

# Book of Abstracts

## The 1<sup>st</sup> International Conference on Agriculture, Food Security & Safety

(AgroFood 2019)

07<sup>th</sup>-08<sup>th</sup> November 2019 | Colombo, Sri Lanka

Committee of the AgroFood 2019

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Book of Abstracts of the 1<sup>st</sup> International Conference on Agriculture, Food Security & Safety (AgroFood 2019)

Edited by Prof. Samih Abubaker and Dr. Asna Urooj

ISBN 978-955-3450-02-9

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Published by iConferences, No: 178/13/B6, Gamsabha Road, Kelanimulla, Angoda, 10620, Sri Lanka

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Food security is both a complex and challenging issue to resolve, it can happen when all people are able to access enough safe and nutritious food to meet their requirements for a healthy life. However, Food security faces a number of challenges across both production and consumption which research will be essential to solve. Many countries are facing the double burden of hunger and under-nutrition alongside overweight and obesity, with one in three people across the globe currently suffering from some form of malnutrition. World Food Day reminds us of the fragility of food security in the 21st century. Rising populations, rising incomes and changing diets coupled with falling water tables, increasing soil erosion and climate are the challenges the world today is facing to ensure Global Food Security. The International Conference on Agriculture, Food Security and Safety 2019 under the theme: “Global Food Security; Reality and Challenges” to be held on 7-8 Nov 2019 at Colombo is a great platform which brings together scientists, academia, policy makers, and all stake holders to address these challenges, increase coordination and collaboration on research and to facilitate its translation into policy and practice.

The Department of Studies in Food science and Nutrition, University of Mysore, India takes pride to participate in this event as an academic partner.

I wish all delegates a fruitful deliberations and the event a great success.

### **Dr. Asna Urooj**

Professor and Chairperson of the post- graduate Department of Studies in Food science & Nutrition, University of Mysore, India  
Conference Chairperson – AgroFood 2019

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# **ABSTRACTS OF KEY SPEAKERS**

[01]

**CREATING SUSTAINABLE FOOD FUTURE AND HEALTHY DIETS THROUGH DIVERSE FOOD SYSTEMS***Urooj A\**

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Increasing demand for nutritious, safe, and healthy food because of a growing population, and the pledge to maintain biodiversity and other resources, pose a major challenge to agriculture that is already threatened by a changing climate. Agricultural sector initiatives offer enormous potential for improving diet quality and household-level food security. A paradigm shift is occurring from the current production/productivity goals to developing nutritionally enhanced and resource use-efficient crops. Intensive industrial agriculture does not appear to be sustainable and does not contribute to a healthy human diet. Diverse and healthy diets, largely based on plant-derived food, may reduce diet-related illnesses. Reduced consumption of livestock products and increased use of plant products are central to reducing food carbon footprints and healthy eating. Fundamental to better health is understanding gene–nutrient interactions in growth and development and in disease prevention; genomics and phenomics may assist selecting for nutritionally enhanced, resource use-efficient, and stress-resilient cultivars. According to the UN study, the world’s food supply is under severe threat from loss of biodiversity and in the last two decades, approximately 20% of the earth’s vegetated surface has become less productive. Plants, available in abundance, although are the cheapest food sources for human consumption, are still underutilized. Wheat (*Triticum aestivum*), Rice (*Oryza sativa*), Maize (*Zea mays*) and Sugarcane (*Saccharum officinarum* L) are the four most widely cultivated crops in the world. At this juncture, it becomes necessary to explore the underutilized millet crops, including crops of tribal utility as long-term viable options for a sustaining the supply of food for humans. Despite diversity in modern foods systems in terms of productivity and variety, hunger and malnutrition still persist in many countries. Alleviating malnutrition in all forms is the goal set by the United Nations while declaring 2016-25 as ‘Decade of Action on Nutrition’ emphasizing the use of a food-systems approach to analyze the effects of agriculture production, commercialization, and sex on diet quality and nutrition. A holistic and synergic approach by food and medical scientists, food sector industries, breeders, and farmers is needed to develop diversified and nutritious cultivars with lower environmental impact to improve human health and well-being.

Keywords: Food security, food systems, diet and nutritional functional diversity, food matrices

# **ABSTRACTS OF FREE PAPER SESSIONS**

**FREE PAPER SESSION (A)**

**FOOD SECURITY**



A1

[02]

## IMPACT OF CLIMATE SMART AGRICULTURE ON GLOBAL FOOD SECURITY- A REVIEW

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**Background:** Ending up in hunger, warranting global food security and sustainability are key important foundations to be concerned with the rapid escalation of global population. Presently, 20% of the global population is food insecure and the global agricultural production should be increased by 60% by 2050 to encounter the increasing demand for food. Consequently, climate smart agriculture is a holistic approach for transmuting and guiding the conventional system of agriculture to guarantee the food security under new realities of climate change. **Objectives:** To explore the innovative technologies and prospective strategies that can be embraced to accomplish the objectives of climate smart agriculture and to recognize the restrictions associated with the enactment of climate smart agriculture concept in different regions of the world. **Methodology:** This study primarily aimed at comprehensive review of the existing literature on strategies for implementation of climate smart agriculture, its novel technologies and its environmental concerns and their potential utilization, especially in safeguarding the global food security to update our recent state of knowledge and formulate a compendium of present and past developments. Further, different efficient practices that have been employed to intensify the efficient resource utilization practices in an attempt to figure out how to fill the gap between conventional agriculture and smart agriculture for over the years have been earmarked. The strengths, weaknesses, opportunities and potential limitations of implementing new smart agricultural technologies options with particular reference to food security were highlighted and knowledge gaps were identified. Research priorities and future challenges that will support in the implementation of effective smart agricultural practices in present context with multi-prong strategies were discussed. **Results and Discussion:** Climate smart agriculture is a combination of proven practical strategies like mulching, intercropping, crop rotation, integrated crop-livestock management, improved water management and new innovative Internet of Things (IoT) applications to increase quality, quantity, and sustainability of agricultural production. High opportunity costs of lands, lack of training and knowledge and lack of market opportunities can be recognized as some limitations for popularizing the climate smart agriculture among farmers. However, through the provision of supportive services, access to new knowledge and technologies and through the implication of effective institutional policies these limitations can be greatly minimized. **Conclusions and Recommendations:** Climate Smart Agriculture encourages harmonized engagements by researchers, farmers, government sector, private sector, civil society and legislators towards climate-resilient pathways through (a) enhancing local institutional effectiveness; (b) building evidence; (c) networking climate and agricultural financing (d) nurturing coherence between climate and agricultural policies. However, it needs to respond to the challenges and limitations effectively to improve all aspects of the climate smart agriculture.

Keywords: Climate smart agriculture, food security, climate change, innovative technologies

A2

[03]

**LOCAL AGRO BIODIVERSITY TOWARDS NUTRITION SENSITIVE  
AGRICULTURE, FOOD SECURITY AND HEALTHY DIETS**

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Sri Lankan agrobiodiversity consists vast array of cultivated and wild crop species, landraces and traditional varieties if made available and utilized effectively, can contribute significantly towards food and nutrition security of the country. Utilizing the existing agro biodiversity achieved through effective mechanisms carried out as home garden diversification with local agro biodiverse food crops, characterization of nutrition profiles of these crops by food composition analysis, creating healthy, sustainable diets utilizing local agro biodiversity and increasing awareness of the population and out scaling through information events and programs. Biodiversity for Food and Nutrition (BFN) project implemented above activities successfully partnering up with the government institutes, universities as well as non-governmental organizations. Home garden diversification carried out in three diverse ecosystems in Udukumbura, Gampola, Giribawa & Niunhella villages popularizing local traditional food crops and traditional yams with value added products. Food composition analyzed for 68 priority agro biodiverse species and 30 underutilized crops including fruits vegetables and leafy vegetables. Sustainable diets explored & popularized through Food festivals fruit drinks and introduced in to “HelaBojun” food outlets. Awareness raised through food festivals, diversity fairs, competitions among school children, scientific symposiums to grasp the importance of food security & agrobiodiversity among the population. Uplifting & execution of agribusiness models as “HelaBojun” and “Poshana Mandapaya” empowering women in business and promoting nutrition sensitive agriculture utilizing the existing agrobiodiversity. Activities undertaken by BFN initiative have successfully moved forward in Sri Lanka to achieve food and nutrition security through conservation and sustainable use of local agrobiodiversity.

Keywords: Agrobiodiversity, diversification, food composition, food security

A3

[04]

## IOT BASED SMART PROTECTED HOUSES AND FOOD SECURITY IN SRI LANKA-A REVIEW

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**Background:** Sri Lankan population is estimated to reach 25 million in 2040. The food production should be increased by 25% to feed this predicted escalating population. 4.7 million People out of 21 million population in Sri Lanka do not have access enough food for a healthy life. Sri Lanka is ranked as 67<sup>th</sup> out of 119 countries and 67<sup>th</sup> in out of 113 countries in global hunger and global food security indices, respectively in 2018. Unpredictable weather patterns, land degradation, pest and disease out breaks, high import duties and non-tariff barriers are the major issues for the food insecurity in Sri Lanka. Domestic food production only fulfills 85% of country's total food requirement. **Aims/Objectives:** To explore the applicability of IOT based smart protected houses as measure to ensure food security in Sri Lanka. **Methods:** The study was supported by a broad literature survey which was based on the use of IOT based smart protected houses as a climate smart agriculture technology in ensuring food security in Sri Lanka. During the literature survey the potentials and limitations of the use smart protected houses in safeguarding food security in Sri Lanka was studied. **Results:** In order to increase the crop productivity per unit area of land smart protected houses can be deployed. A 41.6% yield increment per plant can be obtained from smart protected house compared to conventional protected house. Internet of Things (IOT) based smart protected houses has the ability to control its microclimatic conditions like temperature and relative humidity with related to outside environmental conditions. This fill directly ensure food security by increasing productivity of agricultural lands. **Conclusions and Recommendations:** Smart protected house which has the ability to control microclimatic conditions can give optimum conditions to crops and it makes vegetable crops available throughout the year in any part of the country. It also provides a solution to control pest and disease outbreaks which cause massive yield losses.

**Keywords:** Food insecurity, smart protected houses, climate change, climate smart agriculture, malnutrition

A4

[05]

## IMPACT OF MAJOR INSECT OUTBREAKS FOR FOOD SECURITY IN SRI LANKA AND POTENTIAL REMEDIAL MEASURES

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**Background:** Fulfilling the food demand of an increasing population remains a foremost global concern, where enormous agricultural yield is vanishing every year due to rapid infestation by insects. This may directly affect four key dimensions of food security. Pest damage crops at different stages of growth which leads to 25% to 30% crop losses annually could have consequences for food availability of the nation. The stability of whole food systems may be at risk under pest outbreaks because of the short-term variability in food supply. **Aims/Objectives:** Increase the volume of food crops production is immediate requirement to feed rapid growing population of the country where frequent and sever insect attacks remain as major constrains. Therefore, research must focus on analyzing major insect pest outbreaks that damage the major food crops and its effect on food security in Sri Lanka. **Methods:** A review summarizes different primary studies from which conclusions will be drawn into a holistic interpretation contributed by existing theories and models. **Results:** Literature reveals that, Army warm (*Spodoptera frugiperda*) was the worst pest infestation in the country history which destroyed 800,000 hectares of maize field. Of the food crops cultivated in Sri Lanka rice is the staple, mainly attacked by Brown plant-hopper resulting 20 000 and 600 000 tonnes annual imports of milled rice. Country's fruit basket severely affected by mealybug attack during recent decades which remains long term economic impacts. Vegetables were recorded as the highest sensible crop for insect outbreaks throughout the year which hamper crop productivity, compromise their sustainability and effect product quality. **Conclusions and Recommendations:** Insect pest outbreaks had a significant effect on both food security and nutritional status in Sri Lanka, with fluctuation of climatic factors and extreme weather event intensify the frequency and impact of insect outbreaks on food security. Initiate comprehensive agriculture policy to successfully address insect outbreaks as country's crop production sector is the backbone of the country's food security. Meanwhile is important to analyze existing policy issues and implementation programs to keep insect pest damages at economic threshold level.

Keywords: Food security, pest, insect outbreaks, crop

A5

[06]

**ENHANCE FOOD SECURITY AND CONSERVE ENVIRONMENT THROUGH ORGANIC URBAN FARMING IN SRI LANKA: A REVIEW**Maheepala S.A.D.S.S, Perera T.A.N.T and *Jayasinghe G.Y\**

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Population growth clearly indicates a doubling of human numbers over a period of 50 years and it is threatening the world's food security. Supply sufficient foods to all people is a major problem, specially, in developing nations including South East and South Asia, where approximately 50% of the world's poor live. Though, Sri Lanka is a developing nation it has an amazing history of maintaining a high value on basic human needs. Rural, small farmers are responsible for producing 90% of the food requirement in Sri Lanka. Agricultural lands in Sri Lanka are under considerable pressure as industrialization and urbanization have absorbed arable lands. Agro-chemicals are used in agriculture as the best solution to increase the crop yield and to reduce the losses while full filling the food demand. Excessive usage of agro-chemicals causes major environmental issues such as eutrophication, ground water contamination, ecosystem degradation, and land pollution. Also, it is threatening the safety and the quality of food that create numerous health issues. Urbanization and deforestation up raise urban heat island effect (UHIE), which discomfort human's life. High quality food needs to be produced from a shrinking land base with less agro-chemical usage. Organic urban farming is a sustainable solution which confirms food security with safe and high quality foods. Green infrastructures; green walls, green roofs and urban wetlands, can be arranged as alternative surfaces for farming and it reduces environmental issues specially, UHIE. This study comprehensively reviews the existing literature on (i) organic urban farming on food security, (ii) techniques, (iii) benefits and drawbacks and (iv) future perspectives.

Keywords: Agro-chemicals, eco-system degradation, land degradation, urban heat island effect, urbanization

A6

[07]

**METHODOLOGY FOR NATIONAL COMPREHENSIVE FOOD INSECURITY AND VULNERABILITY ASSESSMENT AT DIVISIONAL SECRETARIAT LEVEL FOR SRILANKA**

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Although Sri Lanka is a predominantly agricultural country, national food security problems exist in certain parts of the country for various structural and management reasons. Food insecurity indicates physical unavailability of food due to social and economic factors and hence it is essential to make an assessment of food security at a lower level of administrative unit such as Divisional Secretariat (DS) divisions or Grama Niladari (GN) divisions where the most vulnerable population exists. In order to achieve this, it is necessary to collect data on large number of socio-demographic variables and use an effective statistical approach to combine the data to reflect food security. The dimensions of the food insecurity framework comprise three physical determinants such as availability, accessibility, and utilization, and a temporal determinant such as stability. This study aims at providing a methodology towards the development of an index to assess the vulnerability to food insecurity of DS Divisions across above four dimensions. Multivariate approach is carried out with Factor Analysis to combine the data in different dimensions into a single index representing food insecurity status of the country at DS level. The overall index is calculated and visualized for each DS Divisions as maps using Geographical Information Systems incorporating neighborhood analysis, hotspot analysis and cluster analysis. This allows ranking the DS Divisions according to their index score, and studying their identified trends to deeply investigate the performance across each dimension and develop policy alternatives. Possible further development of this study would be applied at GN divisional level to develop a complementary index focusing on the detail individual aspects of food security variables.

Keywords: Geographical Information Systems, food Security, neighborhood analysis, factor analysis, hotspot analysis, cluster analysis

**FREE PAPER SESSION (B)**

**FOOD SCIENCE, FOOD PROCESSING & FOOD SAFETY**

B1

[08]

**POROUS CRUMB STRUCTURE PROPERTIES OF LEAVENED FOOD PRODUCTS PREPARED FROM SELECTED POPULAR RICE VARIETIES IN SRI LANKA***Rathnayake, H.A<sup>1\*</sup>*, Navaratne, S.B<sup>1</sup> and Navaratne, C.M<sup>2</sup><sup>1</sup>Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka<sup>2</sup>Department of Agricultural Engineering, Faculty of Agriculture, University of Ruhuna, Sri Lanka\*Email: [heshani@sci.sjp.ac.lk](mailto:heshani@sci.sjp.ac.lk)

Current study was conducted to characterize the porous crumb structure properties of leavened food products prepared from selected popular rice varieties in Sri Lanka. Three certified paddy varieties (BG300, BG94/1 and At309) along with an unknown variety of rice sample obtained from a local reputed rice supplier were selected for the study. Paddy samples were de-husked and polished. The polished rice was subjected for wet milling and sieved to obtain particle size between 180-75microns. Four crumb samples were prepared using each rice flour type with wheat flour in 50:50 ratio followed by fermentation and gelatinization under 1kg/cm<sup>2</sup> initial air pressure in a closed chamber. Specific volume, bulk density, hardness and cellular structural properties of developed crumbs were evaluated. BG300 showed the highest crumb specific volume (2.2182cm<sup>3</sup>g<sup>-1</sup>) and the lowest bulk density (0.4513gcm<sup>-3</sup>) compared to the other three samples. Though, crumb hardness of At309 is the lowest (924.91g), it isn't significantly different ( $P \geq 0.05$ ) to BG300. Well-developed porous crumb structure was obtained from BG300 and BG94/1 with significantly higher ( $P \leq 0.05$ ) cell density compared to At309 and unknown rice sample. Further, BG300 showed more circular (0.5333) and solid (0.744) pores comparatively other three samples. BG300 can be practically applied to obtain better porous crumb structural properties in rice related leavened food products when fermentation and gelatinization are conducted under slightly higher air pressure conditions.

Keywords: Crumb, leavened food, porous structure, rice varieties, wet milling

*Acknowledgement: National Science Foundation, Sri Lanka (Grant number: TG/2017/Tech-D/03), Department of Food Science and Technology, University of Sri Jayewardenepura, Rice Research and development Institute, Bathalegoda, Rice Research Station, Ambalanthota.*



B2

[09]

**ANTISEPTIC PROPERTIES OF ACMELLA PLANT EXTRACTS  
AND IDENTIFICATION OF MICROBES ON FISH PROCESSING SURFACES***Uthpala T.G.G<sup>1</sup>\*, Navarathne N.M.M.G.S.B<sup>1</sup>*<sup>1</sup>Department of Food Science & Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka\*Email: [gimhani@sci.sjp.ac.lk](mailto:gimhani@sci.sjp.ac.lk)

Identification of microorganisms in fish food processing surfaces (FFPS) is important in controlling safety and quality of processed food products. The purpose of this study was to identify and control of bacteria grown on stainless-steel (SS) FFPS using Acmella plant extract. Three SS (ALSI 304) food processing surfaces were prepared in the laboratory and it was made to contact with fresh fish samples (tuna) for 2 hours. These three surfaces were kept undisturbed for 2 days at room temperature after removing samples and rinsing surface with fresh water. After rinsing, one surface was treated with Acmella plant extract and the other with a commercial sanitizer (positive control). The rest surface was kept untreated as the negative control. Swab samples were collected using 100cm<sup>2</sup> template after 2, 4, 8, 24 and 48 hour intervals and total plate count was obtained using PCA media. Simultaneously, inoculated fish samples were taken and identified types of microbes using VITEK 2 analyzer and gram staining. There were 2.55, 2.82, >9 log cfu /100cm<sup>2</sup> for Acmella treated, positive control and negative control surfaces respectively after 48 hours, against initial population of 4.48 log cfu/100cm<sup>2</sup>. Higher value of reduction was reported by Acmella, which was not significantly differed ( $p>0.05$ ) with positive controller however, was differed with negative controller ( $p<0.05$ ). Moreover, identified microbes on SS FFPS were *Micrococcus luteus*, *Staphylococcus haemolyticus*, *Staphylococcus warneri*, *Staphylococcus pasteurii* and *Acinetobacter baumannii complex*. Acmella plant extract is an effective alternative for commercial sanitizers in suppressing growth of microorganisms on FFPS and four gram-positive and one gram- negative isolates were identified. Hence, water extracts of *Acmella oleracea* can be considered in the management of microbes in FFPS.

Keywords: Fish processing surfaces, Tuna fish, Acmella extracts, stainless steel surfaces, surface sanitizer

*Acknowledgement: University Research Grant (ASP/01/RE/SCI/2017/22) of University of Sri Jayewardenepura*

B3

[10]

**ASSESSMENT OF POTENTIAL USE OF *Vateria copallifera* AS A FLOUR;  
NUTRITIONAL AND FUNCTIONAL PROPERTIES**Mihiranie M.K.S<sup>1</sup>, *Jayasinghe J.M.J.K*<sup>1\*</sup>, Wanasundara J.P.D<sup>3</sup>, Jayasinghe C.V.L<sup>2</sup><sup>1</sup>Department of Food Science and Technology, University of Sri Jayewardenepura, Sri Lanka<sup>2</sup>Department of Food Science and Technology, Wayamba University of Sri Lanka, Sri Lanka<sup>3</sup>Saskatoon Research and Development Centre, Agriculture and Agri-Food Canada, Canada\*Email: [jagathj@sci.sjp.ac.lk](mailto:jagathj@sci.sjp.ac.lk)

*Vateria copallifera* (Sin; *Hal*) seeds are recognized as a healthy food source in Sri Lanka. *Hal* seeds have been used in the traditional food preparations as fresh scraped particles and flour made from dried *hal* seeds are utilized by none of the Sri Lankan people. It is worthwhile to assess the nutritional and functional properties of *Hal* flour to use as a potential healthy flour source for commercial food applications. Therefore, the objective of this study was to evaluate the nutritional and functional properties of *Vateria copallifera* flour. The nutritional properties; moisture, carbohydrate, fat, crude fiber, protein, total sugar, total starch, amylose and amylopectin content were assessed. The functional properties of flours, swelling capacity (SC), water holding capacity (WHC), oil holding capacity (OHC), emulsion activity, emulsion stability, foaming capacity, foaming stability, gelatinization temperature, least gelatinization concentration and bulk density were analyzed. *Hal* flour contained 8.42±4.11% moisture content, 5.21±0.003% fat content, 4.025±1.64% protein content, 1.82±0.22% mineral content, 45.67% total carbohydrate content and 3.34±0.05% crude fiber content. In addition, *Vateria copallifera* flour consists of 0.413±28.20% total starch content, 0.003±0.78% amylose content and 0.41% of amylopectin content. Besides that, *Hal* seed flour presented higher WHC (111.75±2.93%), OHC (99.68±5.92%) and SC (45.96±7.06%) which are important on food processing. Flour made from *hal* seeds has important nutritional and functional characteristics and therefore it can be used as a healthy flour source in the food processing and value addition.

Keywords: *Vateria copallifera*, flour, nutritional characteristics, functional properties

B4

[11]

**EVALUATION OF USEFULNESS OF SELECTED FOOD COMPOUNDS AS AN ACTIVE SUBSTANCES WITH MODULATING ABILITY OF BITTER TASTE IN CHOCOLATE**

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Numerous compounds with pro-health activity are present in the cocoa bean. Cocoa contains polyphenols such as anthocyanins, catechins and flavan-3-ol and proanthocyanidins. The catechins include (-) - epicatechin, (+) - catechin, (+), and the anthocyanin giving cocoa beans the color of cyanidino - 3 -  $\beta$  - D - galactoside and cyanidino - 3-  $\alpha$  - L - arabinoside. In addition to polyphenols, cocoa is also rich in alkaloids - methylxanthine, i.e. caffeine, theobromine and theophylline. The presence of these compounds in chocolate determines its health-promoting properties, but at the same time has a bitter taste, often undesirable by consumers. The aim of the work was to assess the suitability of selected raw materials as a source of active compounds that are modulators of bitter taste in chocolate. Plant raw materials, fungi, eggshell and WPC80 dairy protein were tested. Application tests in chocolate, allowing the assessment of the impact of the masking effect of the bitter taste, were examined sensitively - using the five-point method. The selected additives were evaluated for cytotoxic activity on the MCF 7 breast cancer cell line. The effectiveness of selected ingredients as modulators of bitter taste has been confirmed in application tests. In bitter chocolate trials, the best effect masking the bitter taste was found for trials with carrot extract and WPC protein in combination with vanilla. It has been shown that the proposed additives that modulate the bitter taste are cytotoxic in relation to breast cancer cells, among them, in particular, egg shells, turmeric, oregano, fiber oat synbiotic, shi-take lyophilisate and psyllium fiber. The addition of plant raw materials, eggshells and WPC proteins may affect the bitter taste of the chocolate bar and at the same time increase the health-promoting effect.

Keywords: Chocolate, health, bitter, taste, MCF 7, modulators

B5

[12]

## QUALITY ASSESSMENT OF BISCUIT INCORPORATED WITH *Cassia auriculata* L. FLOWER POWDER

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**Background:** *Cassia auriculata* L. is a shrub found in the Dry Zone of Sri Lanka. *C. auriculata* L. flower is a rich source of natural antioxidant with medicinal properties. Prevalence of chronic diseases is a public threat worldwide. Thus, value added food products containing *C. auriculata* L. flower will be helpful to reduce the risk of some chronic diseases. **Aims/Objectives:** The study was aimed to investigate the nutritional and sensory qualities and antioxidant properties of biscuits prepared by incorporating *C. auriculata* L flower powder. **Methods:** Fresh flowers were collected, cleaned and dried under sun (8 hours) and powdered. The basic recipe (1 kg) for the biscuit contained wheat flour (500 g), sugar (200 g) margarine (200 g), roasted peanut kernel (100 g) and baking powder (2 teaspoon). Biscuits were prepared with the incorporation of sundried flower powder at different amounts 5% (T<sub>1</sub>), 10% (T<sub>2</sub>) and 15% (T<sub>3</sub>) of total weight of the dough mixture. Biscuit prepared without the flower powder was used as control. Biscuit samples were analyzed for proximate composition, antioxidant properties [total phenolic content, total flavonoid content, antioxidant capacity and DPPH (2, 2 -diphenyl -1 picrylhydrazyl) radical scavenging activity] and sensory properties. Sensory evaluation was carried out using 15 untrained panel members using 5-point Hedonic test. **Results:** Moisture and ash contents of the samples did not differ significantly. Crude protein and crude fiber contents were decreased with increasing the amount of flower powder. Highest protein was recorded for the control (14.17%), whereas, highest crude fiber content was recorded in control (2.7±0.02%) and T<sub>1</sub> (2.4±0.02%). T<sub>3</sub> consisted lowest fat content (20.46 %) than other samples. Antioxidant properties of all samples differed significantly. Compared to control, all treatments showed higher antioxidant potential and antioxidant potential was increased with increasing the amount of flower powder. Sensory evaluation showed that the biscuit containing 5% of the flower powder and control had the highest overall acceptability. **Conclusions and Recommendations:** *C. auriculata* L. flower powder can be incorporated into biscuits to prepare biscuits with natural antioxidants and acceptable sensory qualities.

Keywords: Antioxidant, biscuit, chronic diseases, sensory qualities

B6

[13]

**DETERMINATION OF SENSORY AND MICROBIAL QUALITY OF THE DEVELOPED PROBIOTIC FERMENTED DAIRY DRINK**

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This study was conducted with the aim of developing a probiotic fermented dairy drink (Yakult) using *Lactobacillus casei* bacteria and to determine viability of probiotics and sensory properties during the storage. Fresh skim milk was inoculated by *Lactobacillus casei* bacteria 10<sup>5</sup>cfu/ml and incubated at 37°C for 48 h. Then, milk coagulum was diluted with sterilized water (60:40, 70:30, 80:20) and the selected best ratio (70:30) was made with vanilla and strawberry flavor with/without sugar and considered for sensory analysis using five-point hedonic scale. The best product was kept at 2 and 4 °C storage for 7 days and acidity, pH, aerobic plate count, yeast and mould, and sensory analysis were measured daily for 7 days. Results revealed that the strawberry flavored fermented dairy drink with sugar showed the highest average rank for aroma, color, texture, flavor and overall acceptability respectively. The pH and acidity were not significantly ( $P>0.05$ ) different during the storage of the strawberry fermented milk at both temperatures. Total aerobic plate count 5.30±0.09 CFU/ml showed below the safe limit at 7th day of storage. Similarly, yeast and mould count were not significantly ( $P>0.05$ ) different during storage. Based on the sensory and analytical results, the strawberry flavored fermented dairy drink was acceptable up to seven days of storage.

Keywords: Probiotics, sensory quality, microbial quality, shelf life

B7

[14]

**EFFECT OF REPEATED DEEP FRYING ON THE OXIDATIVE STABILITY AND QUALITY OF COCONUT OIL**Sarusha S and *Rajapakse R.P.N.P\**

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This study was conducted to find the effect of repeated deep frying on the quality of coconut oil produced by pressing of copra. For this purpose, coconut oil was heated at 180°C for 20 min with or without food, for ten repeated frying cycles. Samples were tested for oxidative stability, physicochemical properties and structural alterations using standard methods. Free fatty acid content and thiobarbituric acid reactive substances (TBARS) increased significantly ( $p < 0.05$ ) while saponification value and iodine value decreased significantly ( $p < 0.05$ ) with increasing number of frying cycles. When oil was heated without food, peroxide value increased significantly ( $p < 0.05$ ) over the frying cycles. However, when oil was heated with food, peroxide value increased significantly ( $p < 0.05$ ) until the sixth cycle and thereafter decreased significantly ( $p < 0.05$ ) as a result of degradation of peroxides into secondary oxidation products. There were no significant ( $p > 0.05$ ) differences in the peroxide values and TBARS values when the oil was heated with or without food, since water released from the food acts as a barrier for oxygen and inhibits formation of peroxides and secondary oxidation products. Free fatty acid content increased significantly ( $p < 0.05$ ), only when oil was heated with food due to the hydrolysis of triglycerides in the presence of water. It indicates, repeated heating of coconut oil had a significantly ( $p < 0.05$ ) negative effect on its oxidative stability and physico-chemical properties compared to the accepted limits. However, coconut oil can be used for maximum of 2-4 repeated deep frying cycles, while maintaining its physico-chemical parameters under the specified limits of CODEX guidelines.

Keywords: Coconut oil, deep frying, oxidative stability, hydrolysis, polymerization

B8

[15]

**COMPARATIVE EFFECTS OF ETHEPHON AND ACETYLENE INDUCED  
RIPENING ON PHYSICOCHEMICAL PARAMETERS OF BANANA***(Musa acuminata, AAB)**Maduwanthi, S.D.T\**, Marapana, R.A.U.J

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**Background:** Artificial or induced ripening is a need in banana trade to meet consumer expectations. **Aims/Objectives:** This study was to evaluate effects of commonly used artificial ripening agents such as ethephon and acetylene on physicochemical parameters of banana fruit. **Methods:** Freshly harvested green mature banana (*Musa acuminata*, AAB) bunches were procured from an orchard in Dankotuwa, Sri Lanka. The banana hands in same maturity stage were subjected to 1000 ppm ethephon, 1000 ppm acetylene and control sample was allowed to ripen naturally. Stage of maturity, firmness, peel colour, total sugar and total starch were analysed in 48 hour intervals. High Performance Liquid chromatography was done to analyse sucrose, glucose, fructose, maltose, malic acid, tartaric acid, oxalic acid, citric acid in fruit flesh at fully yellow stage. **Results:** Ethephon and acetylene treatment converted the green fruit to fully yellow within 2 days while it took 8 days in natural ripening. The peel colour and firmness was significantly high ( $p < 0.05$ ) in acetylene treated fruits at eat ripe stage (stage 6). The highest total sugar level,  $19.91 \pm 0.07$  g/100g was detected in naturally ripened banana while there was no significant difference in total starch levels. Citric, malic and oxalic acid levels are significantly low ( $p < 0.05$ ) in both acetylene and ethephon treated banana at stage 6. Glucose and fructose levels are significantly low ( $p < 0.05$ ) in acetylene treated banana while sucrose was only detected in untreated samples. **Conclusions and Recommendations:** Ethephon and acetylene affect significantly on total sugar, sugar profile and organic acid profile in banana flesh which may lead to poor quality in banana.

Keywords: Artificial ripening, carbide, ethephon, quality of banana





**FREE PAPER SESSION (C)**

**NUTRITION**

C1

[16]

**DETERMINATION OF VITAMIN-C CONTENT IN SELECTED CONCENTRATED LIQUIDS BY EVAPORATION AND PROGRESSIVE FREEZE CONCENTRATION TO ASSESS THE QUALITY OF TWO CONCENTRATION METHODS***Jayawardena J.A.E.C<sup>T</sup>\**, Vanniarachchi M.P.G<sup>1</sup>, Wansapala M.A.J<sup>1</sup><sup>1</sup>Department of Food Science and Technology, Faculty of Applied Sciences, University of Sri Jayewardenepura, Sri Lanka\*Email: [erandya87@gmail.com](mailto:erandya87@gmail.com)

**Background:** Most of the concentration techniques operate on a temperature around or above room-temperature. This will lead to the deterioration of the original quality of the liquid. Evaporation, membrane concentration and freeze concentration (FC) are major concentration methods and FC is the most suitable method over others since FC operates below 0 °C. Progressive freeze concentration (PFC) is a novel FC technique which uses a simple cylindrical apparatus. Vitamin-C (L-Ascorbic acid) is the major vitamin presented in many natural juices. It is a heat sensitive vitamin and can be used as a factor for analyzing the quality of the liquid products. **Objective:** Compare the quality of some concentrated liquid foods by analyzing the percentage loss of Vitamin-C during PFC and evaporative concentration. **Methods:** Coconut water, pineapple, tomato, and starfruit juices were concentrated using rotary evaporator and PFC method. Total vitamin-C in two concentrated products was analyzed by UV-spectrophotometer. **Results:** A linear concentration range for standard solutions of ascorbic acid was achieved up-to 100 mg L<sup>-1</sup>, with a correlation coefficient of 0.9949 at 521nm. Vitamin-C loss of coconut water, pineapple, tomato, and starfruit juices caused by evaporation were 31.96 %, 38.52 %, 56.70 % and 44.87 % respectively. Vitamin-C loss by PFC for same juices were 9.9 %, 6.31 %, 10.40 %, and 3.51 % respectively. **Conclusions and Recommendations:** Compared with evaporation, PFC is the best method for concentrating natural liquid food with minimal damage to the original Vitamin-C content. Comparison of membrane concentration and PFC is important for further studies.

Keywords: Progressive freeze concentration, evaporation, Vitamin-C (Ascorbic acid), liquid food

C2

[17]

**IN VITRO STARCH AND PROTEIN DIGESTIBILITY PROFILE OF PROCESSED FOOD SUPPLEMENT DEVELOPED FOR THERAPEUTIC USE***Pai K.N\**, Urooj A

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**Background:** Cereals and pulses contain a range of anti-nutrients which interfere with nutrient absorption at the gut. Processes such as soaking, fermentation, germination, heating etc., inhibit anti-nutrients, improve digestibility and make the food suitable for therapeutic use. **Aims/Objectives:** The study aimed at evaluating the effect of drum drying on the *in vitro* starch and protein digestibility of a high calorie and high protein food supplement. **Methods:** The cereals, pulses, protein isolates and oil sources used in the development of the supplement were subjected to processing techniques such as soaking, germination, malting and milling. A homogenate of the formulation was prepared and processed using a drum dryer. The effect of drum drying on the *in vitro* starch & protein digestibility was compared with a control. The micro-structural changes were observed using Scanning Electron Microscopy. **Results:** The drum dried formulation showed reduction in the resistant starch [t(2)=7.018, p=0.020] and increase in the rapidly digestible starch [t(2)= -13.533, p=0.005], slowly digestible starch [t(2)= -19.120, p=0.003] and starch digestibility index (control, 41.8%; drum drying, 71.2%) than the control. The shift from the more resistant form to the more digestible form of starches due to drum drying was statistically significant (p<0.05). Similar results were observed in the protein digestibility. The micro-structural analysis revealed changes in structure due to starch gelatinization and protein degradation. **Conclusions:** The digestibility of protein and starch is an important attribute in patients with malnutrition and altered gut function. Suitable food processing methods can make the supplement suitable for therapeutic use.

**Keywords:** Processing, food supplement, *in vitro* starch digestibility, *in vitro* protein digestibility, scanning electron microscopy

C3

[18]

**ANTIOXIDANT PROPERTIES OF SELECTED VARIETIES OF BANANA BLOSSOM DRIED USING DIFFERENT METHODS**Theepana Y, *Sarathadevi R\**, Sivakanthan S

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There is an increasing trend towards the use of natural sources as antioxidants in order to improve the health. Banana blossom is a good source of antioxidants available locally and cheaply. The study was aimed to evaluate the antioxidant properties of four varieties of banana blossom (*Itharai*, *Kathali*, *Monthan* and *Kappal*) dried using different methods. Banana blossoms were cut and soaked in antibrowning solution (0.3 % of citric acid) for 30 minutes. After draining, composite sample was prepared by mixing the blossoms of the same variety collected from different areas and composite sample was used to make dried samples [sun-dried (8h), oven-dried (45°C for 24 h) and microwave oven-dried (280.W)]. Before extraction, dried samples were ground to make fine powder. In order to extract antioxidants, prepared samples (3 g) were extracted using 60 mL of ethanol (70%, v/v) by shaking at 200 rpm at ambient conditions for 6 h. Then, Extraction was repeated two more times and supernatants were pooled and solvent was evaporated to get dry extract, which is used to analyze antioxidant properties by determining total phenolic content (TPC), total flavonoid content (TFC), antioxidant capacity (AC) and 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity. The highest total phenolic content (81.6±4.7 mg gallic acid equivalent/g dry matter) and highest total flavonoid content (50±2 mg catechin equivalent/g dry matter) were obtained by microwave oven dried samples of *Kathali* and *Monthan*, respectively. Highest antioxidant activity (IC<sub>50</sub> value, 0.049±0.004 mg/mL) was exhibited by microwave oven dried *Kappal*. Highest total antioxidant capacity (177.7±7 mg ascorbic acid equivalent/g dry matter) was observed in microwave oven dried *Kathali* variety. Ethanolic extracts of all four varieties of banana blossom dried using different methods are found to be abundant sources of natural antioxidants. Among drying methods, microwave oven drying is found to be the most suitable method of drying to preserve or retain antioxidants. The dried blossoms can be used to prepare the value added food products enriched with natural antioxidants.

Keywords: Antioxidant, banana blossom, composite sample, radical scavenging activity

C4

[19]

**ASSESSMENT OF NUTRITIONAL STATUS AND BIOCHEMICAL PARAMETERS OF THE GERIATRIC INMATES RESIDING IN OLD AGE HOMES IN THE CITY OF MYSORE**

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*Nutrition* is an integral part of life-cycle. Monitoring the nutritional status and educating geriatrics on the dietary modifications and lifestyle changes will help to live and age healthy. **Objective:** The study was conducted to assess the nutritional, physiological and physical activity status of geriatrics residing in Old Age Homes in Mysore (Karnataka, India) by analyzing their food recall, nutritional status and biochemical parameters along with other indicators of aging. Fifty geriatrics (60-80yrs) were assessed for nutritional status using anthropometric measurements (viz, Height, Weight, Body Mass Index -BMI), MUAC, Triceps and WHR), biochemical parameters (viz, BP, Blood Glucose, Hb, total cholesterol, TGL etc.). We analyzed their food recall, nutritional status and biochemical parameters along with other indicators of aging. A validated questionnaire was used for study of aging (viz, pain, vision changes, fatigue etc.) and physical activity status were also assessed. 90% of the subjects were either overweight or obese. 60% of the subjects had a MUAC of 24-30 cm. More than 70% of the subjects had pre-existing conditions like diabetes, hypertension and anaemia. 20% of the subjects had elevated total cholesterol and TGL and the rest of the 80% had borderline high total cholesterol (190-200mg/dl). The only physical activity in the routine was brisk walking for 15 to 20mins. The dietary menu followed in all old age homes did not meet the dietary requirements to foster the needs of pre-existing diseases or the aging physiology. Old age is an inevitable phase of human life cycle, generally assumed to be undesirable and difficult.

**Keywords:** Old age home, geriatrics, nutritional status, biochemical parameters, physical activity.



**FREE PAPER SESSION (D)**

**FARM AND AGRICULTURE PRACTICES**

D1

[20]

**FACTORS AFFECTING ON SUSTAINABLE PADDY FARMING – A CASE STUDY  
IN *Dedigamuwa* WETLAND-PADDY ECOSYSTEM***Ranasinghe, R.D.A.K<sup>I</sup>\*, Ginigaddara, G.A.S<sup>1</sup>*<sup>1</sup>Department of Agricultural Systems, Faculty of Agriculture, Rajarata University of Sri Lanka, Sri Lanka\*Email: [aranikranasinghe@gmail.com](mailto:aranikranasinghe@gmail.com)

Wetlands are one of the world's most important environmental assets, existing in all continents and latitudes. *Dedigamuwa* wetland ecosystem is one of natural wetlands in Colombo district which is situated in Western part of the *Kelani* River basin. Long term intensive paddy farming practices have led to loss of original characteristics of this ecosystem. This study was carried out to evaluate the paddy farmers' perception on wetland ecosystem services and to identify the factors affecting on paddy farmers' adaptability for sustainable agricultural practices. A questionnaire survey was conducted for 100 randomly selected paddy farmers in *Dedigamuwa Grama Niladhari* division. Focus group discussions and key informant interviews were conducted to collect information. Descriptive statistics were used to assess the farmers' perception while multiple linear regression was used to identify the factors affecting on adaptability for sustainable paddy farming. Regression results revealed that, profitability, farmer education level, frequency of extension services, hired labour/acre and farming experience are significantly ( $p < 0.05$ ) influencing on adoption of sustainable agricultural practices by the paddy farmers. Flood controllability and provision of habitats for flora and fauna were identified as the most perceived ecosystem services by farmers. Overall results emphasized that, there are less adoption of sustainable paddy farming practices due to less knowledge on significance of wetlands, less government intervention and lack of extension services for farmers. Hence, the study suggests that, in order to promote sustainability, these farmers require public enlightenment on importance of ecosystem services provided by natural wetland ecosystems.

Keywords: Ecosystem services, farmers' perception, paddy farming system, sustainability, wetland



D2

[21]

**PESTICIDE USAGE IN SRI LANKAN PADDY CULTIVATION: SPECIAL REFERENCE TO FARMER RISK PERCEPTION**

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Paddy cultivation plays vital role in Sri Lankan agriculture since rice is the staple food. Literature revealed that misuse and overuse of pesticides in paddy cultivation has led many health and environmental issues. Therefore, the overall objective of the study is to identify pesticide usage patterns in paddy cultivation based on technical aspects and farmer perception of risk. Multistage random sampling technique was employed in sample selection. The sample of 330 paddy farmers representing three climatic zones of Sri Lanka were surveyed using a structured questionnaire. According to the descriptive analysis, herbicides are the major category of pesticides use in Sri Lankan paddy cultivation irrespective of climatic zone and irrigation method. Majority of the surveyed farmers applied herbicide as an input. However, majority of farmers consider presence of substantial amount of pests or pest population before applying insecticides. Certainty Equivalent method and risk attitude scale was used to directly elicit farmer risk preferences. The results of risk attitude scale depicted that the relatively large group of farmers exhibit risk-averse behavior and it is consistent with risk attitude measures rooted in the expected utility approach by means of certainty equivalence. Risk premium of 0.0176 indicates that risk-averse behavior of Sri Lankan paddy farmers. Even though paddy farmers showed risk-averse behavior, there is a propensity to minimize pesticide usage through extension and training of integrated pest management techniques. Hence, national level protocol and monitoring mechanism are required, by incorporating the risk dimension of pest management and farmer risk perception.

Keywords: Certainty equivalent method, paddy cultivation, pesticides, risk attitude

D3

[22]

**SAFETY ISSUES IN FRUIT AND VEGETABLE SUPPLY CHAINS IN SRI LANKA:  
A REVIEW***Vidanapathirana R.P\**

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Safe food consumption across the globe has been overly threatened by food adulteration using harmful chemicals, which is detrimental to health. The practice is rampant in developing countries where many loopholes exist in the law enforcement paving way to various unscrupulous acts throughout the supply chains by various actors like farmers, collectors, and traders, thereby controlling quality and assuring safety of fruits and vegetables in supply chains remain critical challenges. This paper reviews safety issues related to food adulteration in fruit and vegetable supply chains and institutional level measures to minimize quality and safety issues prevalent in fruit and vegetable supply chains particularly in Sri Lanka employing literature survey and key informant interviews. It provides valuable insights identifying problematic areas related to food safety issues in fruit and vegetable sector in the country. Unregulated pesticide usage, poor awareness and technical know-how of the farming community, lack of sufficient national standards to measure food safety and absence of an integrated approach to ensure food safety were identified as major drawbacks. It emphasizes that the local food control mechanism does not have a farm to table approach. It underscores the need for a cost effective safety assurance system for consumer satisfaction and a separate market window to provide safe fruits and vegetables to consumers.

Keywords: Food safety issues, fruits and vegetables, supply chains

D4

[23]

## INVESTIGATE THE PRODUCT HARM CRISIS IN CEYLON CINNAMON VALUE CHAIN

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**Background:** Product harm plays a vital role in conveying evidence to make a rational purchasing decision. Uplifted prevalence on non-communicable disease, changes the human food consumption towards the safe and functional foods. Ceylon cinnamon becoming popularized due to its confirmed functional properties. But the labels of retail packs are rarely direct consumers to the best choice. Ceylon cinnamon is one of the frequent victims in international market due to product harm crisis. Cassia, the direct competitor of Ceylon cinnamon, always misleads the consumers in international market place due to improper labelling issues. **Aims/Objectives:** Study strives to identify the magnitude of product harm crisis occurs in international markets (USA, Mexico & Europe) and recommend an effective solution. **Methods:** Data collection was conducted by online survey and survey strategy composed of keyword search along with analysis of retail packs of cinnamon products. One hundred and forty-five product types were considered in 75 online retail formats. All products were analyzed for the label attributes. **Results:** Of the sample majority (73%) of the product labels were poor in essential information which misleads the consumer. Ceylon cinnamon, popular among health concern consumers due to its inherited characteristics, low coumarin levels and rich phytochemicals. Absence of botanical name, picture of Ceylon cinnamon and country of origin were key missing information along with coumarin content. **Conclusions and Recommendations:** The study recommended an informative label architecture with essential elements to proof the origin of the product will cater the consumer demand while rational purchasing decision ultimately resulted in consuming a health product.

Keywords: Ceylon cinnamon, label attributes, harm crisis, Europe, food crisis



**FREE PAPER SESSION (E)**

**FOOD AND AGRICULTURE**

E1

[24]

**DETERMINANTS AND DEVELOPING STRATEGIES OF GEOGRAPHICAL  
INDICATION (GI) COFFEE FARMER TO ADOPT SINGLE ORIGIN (SO)  
PROCESSING SCHEME**

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Java Preanger coffee as GI product could not exist as expectation, rather than becoming unknown product creation both for farmer and consumer. The failing of Java Preanger coffee reacts regional government in search more applicable concept by issuing Multidimensional Action Plan (MAP), which tries to specify welfare-development agenda to assist the creation of more localized product with new trademark namely Single Origin (SO) trademark. Rather than GI, this conception allows freer on the norm each group. To run this new business model, government needs a pilot study as a benchmark before completing its implementation to all GI territories, due to major budget constraint. This paper aims to overlook at the factors affecting farmer's adoption followed by prioritizing strategies to develop program implementation. The study will divide farmer as an adopter or non-adopter to identify the choice vary between both, by operating logit model as a choice probability model, furthermore, prioritizing the strategy using Analysis Hierarchy Process (AHP). As a result, dominant factors affecting farmer on adoption vary from (1) GI knowledge, (2) socio-economic factor; age-gender-education level, training experience, land size, and yield per season, (3) geographic factor, (4) relative advantage of practice; cost, future profit, and time for profit, (5) collective action, and (6) farmer behavior, including (7) level of satisfaction of the program. For its effectiveness, these prioritized strategies to be done consecutively; (1) farmer institution improvement, (2) farmer technical skill development, (3) partnership building, (4), financial access support (5) marketing development, and finally (6) technology support.

Keywords: Geographical indication, coffee, farmer adoption, single origin (SO)

E2

[25]

## INVESTIGATE THE RELATIVE DISTRIBUTION OF PLANT NITROGEN IN DIFFERENT COMPONENTS OF ANCIENT WHEAT SPECIES AND MODERN BREAD WHEAT

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**Background:** One of the challenges faced by wheat breeders is to develop wheat cultivars that has high nitrogen use efficiency hence minimize pollution risk while maintaining farmers' revenue by producing acceptable yield. Minimizing pollution can be achieved either by applying low nitrogen fertilizer or improving plant uptake of nitrogen. **Objective:** Present study was conducted to compare plant nitrogen uptake and relative distribution in different plant components of four wheat species under three nitrogen fertilizer regimes. **Methods:** Two field experiments were conducted to study relative distribution of nitrogen in different plant components of ancient wheat species and modern bread wheat in 2013 and 2014 at Sutton Bonnington Campus, University of Nottingham, UK. They included cultivated einkorn (*Triticum monococcum* L.), cultivated emmer (*T. dicoccum*) and spelt (*T. spelta* L.), together with modern bread wheat (*T. aestivum*). Split-plot design was used to set up both experiments where nitrogen treatment was randomized on main plot and genotypes on the sub-plot with three replicates. **Results:** Straw, chaff and grain nitrogen percentage were significantly affected by genotype, nitrogen and genotype by nitrogen interaction for both experiments. Nitrogen percentage increased significantly with N supply for all components. The total plant nitrogen uptake (excluding root nitrogen uptake) was high in emmer under high nitrogen fertilizer while spelt had the highest total plant nitrogen uptake at low and zero nitrogen fertilizer applications in both experiments. In 2013, the highest straw and chaff nitrogen uptake was recorded in spelt species while grain nitrogen was high in emmer though bread wheat recorded to highest chaff and grain nitrogen uptake in 2014 under high level of nitrogen fertilizer. **Conclusion:** According to the results it can be concluded that ancient wheat species may have ability to uptake more fertilizer nitrogen and store in plant structures than modern bread wheat. However, modern bread wheat converts most of the uptake nitrogen towards the economic yield.

Keywords: Chaff nitrogen, nitrogen uptake, straw nitrogen, wheat species

E3

[26]

**COMMUNITY PERCEPTION OF WETLAND USE FOR SUSTAINABLE AGRICULTURE; CASE STUDY IN KADUWELA WETLAND, SRI LANKA***Navarathne W.R.M.D.P<sup>I</sup>\*, Dissanayake S.P<sup>1</sup>, Ginigaddara G.A.S<sup>1</sup>, Kekulandara K.K<sup>2</sup>*<sup>1</sup>Department of Agricultural Systems, Faculty of Agriculture, Rajarata University of Sri Lanka<sup>2</sup>Janathakshan (GTE) Ltd\*Email: [dinushinavarathne@gmail.com](mailto:dinushinavarathne@gmail.com)

Wetlands serve as valuable and adaptive natural infrastructure for agricultural development. This study is based on the choice of upland crop cultivations in the dry season of the urban *Kaduwela* wetland and structured questionnaire was administered to the farmers focusing on their upland crop cultivations. Data revealed that constraints in supportive services, irrigation issues, marketing problems and technological issue as the major risks and constraints. According to the results of binary logistic regression; land extent {Odds Ratio (OR)=0.387}, knowledge on environment friendly farming practices (OR=0.070), knowledge on traditional farming practices (OR=14.696), farming experience (OR=1.126), and access to extension services (OR=0.202) were recognized as significant factors ( $p<0.05$ ) influencing the upland crop cultivation whereas the occupation (OR=0.358) was significantly influencing at 10% significant level. Mixed cropping, intercropping, crop rotation, ridge and furrows, raised beds, incorporation of soil amendments and agroforestry practices are applied for upland crop cultivations and choice of majority of the farmers was to cultivate upland crops in the *Kaduwela* wetland area with these suitable agricultural coping strategies.

Keywords: Agriculture, upland crop cultivation, wetland



E4

[27]

**CHANGES IN ORGANIC ACID AND SUGAR CONTENTS OF JACKFRUIT  
(*Artocarpus heterophyllus* Lam) FLESH WITH MATURITY**

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Organic acids and soluble sugar levels, which are highly variable, have a greater impact on jackfruit flavour. This study aims to investigate the changes in levels of organic acids and sugars in the firm variety of jackfruit at different maturity stages. Four maturity stages of jackfruit flesh, including immature stage 1 (6-7 weeks), immature stage 2 (8-10 weeks), mature stage (12-14 weeks) and full ripe stage (14-16 weeks), collected from several jackfruit trees in the Western Province, Sri Lanka, were analyzed for organic acid and sugar contents using High-Performance Liquid Chromatography technique. Organic acid and sugar contents were significantly changed ( $p < 0.05$ ) with the maturity stages of jackfruit flesh. The citric acid content increased, with a range of  $0.03 \pm 0.00$  -  $0.30 \pm 0.01\%$ , while the levels of malic and tartaric acids decreased with maturity, ranging between  $0.07 \pm 0.00$  -  $0.03 \pm 0.00\%$  and  $0.08 \pm 0.00$  -  $0.19 \pm 0.00\%$ , respectively. Oxalic acid was not detected at any maturity stage. The levels of fructose and glucose in jackfruit flesh showed an increasing trend, ranging between  $0.22 \pm 0.03$  -  $3.04 \pm 0.02\%$  and  $0.31 \pm 0.13$  -  $2.69 \pm 0.16\%$ , respectively. Sucrose was not detected in the two immature stages, but it was the dominant sugar in the mature stage ( $1.04 \pm 0.04\%$ ) and fully ripen stage ( $5.32 \pm 0.93\%$ ). Maltose was not detected at any of the four maturity stages of jackfruit flesh. Results clearly indicated a significant difference ( $p < 0.05$ ) in organic acid and sugar contents at different fruit maturity stages of jackfruit flesh.

Keywords: *Artocarpus heterophyllus*, Jackfruit, maturity stage, organic acids, sugars

E5

[28]

**EFFECT OF COMBINED PLANT EXTRACT POSTHARVEST TREATMENT ON THE QUALITY OF ‘KARUTHAKOLUMBAN’, ‘WILLARD’ AND ‘KODIMA’ MANGOES IN JAFFNA**

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Mangoes are popular fruit crop in Sri Lanka and mango trees are found in most of the home gardens in Jaffna situated in northern region of Sri Lanka. However, postharvest losses of mangoes are high in Jaffna due to lack of suitable postharvest practices to minimize deterioration of fruits. Thus, aim of this study was to investigate low cost postharvest treatment on keeping quality of selected mango varieties. Mature ‘Karuthakolumban’, ‘Willard’ and ‘Kodima’ mangoes were harvested properly with 5 cm stalk. Stalk was removed carefully and fruits were washed in water. Air dried fruits were used for postharvest dip treatment. Combined plant extract solution was prepared with 0.5 ml of each 1% Aloe Vera, 1% onion, 1% neem leaf and 1% neem bark mixed with 98ml of water. These plants extract showed antifungal activity against the pathogens involved in stem end rot and anthracnose of mangoes. Twenty seven mangoes in three replicates in each variety were dipped separately in 2% combined plant extract solution and kept at ambient conditions. Another set of fruits of all three varieties dipped in water and kept as control. Mango fruits dipped in 2% combined natural extract solution and stored at ambient condition showed good results in terms of taste, appearance, storage life extension, low disease development and marketability. Among the treated fruits, marketability (89%) and storage life extension (6 days) were high in ‘Karuthakolumban’ and ‘Kodima’ mangoes respectively. Treated ‘Kodima’ mangoes were stored for 14 days without affecting quality while storage life of control ‘Kodima’ fruits was 8 days. There were no significant difference ( $p=0.05$ ) observed in total soluble solids, pH and moisture content of treated and non-treated fruits of all three varieties at ambient conditions. Treatments using plant extracts are chemical free, consumer safe and very useful for home garden growers.

Key words: Mangoes, postharvest treatment, marketability, storage life and quality

*Acknowledgements: Financial assistance given by NRC (grant No. 07/72) is gratefully acknowledged.*

E6

[29]

**INDIAN PROCESSED FOOD INDUSTRY – CURRENT STATUS AND FUTURE*****Raja Bai V.J\****

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The Food Processing Industry in India ranks fifth in size in the country and employs 19 per cent of the industrial labour force. India is a front ranking producer of perishable commodities. But processing is insignificant and still in the nascent stage of development. In spite of the fact that India is a leading producer of many basic food items in the world and her cost of production is one of the lowest, the processed products are not competitive in the global market. In terms of the current status of the food processing industry in India, domestic market for processed food is not fully developed and infrastructure is lacking for marketing fresh perishables. In India, in the post-liberalization era, import of processed food is increasing but export is remaining static. What is required of the Indian food processing industry is that infrastructure facilities need to be created around the government established, but not so far fully utilized food parks, in order to take care of the supply side of the food processing industry. Indian processed food industry has a huge challenge to increase the processing of perishables and provide significant growth to global trade by adding increased value to the end products. Ministry of Food Processing Industry (MOFPI) had drawn up a vision 2015 for trebling the size of the food processing industry. The study aims to highlight the current status of the food processing industry in India and probe into the causal factors which contribute to the problems of the industry. It also highlights the needs of the food processing industry in India with regard to the future. The study suggests the most effective ways of addressing the problems of the industry which would help in promoting the growth of the industry in the global scenario and also ensure food security and safety in the country.

Key words: Food processing industry in India, domestic market, global market, MOFPI

E7

[30]

**RICE YIELD AND SOIL HEAVY METALS DURING THE TRANSITIONAL PERIOD FROM CONVENTIONAL TO ORGANIC INPUT SYSTEMS**

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The debate of conventional and organic crops production always depicts concerns of food security against health and environmental concerns. The conventional agriculture maximizing its yield threatening human health and environment due to excessive use of agrochemicals. In contrary, organic systems result low yields threatening food security of many developing countries despite the safeness to human health and ecosystems. This study was designed to assess the yield changes of long evolving conventional to organic transition along with the heavy metal dynamics. Three systems a) conventional inputs (mineral fertilizer inputs) b) organic inputs (organic fertilizer inputs) and c) reduced inputs (substitution rates of mineral and organic fertilizer) laid-out on a split-plot design in alfisols in low country dry zone in order to test the performances of rice (*Oryza sativa* L.) Interestingly, conventional and reduced system were significantly different in mean seed yield ( $p < 0.05$ ) in major season, while mean yields were similar in the minor seasons. Rice mean yield with organic inputs were half of the yield of conventional in the major season, while the same was 1/4th in the minor season. Yields of conventional and reduced inputs were superior in minor season in contrast to the major season. In contrary, yield with organic inputs diminished almost by 0.5 tha<sup>-1</sup> from major to minor season. None of the tested heavy metals were above the permissible standards at the beginning of the study. The heavy metals uptake was proportionately substantial by crops in both seasons, however risk of contamination either by mineral fertilizers or by urban compost was not observed. The first set of data concluded that inefficiency of organic inputs in resulting greater yield in a short run, leaving gradual substitution of organic and mineral inputs as a viable solution of maintain food security. In addition, risk of heavy metal contamination by both mineral fertilizers and urban compost was minimum in short run.

Key words: Heavy metals, mineral fertilizer, organic fertilizer, yield

**FREE PAPER SESSION (P)**  
**POSTER PRESENTATIONS**

P1

[31]

**ANTIOXIDANT ACTIVITY AND PHYSICOCHEMICAL PROPERTIES OF *Carissa carandas* (L.) (Apocynaceae) DURING DIFFERENT MATURITY STAGES***Kasunmala I.G.G<sup>I\*</sup>*, Navarathne S.B<sup>1</sup>, Wickramasinghe I<sup>1</sup>

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**Background:** *Carissa carandas* (L) is a native fruit, which grows wild in bushes and fruits are generally consumed freshly in its all stages immature, matured and ripen. Physicochemical, antioxidant and sensory properties of fruits shows a significant different between each stage. **Aims/Objectives:** The aim of this study was to analyze the physicochemical and antioxidant properties at different maturity stages of the fruit and find the best maturity stage for commercialization. **Methods:** Fruits were collected from Galle, Sri Lanka and maturity stages were selected sorted according to the progressive fruit development by its colour change, MS1, immature - white colour, MS2, mature - red and white colour, MS3, ripen - reddish purple colour. Each maturity stage was randomly divided into two subgroups for antioxidant analysis and physicochemical testing. Antioxidant analysis was performed to freeze dried fruit samples. **Results:** Weight, volume, length, width, titratable acidity, total soluble solids and moisture content of fruits were increased while pH was decreased significantly ( $P < 0.05$ ) and color of the fruits in terms of lightness ( $L^*$ ) and yellowness ( $b^*$ ) were decreased significantly ( $P < 0.05$ ) while increasing the redness ( $a^*$ ) all through maturation. According to antioxidant activity variation, total phenol content value showed no significant different between immature and ripen stages but having with a slightly increment in mature stage. 2,2-diphenyl-1-picrylhydrazyl, ferric reducing antioxidant power and Oxygen radical absorbance capacity values were increased with maturation and ripening of *C. carandas* fruit. **Conclusions and Recommendations:** The study revealed that reddish purple ripen fruits contained significantly high amount of antioxidant activity and can be used as a natural antioxidant in food industry.

Key words: native fruit, purple colour, effect of ripening, bio assays

P2

[32]

**STUDY ON THE FUNCTIONAL PROPERTIES AND SENSORY EVALUATION OF THE INCORPORATION OF GREEN LEAFY VEGETABLES IN TRADITIONAL INDIAN MULTI GREEN SPICE MIX.**

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The process of dehydration of Green leafy vegetables (GLVs) not only preserves them for prolonged period but also can act as a rich source of micronutrients and phytochemicals for use as a healthy natural supplement in sparse season. *To prepare and study the functional properties of Multi-Greens Spice Mix* by incorporating 6 dehydrated GLV viz, Curry leaves - CL (scientific name – *Murraya koenigii*) Cilantro -CoL (*Coriandrum sativum*), Mint-ML, Fenugreek-FL (scientific name -*Trigonella foenum-graecum*), Drumstick-DrL (scientific name- *Moringa oleifera*) and Dill-DL (scientific name- *Anethum graveolens*) at different combinations. Standard and three variations of **Multi-Greens Spice Mix** were prepared by adding three greens at 6% in each variation (V1-CL, CoL & ML, V2- CoL, DrL & DL, V3-CL, FL & DrL). The products were analyzed for moisture, ash, iron and functional properties such as-bulk density, emulsification, water and fat absorption. The products prepared were subjected to sensory evaluation (Parameters - colour, flavour, texture, taste, after taste, appearance and overall acceptability) along with steamed rice cake, rice and clarified butter. Moisture content of the products ranged between 3.98%-9.58%, ash was high in curry leaves incorporated spice mix and iron content ranged between 20-38mg/100gms of mix. An increase in the bulk density, water and fat absorption was observed in drum stick leaves incorporated spice mix. *Multi-Greens Spice Mix* were acceptable compared to standard especially addition of drum stick and dill leaves enhanced the flavor of the spice mix. Since the GLV used were most commonly available in the local area with affordable price, the spice mix can be prepared at house hold level. As rich sources of phytochemicals the GLV incorporated products can be promoted commercially for both healthy and disease specific subjects.

Key words: Green leafy vegetables, Multi-Greens Spice Mix, phytochemicals, functional properties.

P3

[33]

**MORPHOLOGICAL VARIATION AND FRUIT QUALITY OF DIFFERENT VARIETIES OF BANANA IN JAFFNA**Abithanchani S. and *Krishnapillai N.\**

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Banana is an important tropical fruit crop which has high consumer demand in northern region of Sri Lanka. Banana cultivation mainly depends on different varieties of Banana including cooking type and dessert type. Morphological variation is important to determine the rate of photosynthesis and fruit yield. Morphology and fruit quality studies are the prerequisite to select suitable varieties for cultivation of banana. Thus, this study was aimed to investigate variation in morphology and fruit quality of different varieties of banana available in Jaffna. In this study, seven banana varieties with popular 'Kathali', 'Kappal' and 'Etharai' were selected and evaluated for morphological variations of leaves, inflorescences and fruits based on guidelines of the International Plant Genetic Resources Institute. High variation was observed for the qualitative parameters of leaf colour, male bud shape, rachis position, fruit shape and remains of flower relicts at fruit apex. There were significant difference ( $p=0.05$ ) observed in quantitative parameters of leaf length, thickness of leaf, stomatal density, peduncle length, fruit length, peel thickness and wax content of leaves of selected banana varieties. Wax content was observed to be high in 'Sambalmondan' and chlorophyll content of leaves was found to be high in 'Etharai' varieties. Fruit quality parameters such as percentage of edible portion, total soluble solids, pH, titratable acidity, moisture content, and ash content showed significant difference ( $p=0.05$ ) among the varieties. Total soluble solid was observed to be high in 'Etharai' variety. Attractive fruit peel with shiny red colour and highest edible portion were found in 'Red banana' (Sevvalai) variety. Firmness index was high in cooking type variety 'Sambalmondan' compared to other dessert varieties. Based on fruit quality parameters and taste panel results, evaluated varieties including 'Maruthuvam' were suitable as dessert varieties except 'Sambalmondan'.

Key words: Banana varieties, IPGRI, morphology, quality and taste panel



P4

[34]

## RAPID UP COMPOSTING AS A HOLISTIC APPROACH FOR FOOD AND YARD WASTE MANAGEMENT

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**Background:** Growth of population in the world is presently escalating at a rapid rate per year and anthropological activities cause severe environmental degradation such as pollution of air, water, soil, deforestation etc. Humans produce huge quantities of trash in food and agriculture industry and mostly it ends up in landfills. Landfills result in methane generation which can contribute to the greenhouse effect. Hence, developing composting systems and technologies is an important part for sustainable waste management. Compost is a stable, humus rich organic mixture resulting from the breakdown of organic components under aerobic conditions with the help of different microorganisms. **Objective:** To identify an efficient and effective technique that can be used to speed up the process of composting in sustainable waste management. **Methodology:** The mini project activities was conducted to improve composting unit in Sri Lanka Institute of Development Administration premises. Here we introduced a homemade microorganism medium to one compost pile and another one kept as reference. Both were prepared as heaps and piles had similar amount of dry browns, greens, aeration, moisture etc. Two compost piles were prepared by using brown leaves, vegetable waste in acceptable C: N ratio of 25:1. Then the microorganism medium was made by mixing yoghurts, yeast, about 6l of water and brown sugar and kept it for 3 days (for 1 pile). The mixture was applied to one compost pile in week after next week while manual turning. Piles were manually watered over a period of approximately 7 weeks. This mini project was conducted under the overall direction and guidance of senior consultant, Mr. Prasad Piyasena. **Results and discussion:** As microorganisms are vital to the composting process, we increased the number of compost microorganisms, mainly yeast, in piles to break down as quickly and efficiently as possible. Using yeast in compost enables bacteria in the compost to continue the decomposition process once cellulose in the organic material has been exhausted and this accelerates the compost process. It is recorded that the average temperature of tested pile is about 44 °C by using a temperature sensor. After 7 weeks, 95% of materials were decomposed in tested pile while other one remained for decomposition. Checking the temperature and turning compost piles is important as piles can get too hot or too cold. Almost any organic material is suitable for composting, but dairy and meat products cannot be composted. **Conclusions and Recommendations:** Rapid up the composting process an important role in building a resilient farming system, by providing both the nutrients sources and energy source to enhance and sustain soil biodiversity. Due to production costs and composting period of this method were low enough to make it as potentially profitable alternative to existing chemical fertilizers, while ensuring human health via food safety.

Key words: Rapid up composting, food safety, organic fertilizers, waste management



**FREE PAPER SESSION (V)**

**VIRTUAL PRESENTATIONS**

V1

[35]

**FORMULATION AND NUTRIENT ANALYSIS OF VITAMIN C ENRICHED RED WINE USING ROSELLE (*Hibiscus sabdariffa*) AND PEPPERMINT (*Mentha piperita* L.)***Purkait T\** and Pandey S

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Wine is considered as a functional fermented food which possess several health benefits. Much research has not been conducted yet to use wine as a vehicle for fortification. Therefore, the study has been undertaken focusing on improvement of the vitamin C content in red wine. Roselle (*Hibiscus sabdariffa*) and peppermint (*Mentha piperita* L.) extract were used for making the wine along with the main ingredients. Baker's yeast (*Saccharomyces cerevisiae*) was used for the fermentation process which was carried out for 28 days. Sensory evaluation was conducted in 9-point hedonic scale and mean scores showed the red wine variation with 10% roselle and 6% of peppermint extract (V2T3) was the best selected one. Mean scores of pH, SG and alcohol by volume % (ABV %) of V2T3 were 2.96, 1.006 and 10.73% respectively. The low pH content has made the microbial resistant and the alcohol content is also within permissible limits. It contains  $0.163 \pm 0.02$  gm/100 ml protein,  $2.667 \pm 0.21$  gm/100ml carbohydrate, and  $74.93 \pm 1.25$  mg/100ml GAE phenol,  $141.20 \pm 1.87$  mg of catechin equivalents/l flavonoid and  $0.0197 \pm 0.001\%$  of tannin. V2T3 contains 25.40mg/100ml of vitamin C whereas the standard red wine (T0) had only 1.91mg/100ml. The statistical F-test indicates that all the results are significant at 5% level. Shelf life study was done in two types of packaging (glass and PET bottles) for both T0 and V2T3. Results indicated that the microbial load is slightly on a higher side in PET bottle (bacterial count:  $40.7 \pm 0.6$  CFU/ml in glass bottle and  $45.7 \pm 0.6$  CFU/ml in plastic bottle; fungal count:  $13.0 \pm 0.0$  CFU/ml in glass bottle and  $13.7 \pm 0.6$  CFU/ml in plastic bottle at 6<sup>th</sup> week). Thus acceptable red wine is developed by fortifying it with roselle.

Key words: Fermentation, GAE, peppermint, phenol, roselle, wine, vitamin C

V2

[36]

**IMPACT OF FOOD PROCESSING ON *IN VITRO* PROTEIN DIGESTIBILITY OF LEGUME BASED WEANING FOOD**

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**Background:** Food processing procedures and the impact of embedment in food matrix can have various positive effects on protein digestibility by improving their protein quality. **Aims/Objectives:** To assess the protein digestibility of weaning food prepared from processed chickpea (*Cicer arietinum L.*) flour using infant protein digestion model. **Methods:** The chickpea (*Cicer arietinum L.*) was procured from the local supermarket of Mysore, Karnataka, India and germinated at room temperature for 12 h. After germination, it was dried at 45°C and milled into whole flour. Further, the proteins were extracted from the flour using a chaotropic buffer for identification. Porridge was prepared from the germinated chickpea flour, and was subjected to *in vitro* protein digestion using static infant digestion model. **Results:** Chickpea proteins such as 11S globulin,  $\alpha$ -TIP, and lectin were identified by SDS-PAGE. Simulated *in vitro* protein digestion suggested that, after 1 hr of gastric digestion, 46% of 11S globulin, the major protein present in chickpea, was hydrolyzed, as indicated by the intensity of the band at a molecular weight of approximately 19.7kDa. However, in the duodenal phase, it was completely hydrolyzed after addition of duodenal digestive proteases. Also, the anti-nutritional factor viz., lectins were degraded due to cooking at high temperature. **Conclusions:** In conclusion, the germination activates endogenous enzymes such as  $\alpha$ -amylase and phytase, which degrades anti-nutritional factors and hydrolyze complex macronutrients to their simple and easily digestible forms suitable for infants. Overall, processed weaning food indicated a higher level of protein digestibility during *in vitro* infant digestion as observed by SDS-PAGE.

Key words: Chickpea, Infant digestion model, weaning food, protein digestibility, germination, roasting

**Funding:** The study was funded by the UK Medical Research Council's Global Challenges Research Fund (MC\_PC\_MR/R019118/1)

## STUDY ON THE IMPROVED CROPPING PATTERNS IN AMAN – BORO – FALLOW BASED CROPPING SYSTEM

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Four improved cropping patterns, CP<sub>1</sub> = Transplanted Aman rice (cv. Binadhan-7)—Mustard (cv. Binasarisha-9)— Boro rice (cv. Binadhan-14); CP<sub>2</sub> = T.Aman (cv. Binadhan-16)— Mustard (cv. Binasarisha-10)— Boro (cv. Binadhan-14); CP<sub>3</sub> = T.Aman (cv. Binadhan-17)— Mustard (cv. Binasarisha-10)— Boro (cv. Binadhan-14) and CP<sub>4</sub> =T.Aman (cv. Binadhan-17)— Lentil (cv. Binamasur-8)— Sesame (cv. Binatil-3) were evaluated over farmers' existing pattern Aman – Boro – fallow to select the most suitable and profitable cropping pattern as well as to increase the cropping intensity by adding a pulse or oil seed crop between two rice crops. The investigation was conducted at the farmer's field of Magura during 2018-19. RCB design with 3 dispersed replications was followed for experiment set up. The results revealed that, maximum rice equivalent yield (REY) was obtained from CP<sub>1</sub> (14.46 t/ha) followed by CP<sub>4</sub> (13.52 t/ha), CP<sub>3</sub> (13.35 t/ha) and CP<sub>2</sub> (13.09 t/ha) during one year crop cycle. Highest gross margin (Tk. 1,90,189) and MBCR (1.83) was obtained from the cropping pattern CP<sub>4</sub> and the lowest gross margin (Tk. 84,138) and MBCR (1.26) was found with the pattern CP<sub>2</sub>. Based on the above results it can be concluded that, Aman rice— Lentil—Sesame pattern i.e CP<sub>4</sub> may be a best choice for the farmers of Magura region for the maximum utilization of their land and gaining more profit compared to the other studied cropping patterns.

Key words: Cropping pattern, cropping intensity, BCR, magura, BINA

V4

[38]

## BREADFRUIT – POTENTIAL FOOD SOURCE FOR FUTURE NUTRIENT AND HEALTH SECURITY

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**Background:** The food production has more than doubled over past five decades, yet significant percentage of population still lack access to optimal nutrition and more suffer from micronutrient deficiencies. Additionally there is also increase in prevalence of lifestyle disorders. Inclusion of traditional crops may be viable means for improving nutrient security. *Artocarpus altilis* (Breadfruit), a staple crop in tropical regions, coastal region of Southern India is less known species hence the scientific documentation on its nutritional composition and biological effects are scarce. **Objective & Methods:** The present study was undertaken to investigate the nutrient composition, identify the phytochemicals present in Breadfruit leaf, bark and fruit parts. Further, these were explored for their potential anti-hyperglycemic and anti-hypercholesterolemic efficacy. **Results:** The leaf, bark and fruit were good sources of nutrients especially carbohydrate, dietary fiber, minerals and protein. Leaf and bark showed higher concentrations of total polyphenols and phytochemicals such as flavonoids, alkaloids, tannins, saponins and glutathione. The HPLC analysis of 80% methanol extract of Breadfruit leaf showed presence Catechin and bark contained Catechin, Bergenin and Synergic acid. The leaf and bark exhibited anti-hyperglycemic ability by significantly reducing the hyperglycemic condition in STZ induced diabetic rats. In diet-induced hypercholesterolemic rats, the lipid profile and biochemical parameters of leaf treated group were near to normal levels and lower than the Statin treated group. **Conclusions:** Breadfruit is nutrient rich, exerts anti-hyperglycemic, anti-hypercholesterolemic and antioxidant potential. By virtue of its nutritional as well as biological effects Breadfruit can be promoted as nutrient rich food and functional food with potential health benefits.

Key words: Breadfruit, nutrient security, Anti-hyperglycemia, Anti-hypercholesterolemic effect, antioxidant.

## NUTRIENT PROFILE AND MACRONUTRIENT DIGESTIBILITY OF POPPED *EURYALE FEROX* SEEDS

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**Background:** *Euryale ferox* (*E.ferox*) is one of the aquatic cash crops grown in South East and East Asia. The seeds are edible and commonly consumed in the popped form. The seeds and the seed coat hold nutritional, medicinal and functional value. Limited literature is available on the macronutrient digestibility of the popped seeds. **Aims/Objectives:** The objectives of this study were to evaluate the proximate composition, mineral profile and digestibility of starch and protein popped *E.ferox* seeds. **Methods:** Popped *E.ferox* seeds were procured from the local market and were subjected to proximate analysis, evaluation of starch fractions, *in vitro* protein digestibility and mineral content. **Results:** Popped *E.ferox* seeds had a moisture content of  $10.37 \pm 0.22$  %. The seeds were predominantly rich in carbohydrates ( $79.38 \pm 0.43$  %) followed by protein ( $9.3 \pm 0.25$  %). The fat and total dietary fibre content was  $0.05 \pm 0.01$  % and  $1.02 \pm 0.15$  %, respectively. Starch accounted for 79.8% of the total carbohydrate. Majority of the starch fraction was rapidly digestible (42.2%). The resistant starch content was 37 %. The starch digestibility index was  $42.3 \pm 0.3$ . The seeds had considerable amount of phosphorus ( $118 \pm 0.03$  mg/100g). The potassium, sodium, calcium and iron content were 41 mg, 22 mg, 26.7 mg and 2.5 mg per 100g, respectively. The *in vitro* protein digestibility was found to be  $84.2 \pm 2.36$ %. **Conclusions:** Popped *E.ferox* seeds are rich source of carbohydrates and they can be an optimum choice for a food with good protein digestibility. Although the seeds are low in minerals, the low sodium and fat content adds therapeutic value of the popped seeds in planning sodium and fat restricted diets.

Key words: *Euryale ferox*, *in vitro* bio accessibility, starch, protein



## FARMACOECONOMICS OF BANANA PLANT WITH ZERO TILLAGE AND LEAST HUMAN INTERVENTION

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Globally, Banana is a popular fresh fruit next to Mango. It is rich in carbohydrates and potassium, the first choice of athletes due to its high energy potential. Vitamin C and carotene (pro-vitamin A), which are among the six vitamins included in the Recommended Daily Allowances of the Food and Nutrition Board of the National Research Council. Banana is also rich in B complex (B1, B2 and niacin) vitamins and antioxidants which reduces risk of neurodegenerative disorders, retards ageing process and helps in lowering the incidence of degenerative diseases, such as heart disease. It has also good export potential. Raw and ripened bananas have a characteristic array of bioactive compounds mainly phenolics, caretonoids, flavonoids and biogenic amines. Its year round availability, affordability, varietal range, taste, nutritive and medicinal value makes it the favorite fruit among all classes of people. In Karnataka (India) the market price of banana ranges Rs.30 to 60 /Kg which is beyond the purchase capacity of below poverty line community. The authors took up the pilot study to reduce the total cost of cultivation of banana with zero tillage and less human interventions to observe enhanced growth of the crop which contributed to the better growth. The parameters chosen for the assessment of plant growth are: Height of plant, Girth of plant, Average no. of leaves. Average flowering period, Average harvesting period, Average weight, yield, Water saved. Better crop performance is attributed to improved soil quality due to zero tillage and least human interventions which conserved soil quality.

Key words: Banana, growth, zero tillage, soil quality

