attitudes towards organic production had a role in the growth of organic farming in the Jaffna district.

Challenges faced by farmers in organic farming: The transitioning to a fully organic cultivation system poses significant challenges. Production issues (87%), less social recognition over chemical farming (81%) and less institutional support (73%) were the major constraints faced by them.

Implementing a progressive reduction of synthetic inputs, accompanied by a long-term strategy to ensure sufficient availability of organic fertilizers and other organic-based alternatives, is a more cautious approach compared to an abrupt and all-encompassing transition to exclusively organic agricultural practices. Hence, the implementation of certification procedures, provision of institutional backing, and dissemination of knowledge regarding organic farming with an emphasis on its economic viability could potentially foster a favorable inclination towards transitioning from conventional agricultural practices.

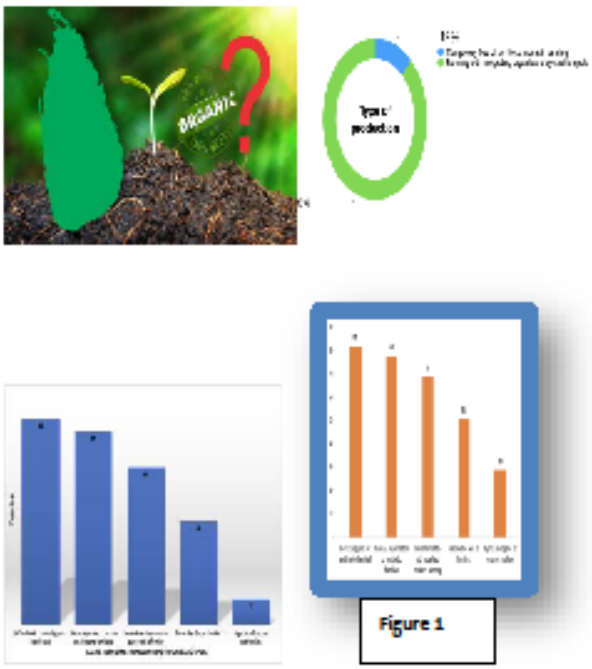


Figure 1

16. VEGAN SENSATION OF JACKFRUIT SEED STARCH; COMPARISON OF *WARAKA* AND *WALA* JACKFRUIT SEED FLOUR STARCH

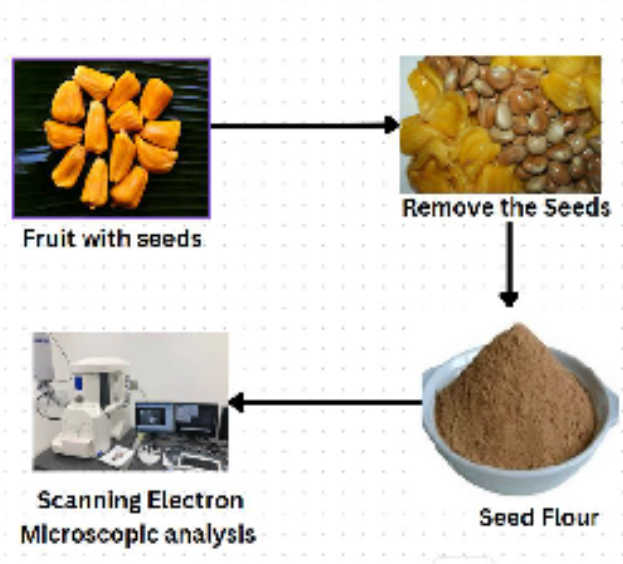
Y.T. Senaweera

Pursuing an alternative starch source for the food industry application to enhance the nutritional quality of the food products is of paramount importance. This study places significant emphasis on the transformation of underutilized jackfruit seeds into starch-rich flour and the detailed study of the microstructural exploration of different jackfruit seed types.

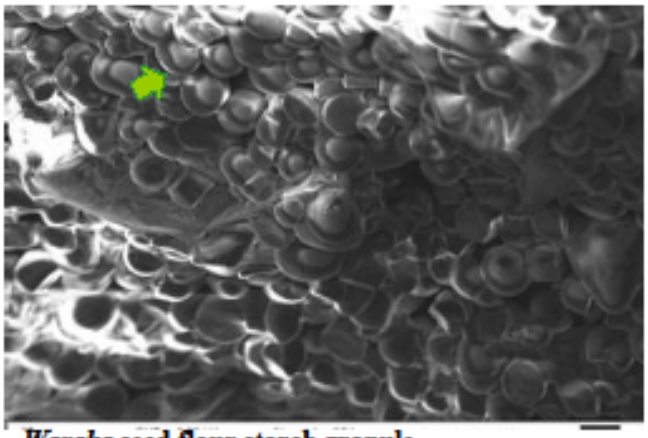
How to identify *wala* and *waraka* cultivars..?

The *'wala'* cultivars of jackfruit are known for their soft texture. The flakes of these varieties are tender, easily breakable, and have a rubbery and spongy consistency. They are often used in dishes where a softer texture is desired, such as curries, stews, and desserts. '*Wala*' jackfruit flakes can range in color from creamy white to light orange, and they are highly nutritious. On the other hand, the '*Waraka*' cultivars of jackfruit are known for their firm texture. The flakes of these varieties are crunchy and have a crisp consistency. They are often used in dishes where a firmer texture is desired, such as salads, stir-fries, and sandwiches. '*Waraka*' jackfruit flakes can range in color from pale yellow to deep orange, and they are also highly nutritious.

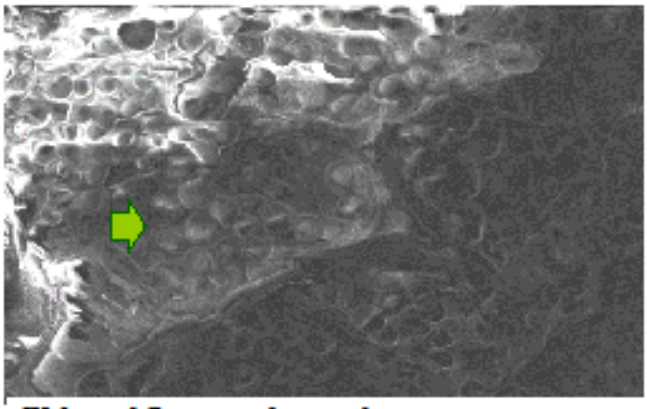
Are there any differences in *wala* and *waraka* seeds..?



SEM (Scanning Electron Microscopic) observation of the two jackfruit seed samples showed different structure morphology. **Bell-shaped** starch granule structure has been seen in *waraka* seed flour while a **spherical** starch granule structure has been observed in *wala* seed flour.



***Waraka* seed flour starch granule**



***Wala* seed flour starch granule**

The starch granule size of the *waraka* seed flour was 8.00±0.78µm and *wala* seed flour starch granule size was 8.93±0.13µm. *Wala* flour showed comparatively higher macro and micro mineral element content such as 47% oxygen, 41% carbon, 8% nitrogen, 2% sodium and 0.7% potassium. *Waraka* seed flour contained 53% of oxygen, 41% of carbon, and 0.5% of potassium.

Where we're headed next?

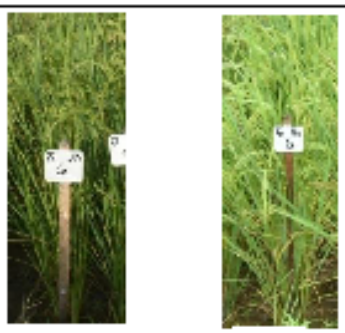
17. Response of Sri Lankan rice germplasm for added nitrogen

R.M.N.H. Senanayake

Breeding rice varieties with improved nitrogen use efficiency (NUE) is an important criterion for lowering production costs and reducing environmental pollution. For that, it is essential to understand the diversity of NUE in the available rice varieties and it will assist the effort to increase NUE in rice varieties through classical plant breeding methods and advanced biotechnological approaches. Therefore, this research was conducted to identify the level of NUE in selected germplasms, and their level of expression of morphological features associated with varieties having higher NUE.

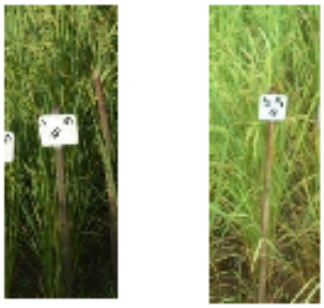
This study was conducted at the Rice Research and Development Institute, Batalagoda (RRDI, Bg), Sri Lanka. Forty locally cultivated rice varieties were assessed under zero nitrogen (N) and 103.5 kg/ha N application. The experiment was carried out during the *Yala* 2022 and *Maha* 2022/23 seasons under irrigated field conditions.

There is a high diversity in NUE and related traits among rice varieties in the germplasm. Among the tested varieties, At 362 (21.27±1.88 in *Yala* 2022 and 23.48±1.36 in *Maha* 2022/23) and Bg 366 (20.98±1.96 in *Yala* 2022 and 20.74±1.32 in *Maha* 2022/23) gave the highest NUE. They gave the highest yield with added N. Sudu heenati (-3.86 ±1.66 t ha^{-1} in *Yala* 2022 and 1.20±1.86 t ha^{-1} in *Maha* 2022/23) and H4 (-2.85±0.76 in *Yala* 2022 and 2.35±2.54 in *Maha* 2022/23) had the lowest NUE while giving a high yield under zero N among the tested varieties.



a b

Equal performances of the Sudu heenati with added N (a) and zero N (b)



c d

Equal performances of the H4 with added N (c) and zero N (d)

Suwandal gave the lowest yield (2.30±0.03 t ha^{-1} in *Yala* 2022 and 1.82±0.46 t ha^{-1} in *Maha* 2022/23) under zero N as well as with the added N (2.27±0.20 t ha^{-1} in *Yala* 2022 and 2.55± 0.12 t ha^{-1} in *Maha* 2022/23). Identified rice varieties performing high yield under zero N condition can be used for low N input rice cultivation while using At 362 and Bg 366 for high yield potential areas with required amount of N fertilizer to obtain high productivity in rice cultivation. As such, rice germplasm shows high diversity with respect to NUE, and further analysis of the genetic background of these rice genotypes is essential to clarify their behavioral patterns and future breeding aspects.

18. USE OF ICT PLATFORMS FOR SUCCESSFUL TECHNOLOGY TRANSFER IN SUGAR INDUSTRY

A.P. Karunathilaka

Introduction

The sugarcane industry in Sri Lanka plays a vital role in the country's agricultural landscape, providing a significant portion (14%) of the annual sugar requirement. However, a pressing issue affecting this industry is the declining rate of sugar recovery over time, primarily attributed to inadequate crop management practices by both growers and industries. To address this challenge, it is imperative to promote the adoption of proper crop management practices and ensure timely knowledge transfer to the industry and stakeholders.

The Benefit of this

This research aimed to determine the information needs of the extension staff attached to the sugar industry in Monaragala district and to identify a low-cost ICT platform for information sharing.

This continuous research project is being implemented in Monaragala district focusing on Sevanagala unit and Pelwatta unit of Lanka Sugar Company (Pvt) Limited and Ethimale Plantation (Private) Limited. The study community comprises all agricultural extension staff working in the plantation divisions of these three sugar industries in the Monaragala district, totaling 195 extension staff members.

A semi-structured questionnaire was used to elicit the most essential information and to identify a suitable ICT platform for information exchange.

Today, mobile phone and ICT usage is very high, so we can use these technologies to ensure adoption through effective technology dissemination.

What we found so far is,

The highest priorities were given to information related to cane quality improvement (93%), weed management (82%), water management (82%), soil nutrient management (75%), mechanization technologies (75%), and ratoon management (71%).

Furthermore, all the respondents chose **WhatsApp** as the most convenient ICT platform to information sharing among the extension staff of three sugar companies.

Outcome of the research

Thus, on the consent of the majority, three separate WhatsApp groups have been formed for the three institutions. This will ensure enhancement of good management practices of the institutions and farming community by providing and re-using essential information to extension staff.

Let's use new technologies for efficient extension services while saving time, effort and money.

19. INTERACTION EFFECTS OF PHOSPHORUS AND ZINC ON RICE GROWN IN THE DRY ZONE SOILS OF SRI LANKA

Kaveena Sammani Mayadunne

Zinc (Zn) deficiency is considered as one of the major causes for low rice productivity in the Dry Zone. Farmers commonly apply Phosphorus (P) fertilizers to rice cultivation and their continuous application has increased P availability in paddy growing soils. High P levels could reduce plant available Zn contents in flooded soils. The relationship between soil P level and Zn availability to plants are highly complex. It can be synergistic or antagonistic interaction. Insoluble P-Zn complexes may occur, if excess P binds a large quantity of Zn. But better combination may result in higher productivity.

Experimental Design

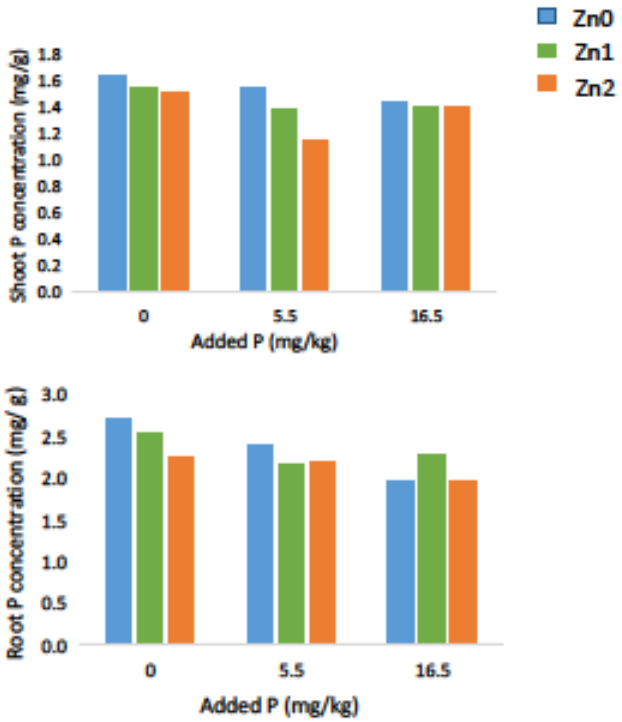
A pot experiment was carried out in a paddy field in Anuradhapura where rice (*var* Bg 358) was grown with all possible combinations of three P levels (P0, P5.5, P16.5 - equivalent to 0, 5.5 and 16.5 mg kg^{-1}) and Zn levels (Zn0, Zn1, Zn2 - equivalent to 0, 1 and 2 mg kg^{-1}). P and Zn contents in shoot and root were measured in addition to growth parameters.

Plant available P content in soil exceeding 19.9 mg kg^{-1} and Zn exceeding 1.02 mg kg^{-1} were considered as sufficient for crop production.

Findings

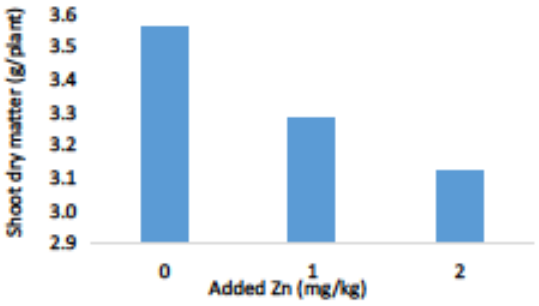
The highest P concentrations in both shoot and roots were observed in the control treatment (without P and Zn application).

In soils that received Zn and P concentrations, both the above and below ground dry matter content decreased. This could be due to the gene encoding P exporter from root to shoot, which is significantly restricted under high Zn supply reducing translocation of P from root to shoot due to formation of insoluble P-Zn complexes within the roots.



P concentration in shoot and root of the rice plant as affected by P and Zn application

Shoot dry matter production decreased with Zn application. The experimental soil remained Zn deficient even with the application of 2.4 mg kg^{-1} of Zn (not shown) probably due to precipitation of Zinc-phosphate in this high P soil.



Shoot dry matter production of the rice plant as affected by Zn application

Inadequate nutrition transfer from roots to shoots may result in a decline in growth of the rice plant. Further studies under field conditions are needed to identify best P and Zn fertilizer management

20. *IN VITRO* ROOTING; THE MOST DECISIVE STEP IN THE RAPID MULTIPLICATION OF WALLA PATTA

Sarujaa Selvaskanthan

Sri Lanka's perfume gold mine

Walla patta, scientifically known as *Gyrinops walla* Gaertn, is an endemic and endangered species of Sri Lanka. It is one of the tremendous sources of the world's most expensive agarwood and its demand keeps growing globally for its distinctive fragrance. The emergence of plant cell and tissue culture technology has opened up possibilities of rapid multiplication for the conservation and commercialization of walla patta to meet with its remarkable demand for making fragrance products.

Research focus

Difficulties in *in vitro* rooting have long remained a major challenge in the micropropagation of woody species. Therefore, establishing *in vitro* rooting protocol for this species is the most crucial step in its multiplication. A study was conducted for *in vitro* rooting of walla patta in activated charcoal containing a semi-solid culture system with varying concentrations of auxins and sugar and filter paper bridged liquid culture systems with different levels of auxins.

Success of *in vitro* rooting

In the first experiment, 50 % of the shoots rooted successfully at the end of 5th week in 2 g/L activated charcoal containing ½ MS semi-solid media, supplemented with 40 g/L sugar and 0.1 mg/L 1-Naphthaleneacetic acid (NAA).

Rooted shoots in the activated charcoal containing rooting media

However, the highest number of roots (6.0) was observed in the shoots, when they were transferred into ½ MS, 2 g/L charcoal added media with 40 g/L sucrose and 0.5 mg/L NAA.

Activated charcoal is mainly used in rooting media for establishing a darkened environment to stimulate soil conditions and promote physiological reactions during the inductive phase. Moreover, it adsorbs inhibitory substances from the culture media. However, non-selective adsorption, especially auxins might be the possible reason for less success of root induction in activated charcoal added media in this study.

Rooted shoots in the filter paper bridged liquid media

In the second experiment, when the shoots were supported with filter paper bridge in ½ MS liquid media, supplemented with 40 g/L sugar and 0.5 mg/L Indole-3-butyric acid (IBA), 66.7% of shoots initiated roots at 4th week after transferring with the highest mean number of roots/ shoot (3.0). The superiority of filter paper bridged liquid media is attributed to better aeration, high nutrient availability and constant access to the nutrients around the roots.

In conclusion;

By optimizing the culture media and its constituents, the *in vitro* rooting protocol for *G. walla* could be perfected using the outcomes of this study.

21. ECONOMIC VIABILITY OF SALAD CUCUMBER CULTIVATION UNDER PROTECTED HOUSES IN THE LOW COUNTRY WET ZONE OF SRI LANKA

Salad cucumber is one of the important protected house vegetable crops with considerable economic potential. Economic validation of salad cucumber cultivation is important for growers to enhance crop production. Therefore, we conducted the present study to evaluate the economic viability of growing salad cucumber in protected houses in the low country wet zone of Sri Lanka.

This research was conducted in a protected house in the low country wet zone from October 2021 to January 2022. Eighty-one uniform salad cucumber seedlings were planted in open top coir grow bags as one vine per bag after seven days of nursery period. Plants were placed on the floor of the protected house with the spacing of 2.0 x 2.5 ft. Albert fertilizer was applied daily while other fertilizers, foliar sprays and fungicides were applied once a week.

Table 1. Cost of salad cucumber cultivation

Cost Item		Value (Rs.)
Seedlings		7290.00
Grow bags		2531.25
Plant training thread roll		1000.00
Fertilizers	Albert solution	14580.00
	Crop Master	225.00
	Nitrabor	150.00
	30:10:10	570.00
	10:52:10	570.00
	$MgSO_4$	200.00
Fungicides	Captan	990.00
	Mancozeb	500.00
	Daconil	2035.00
	Cabriotop	2500.00
	Amistar	2400.00
Foliar sprays	K44	245.00
	Green care	640.00
	Calmax	600.00
Water		5200.00
Electricity		231.84
Labour		45000.00
Total cost (Without labour cost)		42458.09
Total cost per unit area (Without labour cost)		1128.43
Total cost (With labour cost)		87458.09
Total cost per unit area (With labour cost)		2324.42

Table 2. Returns from salad cucumber cultivation

Benefit Item	Quantity (kg)	Unit Price (Rs.)	Value (Rs.)
Harvest	512.3	260.00	133,198.00
Total return			133,198.00
Total return per unit area			3540.61

The benefit-cost ratio was used to evaluate the economic viability of salad cucumber cultivation. The cost of agricultural inputs, labour cost and utility cost were considered as the variable cost excluding the depreciation cost of fixed assets (Eg: protected house, irrigation system, water pump etc.). The returns obtained from the harvest were considered as the revenue. Then the revenue was divided by the total variable cost.

Benefit-Cost Ratio (Without labour cost) = Benefits / Costs
= 3540.61/ 1128.43
= **3.13**

Benefit - Cost Ratio (With labour cost) = Benefits / Costs
= 3540.61 / 2324.42
= **1.52**

According to the calculation, benefit-cost ratio for growing salad cucumber per unit area of land is 3.13 without labour cost and 1.52 with labour cost. Therefore, salad cucumber cultivation under protected house conditions in the low country wet zone of Sri Lanka is profitable for growers. In addition, they can obtain more remunerative income by employing by their own or using family labour for the cultivation.

22. Be informed: Allele profiles of three major *Xa* genes conveying disease resistance to bacterial blight in Sri Lankan rice

Iresha Kumari Edirisingha

Bacterial Blight (BB) is one of the major biotic stresses which affect the quality and quantity of rice cultivations around the world. In rice, the resistance of BB is governed by more than 40 *Xa* genes, of which *Xa4*, *Xa21* and *Xa38* are known to provide durable resistance to BB. Knowing which rice accessions/varieties/advance breeding lines carry the resistance alleles at these genes is important for rice breeders.

Based on the allele profiles of assessed 42 Sri Lankan rice accessions/ varieties using DNA markers, the newly improved rice varieties At 354, Bg 250, and Bg 251 carried resistance alleles at all three genes *Xa4*, *Xa21* and *Xa38* and showed a resistant disease response to BB (EMS of 2), making them good candidates to be used as donors in breeding programs. The rice accessions *Murungakayan* and *Kuru wee* reported susceptible alleles at all three *Xa* genes, however, given their disease responses which lean towards resistance, they could be carrying resistance alleles at other *Xa* genes or at genes yet to be discovered. In addition, among the remaining screened accessions/varieties the resistance alleles existed in a combinations of two or solo. With respect to *Xa4* gene, a novel allele (approximately 225 bp) was reported in *Mada el, Batapola el*, *Suwandel* and At 307. While this warrants for further studies on the new allele, it is indicative of the unique genetic diversity existing within the Sri Lankan rice germplasm.

Though the study does not reveal a strong association between the *Xa* allele profiles and the BB disease responses, it is a glimpse into the gene network mediating BB disease responses. Given the importance of these accessions/varieties for rice breeding programs in Sri Lanka, deducing the allele profiles for these three majors *Xa* genes affecting BB disease response is highly valued. To achieve durable BB disease resistance, it is recommended to introgress these resistance alleles at major *Xa* genes when releasing rice varieties.

Origin	Rice accession/variety	Observed allele			BB disease response
		Xa4	*Xa38*	*Xa21*	Estimated median score (EMS)
Traditional Accessions	*Yakada wee*	R	R	S	8
	Pokkali	R	S	S	4
	Mahakuruwee	R	S	R	2
	Dik wee	R	S	S	5
	Herath banda	R	S	S	4
	Kattaran	R	S	S	6
	Wanni dahanala	R	S	S	3
	Pachchaperumal	R	S	S	3
	Podi hatatha	R	S	S	3
	Gonabaru	R	S	S	4
	Murungakayan	S	S	S	3
	Kuru wee	S	S	S	1
	Batapola el	N	S	S	4
	Suwadel	N	S	R	7
	Mada el	N	S	S	3
Newly Improved Verities (NIV)	At 354	R	R	R	2
	Bg 250	R	R	R	3
	Bg 305	R	R	S	4
	Ld 365	R	R	S	7
	Bw 367	R	R	S	3
	Bw 14-509	R	R	S	3
	Bg 360	R	R	S	2
	Bg 366	R	R	S	3
	Bg 369	R	R	S	3
	Bg 352	R	R	S	1
	Bg 358	R	R	S	7
	At 362	R	R	S	3
	At 373	R	R	S	4
	Bg 251	R	H	R	2
	Ld 371	S	R	R	3
	Bg 357	R	S	S	3
	Bg 301	S	R	S	7
	Bg 300	S	R	S	3
	Bg 310	S	R	S	3
	At 308	S	R	S	3
	Ld 253	S	R	S	2
	Bw 267-3	S	R	S	3
	Bw 363	S	R	S	3
	Bw372	S	R	S	5
	Bw 361	S	R	S	3
	Bg 359	S	R	S	3
	At 307	N	R	S	1

Bacterial blight disease responses are shown in colour codes according to severity with resistant spectrum in green and susceptible spectrum in red.

23. Unlocking the Digital Revolution: Factors Shaping Internet Banking Adoption in Sri Lanka

N.P. Wickramasinghe

The advent of the internet has revolutionized various aspects of society such as culture, communication, employment, and the global economy. It gave birth to the concept of e-commerce and transformed the way we handle financial transactions. Online banking, in particular, has become increasingly popular due to its convenience and time-saving benefits compared to traditional in-person banking methods. Simply put, online banking involves accessing financial information and conducting financial tasks via the internet.

In a highly competitive banking and finance sector, the adoption and use of information technology have become essential. Internet banking has emerged as the safest and easiest way to perform banking activities. Services offered through online banking platforms include account access, fixed deposit inquiries, fund transfers, utility bill payments, online shopping transactions, credit card payments, invoice management, and checkbook requests.

However, the adoption and usage of internet banking are influenced by factors such as income and education level. Recognizing the importance of online banking, Sri Lankan banks have increasingly turned to internet banking as a means to reduce costs and increase profits.

While many commercial banks in Sri Lanka offer robust electronic banking services, a significant portion of customers remains hesitant to use internet banking. This research focuses on the factors that influence customers' adoption of internet banking, with a specific focus on ABC Bank in Sri Lanka.

Methodology: The research is grounded in the Technology Acceptance Model (TAM) with the addition of perceived risk to enhance the model's accuracy. The study included both users and non-users of internet banking, and data were collected through questionnaires distributed via social media and email using Google Forms. The Likert scale was employed for data collection, and multiple linear regression analysis was used to analyze the data.

Conclusion: The research found that for existing internet banking users, perceived usefulness had a significant positive effect on their intention to continue using internet banking. For non-users, both perceived usefulness and perceived risk significantly influenced their intention to use internet banking. These findings offer valuable insights for the banking sector to develop strategies to increase the adoption of internet banking.

The research also revealed that there is room for further investigation, as the factors considered in this study accounted for less than 20% of the variance in behavioral intention. Additional research is recommended to uncover more factors that influence the adoption of internet banking, paving the way for a more digital and convenient future in the banking industry.

24. HAS THE CONVERSION OF RUBBER PLANTATIONS INTO OIL PALM PLANTATIONS AFFECTED SOIL PHYSICAL PROPERTIES AND SOIL HYDROLOGY..?

K.M. Kularathna

Oil palm: Sri Lankan perspectives

Faced with diminishing production, labor shortages, and low prices in the rubber industry, a substantial number of Sri Lankan rubber growers have opted to move into oil palm, enticed by its superior productivity. Despite its economic appeal, concerns have been raised by environmentalists and the general public about the potential impacts of oil palm cultivation on soil degradation, surface and ground water resources, and biodiversity. The focus of this study was to explore how the transformation from rubber to oil palm plantations affects soil properties and hydrology. It was assumed that the change in net organic carbon levels resulting from this conversion could alter soil physical properties, subsequently influencing soil hydrology.

Figure 1: (a) 12-year-old oil palm and rubber site (b) oil palm fruit bunch.

What we did..

Soil properties such as organic carbon, texture, bulk density, aggregate stability, pore size distribution and thermal properties, and soil water content were measured in both plantations.

The topsoil in the oil palm plantation displayed a lower organic carbon content compared to rubber soils. However, except heat storage and clay content, all the other soil properties remained unchanged, suggesting that conversion from rubber to oil palm cultivation did not significantly impact on soil properties and consequently, the water dynamics.

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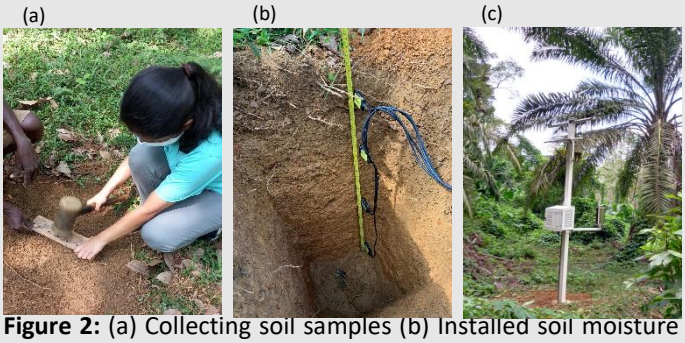
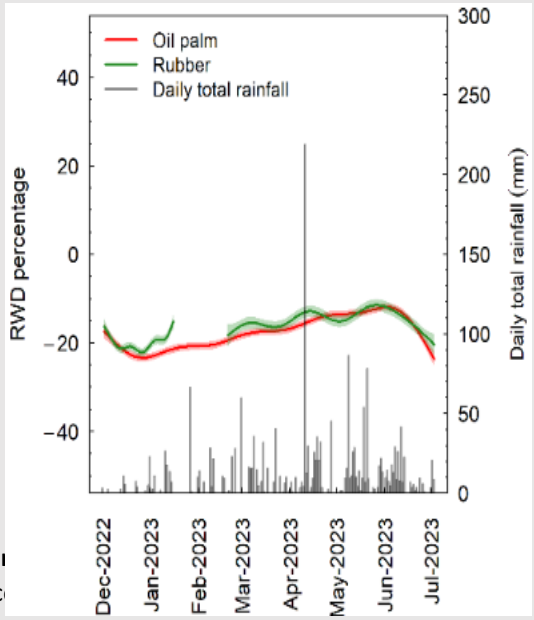


Figure 2: (a) Collecting soil samples (b) Installed soil moisture sensors (c) Installed mini weather station

Oil palm tree draws in more water from top soil layers, ensuring no adverse effect on groundwater level. In contrast, it was found that rubber tree take more water from deeper soil layer with its tap root system.



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Furthermore, as figure 3 illustrated, a rapid drying pattern was observed in the soil grown under oil palm during the dryer period compared to the rubber grown soil. However, it is crucial to conduct further studies across longer dry periods to correctly identify the suitability of oil palm in the dry zone areas.

25. UNVEILING THE POTENTIAL OF LOW LEVEL OF INPUTS ON FODDER SORGHUM CULTIVATION DURING DRIER SEASONS IN THE DRY ZONE OF SRI LANKA

Uthpala Lakdini Karunadhipathi

In a proactive response to the challenges posed by erratic rainfall and water scarcity, Sri Lankan dry zone farmers focus to cultivate more drought resilient crops. The cultivation of fodder sorghum during dry, fallow period is emerging as a promising strategy to revitalize paddy fields while ensuring continuous agricultural productivity throughout the year.

We focused on investigating the impact of reduced fertilizer application, increased plant density, and extended irrigation intervals on nutritional composition and nutrient yield of hybrid sorghum varieties grown in lowland fallow paddy fields in the dry zone during "*Yala*" and "*Third*" seasons. These agronomic practices were combined into four different agronomic management packages (AMPs) to study their combined effects (Table 1) on two hybrid sorghum varieties namely Dairygreen and SX-17.

Table 1: Agronomic management packages of the experiment

Agronomic management practice	Agronomic Management Package (AMP)			
	AMP1	AMP2	AMP3	AMP4
Fertilizer level	F1	F2	75% F1	75% F2
-Basal fertilizer (Urea:TSP:MOP)	100:90:65 kg/ha	150:62:37 kg/ha	75:68:49 kg/ha	113:47:28 kg/ha
-Top dressing fertilizer (Urea)	150 kg/ha	150 kg/ha	112.5 kg/ha	112.5 kg/ha
Plant spacing (cm)	45 x 30	45 x 15	45 x 30	45 x 15
Irrigation interval				
-up to 30 days	5	5	7	7
-after 30 days	8	8	10	10

Research Findings

The study found that the AMPs had varying impacts on nutrient and energy contents of Dairygreen and SX-17, emphasizing the significance of varietal selection in maximizing the nutritional output of fodder sorghum. While Dairygreen exhibited notably higher dry matter, organic matter, and detergent fiber contents, SX-17 demonstrated superior organic matter digestibility and metabolizable energy content.

The cultivation of SX-17 at 45x30 cm spacing with higher fertilizer rates and shorter irrigation intervals (AMP1) resulted in a significant increase in crude protein (CP) content, particularly in the original sorghum crop harvest (Table 2). This insight has far-reaching implications for farmers and agricultural experts seeking to maximize the nutritive value of fodder sorghum for feeding high producing dairy cattle.

The study also found that the agronomic management practices significantly influence the total yield of dry matter (DMY), digestible organic matter (DOMY), crude protein (CPY), and metabolizable energy (MEY) of the original and ratoon crop harvest of hybrid sorghum. Sorghum crops grown at high plant density showcased remarkable higher total DMY, DOMY, CPY and MEY in both the Dairygreen and SX-17 varieties (Table 3).

Table 2: Nutritive value of hybrid fodder sorghum cultivated at low plant density with high fertilizer rate and shorter irrigation interval (AMP1)

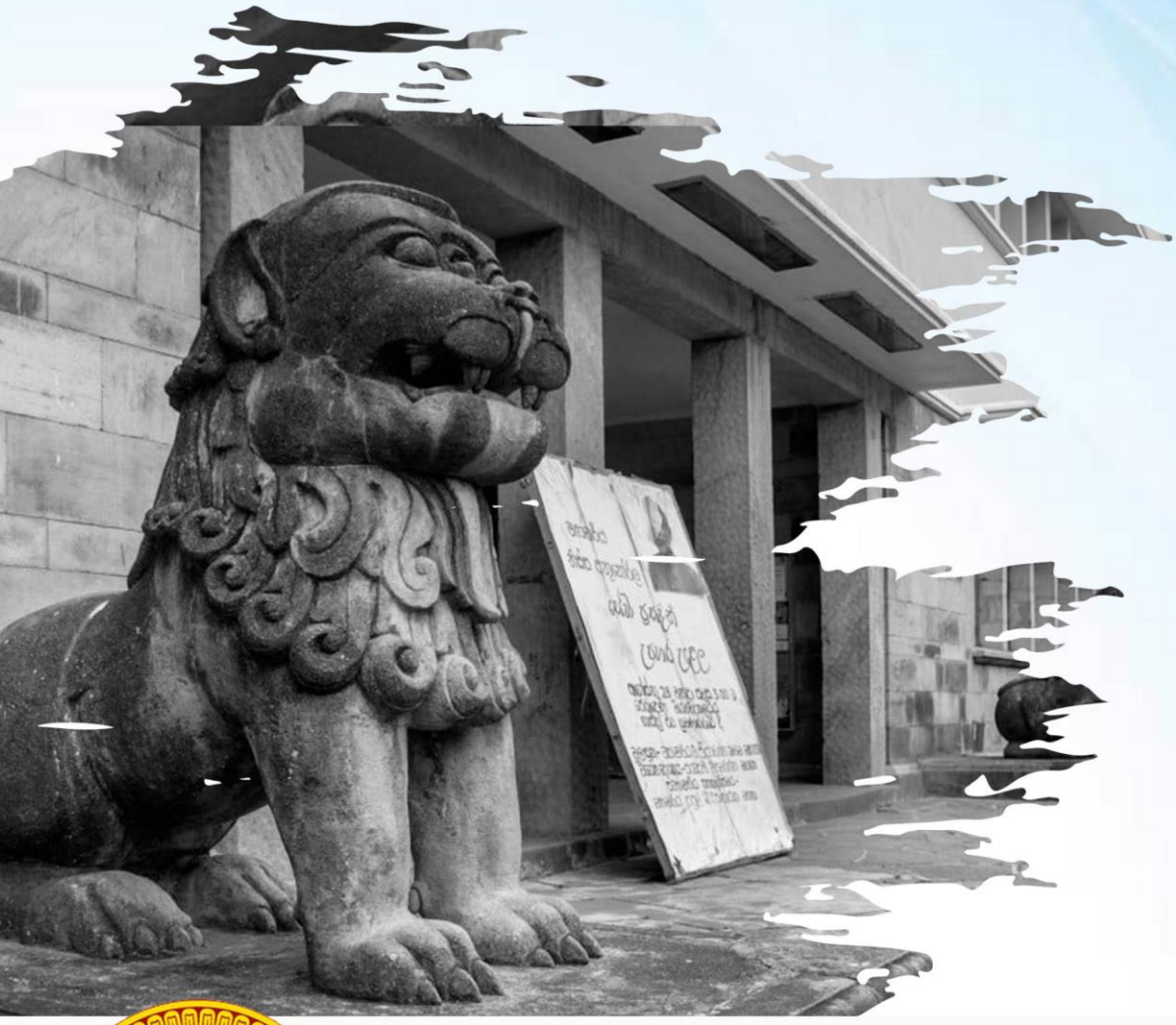
Nutritive value	SX-17	Dairygreen
Dry matter (%)	16.0	22.0
Crude protein (%)	6.5	5.7
Metabolizable Energy (MJ/kg)	8.1	7.3

Table 3: Nutrient yield of hybrid fodder sorghum cultivated at high plant density with low fertilizer rate and extended irrigation interval (AMP4)

Fodder yield	SX-17	Dairygreen
Dry matter (MT/ha)	20.9	25.7
Crude protein (MT/ha)	1.0	1.1
Digestible organic matter (MT/ha)	9.7	11.2
Metabolizable Energy (MJ/ha)	168.7	189.3

Recommendations

In conclusion, plant spacing of 45x15 cm, low fertilizer rate (75%) and extended irrigation interval, could be recommended for cultivation of hybrid fodder sorghum in lowland paddy fields in the dry zone during "*Yala*" and "*Third*" seasons. Conversely, cultivation of SX-17 at 45x30 cm plant spacing alone with higher fertilizer rate, and frequent irrigation could be recommended to produce fodder with high nutrition in dry zone for feeding high-producing dairy cows.



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