



# 2022 Proceedings of the 3<sup>rd</sup> National Symposium on Agro-Technology and Rural Sciences

*“Exploring Path for Sustainable Agriculture through Integrative Research”*

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## **NSATRS 2022**

University of Colombo  
Institute for Agro-Technology and Rural Sciences,  
Weligatta New Town, Hambantota, Sri Lanka

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*“Exploring path for sustainable agriculture through integrative research”*

*3<sup>rd</sup> National Symposium on Agro-Technology and Rural Sciences – 2022  
University of Colombo Institute for Agro-Technology and Rural Sciences – Sri Lanka*

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## **PROCEEDINGS OF THE 3<sup>rd</sup> NATIONAL SYMPOSIUM ON AGRO-TECHNOLOGY AND RURAL SCIENCES 2022**

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Telephone : +94(0)472034200

Fax : +94(0)472034261

Website : [uciars.cmb.ac.lk](http://uciars.cmb.ac.lk)

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## MESSAGE FROM THE VICE-CHANCELLOR

I am delighted to deliver this message at the Third National Symposium of the Agro-Technology and Rural Sciences (NSATRS 2022) as the Vice-Chancellor of the University of Colombo. I congratulate the Director and all academic members of the organizing committee, administrators, and students of UCIARS for the excellent team effort in piloting the NSATRS for the 3<sup>rd</sup> consecutive year amidst a lot of challenges prevailing within the country. Your chosen theme **“Exploring path for sustainable agriculture through integrative research”** enlightening the different disciplines; Innovations for Sustainable Agriculture, Smart Farming and Advanced Agriculture, Food Science and Technology, and Empowering Rural Community through Agribusiness and entrepreneurship personifies the Sri Lankan priorities in addressing food security as well as the rural development.



UCIARS is a center of excellence in the field of Agro-Technology and provides the needs of our country by creating scientists together with entrepreneurs for the betterment of Sri Lanka’s agricultural sector. The University of Colombo is indeed proud of the incredible development observed at the UCIARS, over a relatively short period, portrayed by a remarkable teaching-learning environment achieved with charm and simplicity.

This symposium provides a unique platform for researchers, entrepreneurs, innovative farmers and the industry to deliberate and discuss on the diverse areas of Agro-Technology. I expect that UCIARS will embark on a process of unveiling appropriate and sustainable discoveries, thereby converting the findings into practical applications for the farming community.

I wish you fruitful deliberations and scientific networking that would ensure this to be an annual event of UCIARS. Congratulations!!!

Senior Professor H. D. Karunaratne

Vice Chancellor, University of Colombo, Sri Lanka

## **MESSAGE FROM THE DIRECTOR**

I am delighted to issue a congratulatory message to the proceedings of the 3rd National Symposium on Agro-Technology and Rural Sciences (NSATRS 2022) as the Director of the University of Colombo Institute for Agro-Technology (UCIARS).



The conference is organized under the theme of “Exploring Path for Sustainable agriculture through Integrative Research”. Today, the agriculture environment is changing rapidly due to excessive use of inputs and environmentally unfriendly practices so the whole sector may face a huge threat in the near future. In this sense, sustainable agriculture becomes more important to protect the precious natural environment, maintaining agricultural productivity and profitability in the long run. The incorporation of rural and traditional knowledge into modern agricultural technologies through integrative research may play a vital role in this trajectory.

To make a common platform for researchers from various agricultural disciplines for eye-opening integrative research is the aim of this conference. Organizing such an event in the present situation of the country is challenging and it discloses our commitment towards the development of the agriculture sector.

I take this opportunity to extend my sincere appreciation and congratulation to the organizing committee, keynote speakers, paper presenters and the participants of the conference and wish them all success.

Dr. Asanga D. Ampitiyawatta

Director

University of Colombo Institute for Agro-Technology and Rural Sciences  
(UCIARS)



## **MESSAGE FROM THE CHAIRPERSON**

It is with great honor and privilege for me to convey this message on the occasion of Third National Symposium on Agro Technology and Rural Sciences 2022 (NSATRS 2022) on “Exploring Path for Sustainable Agriculture through Integrative Research”. The symposium will provide a comprehensive overview of the research conducted in the field of Agro-Technology over the past years.



Main purpose of organizing this symposium is to present research findings, dissemination of technology and formulation of future research program for increasing the agriculture productivity in perspective of national and global needs. The diversity of specializations and related themes will enable us to achieve our targeted mandate and vision. The hard work and dedication of all the members of organizing, scientific, technical and financial committees during the preparation for this symposium is highly appreciated. Without them the event would not have been possible. A note of appreciation is offered to the academia for their thorough and timely reviewing of the papers.

On behalf of the organizing committee, let me express my sincere gratitude to the Chief Guest of the event; Senior Professor H. D. Karunarathne, Hon Vice-Chancellor, University of Colombo, the Guest of Honor of the event; Senior Professor S. Subasinghe, Faculty of Agriculture, University of Ruhuna, Director of UCIARS; Dr. A. D. Ampitiyawatta, Keynote speakers of the symposium, Professor Paul A, Iji, Dean College of Agriculture, Fisheries and Forestry, Fiji National University and Emeritus Professor Upali Samarajeewa, Faculty of Agriculture, University of Peradeniya.

Most of all, I thank you, the presenters, for enriching the symposium by your presence. I congratulate to the organizing committee of the NSATRS 2022 and wish today’s symposium, a grand success.

Dr. N. P. Vidanapathirana

Symposium Chairperson / NSATRS 2022

## **MESSAGE FROM THE COORDINATOR**

It was my great pleasure to successfully organize the 3<sup>rd</sup> National Symposium of Agro-Technology and Rural Sciences (NSATRS) and to publish its proceedings. Indeed, there was a collective effort from all of us behind this success.



Recent research statistics revealed that growth of agricultural production has stalled. The yields of major grain crops grow by only about 1 percent per year, which is lower than the world population growth rate. Given that, expanding the cultivated area to fulfil the growing food demands is not a possibility, due to the increasing global population demanding more lands for settlement. On the other hand, agricultural production is reducing due to various reasons such as climate change. Therefore, increasing agricultural productivity is the only solution. I'm sure this research symposium will provide a platform to share and exchange expertise, experiences, and research findings. And will create a forum specially for young researchers to discuss the challenges and future directions in different agricultural research fields to enhance agricultural productivity of Sri Lanka.

Finally, I would like to express my sincere gratitude and appreciation for all reviewers who helped us maintain the quality of the research papers. And the members of the organizing team for their hard work, commitment, and dedication extended to make this a success. Further, I would like to pleasantly request you to put the knowledge gained from this symposium into practical action for the betterment of Agriculture in Sri Lanka.

Dr. D.M.C Champathi Gunathilake

Symposium Coordinator / NSATRS 2022

## **MESSAGE FROM THE SECRETARY**

It is a great honor for me to compile this message as the secretary of the 3<sup>rd</sup> National Symposium on Agro-Technology and Rural Sciences (NSATRS 2022). The University of Colombo Institute for Agro-Technology and Rural Sciences is now, for the 3<sup>rd</sup> consecutive year, congregating NSATRS 2022 on a timely important theme *“Exploring path for sustainable agriculture through integrative research”*. Considering the fact



that the Agriculture is the backbone of the economy of Sri Lanka, the NSATRS 2022 is organized with the main objective of bringing academics, researchers, and professionals in diverse subject areas to promote new horizons that foster enhanced agricultural performances through clean and smart agricultural concepts for ensuring global food security and rural development.

I wish to welcome and extend my thanks to all the respectable invitees, authors, participants, and all well-wishers, on behalf of the UCIARS. I take this opportunity to express my heartiest gratitude to all the members of the organizing committee of NSATRS 2022 as well as all the academic and non-academic staff of UCIARS who sacrificed their valuable time to make this event a great success.

The organizing committee believes time at the symposium would be more productive and would generate enthusiasm among communities to build the agriculture sector of Sri Lanka better. Hope and wish the NSATRS 2022 brings opportunities for all of us to gain new knowledge, reach new heights, and look forward to future endeavors in the agriculture sector in Sri Lanka.

U. R. Chandimala

Symposium Secretary / NSATRS 2022,

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# **INNOVATIONS FOR SUSTAINABLE AGRICULTURE**

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## **EFFECT OF FEEDING TOTAL MIXED RATION (TMR) BRIQUETTES ON THE NUTRIENT INTAKE AND DIGESTIBILITY IN EARLY LACTATING DAIRY COWS IN DRY ZONE SRI LANKA**

R.H.W.M. Karunanayaka, W.A.D. Nayananjalie\*, A.M.J.B. Adikari, M.A.A.P. Kumari, W.V.V.R. Weerasingha and S.C. Somasiri

*Department of Animal and Food Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Puliyankulama, Anuradhapura, Sri Lanka*

### **Abstract**

The excess forage available in rainy seasons can be preserved as total mix ration (TMR) briquettes, which provides long shelf life and more efficient feed delivery. Total mixed rations enhance feed intake and improve digestion in the rumen. Therefore, the present study aimed to evaluate feeding TMR briquettes on nutrient intake and digestibility of dairy cows under local conditions. Nine, crossbred dairy cows with an average body weight of 275±33 kg in the 3<sup>rd</sup> parity were selected and assigned randomly to three dietary treatments in a replicated, 3 × 3 Latin Square Design. The experiment was set up with three trials and each consisted of 35 days, followed by 14 days wash-over period. The three treatments were; control (CTL) guinea grass (*Panicum maximum*) with formulated cattle feed, TMR1, and TMR2. Both TMR1 and TMR2 were formulated using air-dried forages and agro-industrial by-products. Weight of offered and leftover diet and fecal output per cow was recorded during the digestion trial. The nutrient composition of the feed and feces were determined. Dry matter intake (DMI), fecal dry matter (DM) output and apparent nutrient digestibility were estimated. The DMI of CTL (6.796±0.21 kg d<sup>-1</sup>), TMR1 (7.059±0.21 kg d<sup>-1</sup>) and TMR2 (6.995±0.21 kg d<sup>-1</sup>) were not significantly different. The highest (p<0.05) DM digestibility was recorded in TMR1 (57.283±1.89%) and TMR2 (62.627±1.89%) compared to the CTL (43.946±1.89%). There was no significant difference in crude protein (CP) digestibility among the treatments. However, CP intake was significantly higher in TMR1 (0.819±0.02 kg d<sup>-1</sup>) and TMR2 (0.801± 0.02 kg d<sup>-1</sup>) compared to CTL (0.639±0.02 kg d<sup>-1</sup>). Among the treatments, organic matter and neutral detergent fiber (NDF) intake were similar. A lower acid detergent fibre (ADF) intake was (p<0.05) reported in cows fed with CTL diet compared to TMR briquettes. The digestibility of ADF and NDF was higher (p<0.05) in TMR2 (61.701±2.1%, 65.572±1.8%) compared to TMR1 (49.129±2.1%, 58.165±1.8%) which in turn was higher than CTL (41.594±2.1%, 41.819±1.8%), respectively. The study revealed that feeding of TMR briquettes increases the nutrient intake and digestibility of the early lactating dairy cows compared to the typical fresh-cut forage plus concentrates diet in the dry zone, Sri Lanka.

Keywords: Dry zone, Nutrient digestibility, Nutrient intake, TMR briquettes

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## **EFFECTS OF DIFFERENT WEEDY RICE CONTROL METHODS ON AT362 IN AMPARA DISTRICT**

K. M. Aafir\*, H. Rohanadheera and M.S.A. Kalees

*Department of Agro-Technology, University of Colombo Institute for Agro-Technology and  
Rural Sciences, Hambantota, Sri Lanka*

### **Abstract**

Weedy rice is the rice weed that mostly collapses the farmer's to identify rice from weedy rice at their early stage in the paddy field, and it leads to increase cost of cultivation since both crop and weed are fighting for nutrients, water, space etc. The lack of a selective herbicide or other effective means to manage weedy rice has made its control a national priority. Hence, considering this, an experiment was conducted to evaluate the effects of different weed control methods in paddy fields by controlling the weedy rice population to enhance the growth and yield of paddy in the Ampara district. It is one of the prominent problems in Sri Lanka, and farmers are suffering from the high cost of production. With five treatments and four replications, the trial was set up in a randomized complete block design. The treatments were as follows: T1-Control, T2-Hand weeder, T3-Mechanical weeder, T4-Herbicide, and T5-Hand weeding. The parameters of plant number, tiller number, panicle number, panicle length, spikelet number, filled grain, and 1000 seed weight were evaluated for both paddy and weedy rice at the same time. SAS 9.1.3 statistical software was used to analyze the acquired data, and DMRT was used to conduct the mean separation at a significance level of 5%. The data revealed that for plant height in paddy, T5 was recorded as the maximum valued one and showed a significant difference ( $p < 0.05$ ) with all other tested treatments. In the infilled grain of paddy, T3 and T5 showed significant differences ( $p < 0.05$ ) with T4 and T1, and the maximum value was recorded for T3 and T5 (205.75 and 223.50). In the 1000 seed weight test, T5 was recorded as the maximum value (27.47 g) and showed a significant difference with all other treatments. At spikelet number, panicle length, and filled grain, T5 showed lowest value and showed a significant difference with all other treatments. It was concluded that Hand weeding performed better to eradicate the weedy rice population at the field level.

Keywords: Growth, Paddy, Weed control, Weedy rice, Yield

## **TYPES OF PLANTS USED FOR INCREASING THE AESTHETIC VALUE OF LANDSCAPE DESIGN**

J. Piruntha and N. Dahanayake\*

*Department of Agricultural Biology, University of Ruhuna, Kamburupitiya, Sri Lanka*

### **Abstract**

Since ancient times, the landscape has been one of the most beautiful and widely practiced artworks that express culture and development. Landscape aesthetics can be defined as the happiness and pleasure derived from observing natural scenery. Physical characteristics of plants like texture, size, shape, color, and flowering behavior provide aesthetic appeal to the landscaping. Landscape plants on buildings, roadsides, and the path will reduce heat, increase cold air infiltration and reduce pollution. Landscape plants are classified as annual, biennial, herbaceous perennials, shrubs, trees, climbers, cactus, and indoor and ornamental plants. Annuals are used for flower beds as simply arranged on or along the building base, within the entrance path. For example, Petunia, Impatiens, and Marigold can be used. Some annuals are helpful as edging such as Dwarf marigold, Alyssum and Candytuft, hanging baskets (Verbena, Petunia, and Alyssum), massing in beds (Phlox, Zinnia, Salvia, and Verbena). Mostly, shrubs are attractive in their foliage and some plants produce colorful flowers. They are Azaleas, Hydrangeas and Rhododendron. Edges may be established in the landscape for dividing roads, walks, or paths of demarcating areas allocated for specific purposes, such as flower beds. They can be established as foliage plants (*Alternanthera*, *Coleus sp*, *Echeveri*) and flowering plants (*Gerbera*, *Amaryllis*, *Zephyranthes*). Trees create attractive and colorful flowers together with odoriferous flowers. Few species are used for their attractive foliage (*Albizia lebbek*). Trees also are planted on the borders of roads for giving shade (*Terminalia arjuna*, *Saraca indica*). Deciduous trees are established in the landscaping, making it easier to cool in the hot season (*Cassia nodosa*, *Delonix regia*). Climbers can be used in landscape design on arches and walls (*Allamanda*, *Antigonon*). Some are trained as screens (*Bignonia venusta*, *Passiflora edulis*). Some climbers like *Bougainvillea*, and *Philodendron* are grown on strong structures and on trees that look very attractive. Cactus can be used in landscaping by attractive characteristics like shape, flowers, spines, or hairs. *Opuntia microdasys*, *Parodia magnifica* are examples of flowering type cactus. The aesthetic value of landscape design can be increased by different kinds of plants by their attractive look and environmental benefits.

Keywords: Aesthetics, Annuals, Landscape, Shrubs, Trees

## **THE TRANSITIONAL CHANGES OF RICE CROP (*Oryza sativa*) FROM CONVENTIONAL TO ALTERNATIVE NUTRIENT MANAGEMENT SYSTEMS IN THE DRY ZONE OF SRI LANKA**

W. M. D. M. Wickramasinghe<sup>1</sup>, W. C. P. Egodawatta<sup>1\*</sup>, D. A. U. D. Devasinghe<sup>1</sup>, T. D. C. Priyadarshani<sup>1</sup>, D. I. D. S. Benaragama<sup>2</sup> and L. D. B. Suriyagoda<sup>3</sup>

<sup>1</sup>*Department of Plant Sciences, Faculty of Agriculture, Rajarata University of Sri Lanka, Anuradhapura, Sri Lanka*

<sup>2</sup>*Department of Plant Sciences, University of Saskatchewan, Saskatoon, Canada*

<sup>3</sup>*Department of Crop Science, Faculty of Agriculture, University of Peradeniya, Sri Lanka*

### **Abstract**

Alternative nutrient management methods are important to avoid the adverse effects due to conventional mineral fertilizer application. Organic and integrated nutrient management systems are prominent alternative systems. Due to the transitional time for converting a conventional system to an alternative, and with impacts of pests, diseases, weeds, low crop performance and reduced yields, the focus of farmers on alternative farming methods not encouraging. This study was designed to determine the crop nitrogen, biomass, yield, weed biomass and disease incidences during the first year of transitional changes (Wet 2018/19 and Dry 2019) of an alternative nutrient management. The experiment consisted of three nutrient management systems, which were, Conventional system – 100% N applied as inorganic fertilizer application based on recommended by the Department of Agriculture (DOA) 2013, Integrated system - 50% N supply with inorganic fertilizer and 25% N supply with organic fertilizer application, respectively as of the conventional and organic systems, Organic system - No inorganic fertilizer was added and organic manure was applied to satisfy the 50% N amount of the conventional system. The Bg300 rice variety was used as the model crop and the systems were arranged as randomized complete block design with six replicates. Low N%, high weed density and high RBLs disease incidences in the wet 2018/19 season affect low crop biomass and yield. Variation of wet seasons refers to Rice Brown Leaf spot (RBLs) disease incidences, while crop performances and yield of the dry season were not dependent on RBLs. According to nutrient management practices, the organic system reported lower N%, high weed biomass and disease incidences. The crop biomass and yield of the integrated system resulted significantly equal values compared to the conventional system in both seasons and the organic system had the lowest crop biomass and yield. The N, weed and RBLs disease incidences were differed with conventional and integrated systems, crop biomass and yield were significantly similar under conventional and integrated systems with both wet and dry seasons.

Keywords: Conventional, Crop production, Crop protection Organic, Integrated

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## **APPLICATION OF MORINGA LEAF POWDER EXTRACT AS A PLANT GROWTH AND YIELD ENHANCER ON *Capsicum annuum* L. (VAR. MI GREEN)**

P. Tivojan<sup>1</sup>, M. Anusiya<sup>1\*</sup> and S. Rajeshkanna<sup>2</sup>

<sup>1</sup>*Faculty of Technology, University of Jaffna, Kilinochchi, Sri Lanka*

<sup>2</sup>*Regional Agriculture Research and Development Centre, Kilinochchi, Sri Lanka*

### **Abstract**

The study was carried out on the farm of Regional Agriculture Research & Development Centre, Iranaimadu Junction, Kilinochchi from the period December 2020 to April 2021 to evaluate the application of moringa leaf powder extract as plant growth and yield enhancer on *Capsicum annuum* L. var. MI green. The study was laid out in a Randomized Complete Block Design (RCBD) with three replicates. Six different concentrations of the moringa leaf powder extract (MLE): T1– MLE 20%, T2– MLE 40%, T3– MLE 60%, T4– MLE 80%, T5– MLE 100% and T6–0% (control -distilled water) are used for treatments. Foliar application of MLE was sprayed one week after transplanting (WAT) and continued until pod formation. Results of the growth parameters indicated that T5 (MLE 100%) showed significantly highest performance with the height of the plant, the number of leaves per plant, leaf length, leaf width and the number of branches per plant. Similarly, for yield attributes, T5 (MLE 100%) also produced the highest pod length (9.92cm), pod diameter (9.80mm), individual pod weight (3.38g) and yield (14.769 tons per hectare). It can be concluded that the application of Moringa leaf powder extract as plant growth and yield enhancer on *Capsicum annuum* L. It was recommended that farmers should adopt the foliar application of MLE 100% for increases in yield of *Capsicum annuum* L. The Moringa leaf extract as a plant growth promoter is inexpensive, environmentally safe and low-cost technology to improve the yields of the small scale farmers.

Keywords: Chilli, Foliar Application, Growth Promoter, Moringa Leaf Extract

## ***Oreochromis niloticus* AND *Cyprinus carpio* INTEGRATION WITH ORGANICALLY GROWN PADDY: *Oryza sativa* (AT362)**

R.T. Lokuhetti<sup>1</sup>, H.K.R.S. Kumara<sup>1\*</sup>, K.S.S. Atapaththu<sup>2</sup> and S.S. Herath<sup>3</sup>

<sup>1</sup>Department of Agrotechnology, Institute for Agrotechnology & Rural Sciences, University of Colombo, Weligatta

<sup>2</sup>Department of Limnology & Water Technology, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara

<sup>3</sup>Department of Fisheries and Aquaculture, Faculty of Fisheries and Marine Sciences & Technology, University of Ruhuna, Matara

### **Abstract**

This experiment was conducted to examine the impact of rice fish integration on rice fish productivity using *O. sativa* (AT 362), *O. niloticus*, and *C. carpio*. The four treatments in the RCBD were as T1: Paddy + Tilapia(T), T2: Paddy + Carp (C), T3: Paddy + (Carp and Tilapia, (C+P; 1:1 ratio) and T4: Paddy only (Control). Each treatment with three replicates was randomly allocated into twelve experimental plots (4 × 4 m<sup>2</sup>). Planting space was 25cm, with 60 fingerlings per plot. Initial fish weight and length were 1.11g and 4.21cm respectively. The experiment lasted 105 days. Fish were given commercial diet at 5% body weight per day. Plant growth was monitored every 14 days. Manual weeding was done. Fish were harvested at the end of experiment. The number of leaves per plant was significantly higher in paddy cultivated with *O. niloticus*, but there was no significant difference ( $p > 0.05$ ) in plant height among the different treatments. The plants grown with *O. niloticus* showed the highest number of tillers followed by (T+C), carp (C), and control treatment respectively. There was a significant difference ( $p < 0.05$ ) observed in collar width of plants, where *O. niloticus* integrated two treatments had the highest value. The highest number of panicles per plant was also found in *O. niloticus* treatment followed by mix (T+C), carp (C), and control respectively. The weight of *O. niloticus* was significantly higher than that of *C. carpio*. Root area diameter (RAD) was ( $p < 0.05$ ) significantly affected by the fish integration where the highest RAD was found in tilapia integrated treatments. Reproductive and feeding behaviour of tilapia could explained the increased RAD, which ultimately increased the nutrient uptake and consequently a higher yield. Average final weight of *O. niloticus* grown in T and T+C treatments were  $111.3 \pm 3.8$  g and  $109.6 \pm 3.1$  g respectively. The highest survival rate of fish among treatments was observed in *O. niloticus* (75.6 %). According to present findings, it can be recommended to integrate *O. sativa* (AT362) with Nile tilapia (*O. niloticus*).

Keywords: *C. carpio*, Growth, *O. niloticus*, Rice-fish integration, yields

## **MEDICINAL VALUE OF WEEDS**

T.M.N.P. Thennakoon and N. Dahanayake\*

*Department of Agricultural Biology, University of Ruhuna, Kamburupitiya, Sri Lanka*

### **Abstract**

A weed is any plant growing where it is not wanted or interfering with the cultivated crops. Major weeds flora in the world is dominated by the family Amaranthaceae. Other than that, they also belong to Euphorbiaceae, Fabaceae, Malvaceae, Solanaceae, Poaceae, Cucurbitaceae, Pedaliaceae, Rubiaceae, etc. One of the most serious issues in agriculture is weeds that show inter-specific competition and allelopathy for their key growth necessities. They quickly disseminate in a large area, resulting from direct and indirect losses in both quality and quantity of the production. Due to the above negative facts, a man is unfamiliar about the benefits of the weeds. Their medicinal value is the major unseen part. The great biodiversity and endemism of forests make them the most promising habitat for weeds. So, it leads the scientists to discover natural medicinal plants in the forest to maximize the effective pharmaceutical product development. But because of the government's forest policy, collecting medicinal plants from the forest is now quite difficult. Therefore, man has to obtain those values without disturbing their natural habitats in their ecosystem. According to global estimates, more than three-quarters of the world's population cannot afford allopathic medication and have to rely on traditional medicines. Therefore, The World Health Organization encourages, promotes, and facilitates the effective use of weed-derived herbal medicine in healthcare programs. *Alternanthera sessilis*, *Centella asiatica*, *Commelina benghalensis*, *Cynodon dactylon*, *Eclipta alba*, *Marsilea quadrifoliata*, *Oxalis corniculata*, *Phyllanthus niruri*, *Portulaca oleracea*, *Solanum nigrum*, *Solanum trilobatum*, *Trianthema portulacastrum*, and *Tridax procumbens* are some of the most often used medicinal weeds. Burns, cuts and wounds, poisonous bites, and skin diseases are some external problems, and diabetes, jaundice, constipation, diarrhea, fever, hepatitis, headache, cough, and sexual tonic are some common internal problems that medicinally weeds are normally used. Meantime some chemical compounds such as alkaloids, glycosides, polyphenolics, steroids, tannins, resins, flavonoids, tetraploids, and fatty acids are used in curing nutritional disorders and diseases. Therefore, Beneficial weeds should be identified with care by agriculturists and weediologist. They must take care of them and finally have to preserve and proliferate medicinally valuable weeds.

Keywords: Diseases, Medicine, Weeds

## **IMPACT OF TEMPERATURE VARIABILITY IN AQUACULTURE IN BATTICALOA DISTRICT**

V. Sujanthika<sup>1\*</sup> and S. Senthuruvan<sup>2</sup>

<sup>1</sup>*Department of Biosystems Technology, Faculty of Technology, South Eastern University of Sri Lanka, Oluvil, Sri Lanka*

<sup>2</sup>*International College of Business and Technology, Batticaloa, Sri Lanka*

### **Abstract**

Coastal areas involve much for the Sri Lankan economy from areas such as agriculture, fishing, trading and tourism. Batticaloa district was major part of national Gross Domestic income from costal area. With fluctuating temperatures during the past decade, fish feeds, migratory, and breeding habits were directly impacted, while changes in their physical habitat had an indirect impact on growth, mortality, and reproduction. Minimum and maximum temperature, inland fish production and marine fish production data during last 10 years (2010- 2019) were used in this study. Mann- kendall statistics which is one of the non- parametric tests was used for detecting trends of climatic factors illustrating a trend of time series. Sen's slope techniques were used to determine the size of the trend in this study. Maximum temperature increased by 0.58 in annual temperature, and minimum temperature increased by 0.12 each year throughout the ten years, while marine fish output decreased during the studied time period In this region, there has been a downward tendency in marine productivity. Actions at the national policy level are relatively recent, compared to policy formation at the ground level. In Sri Lanka, the concept of addressing climate change-related issues through policy is still in its infancy, but it has the support of the government.

Keywords: Aquaculture, Climate change, Mann- kendall, Policy, Trent



## **DESTRUCTIVE FISHING PRACTICES AND THE NECESSITY OF REFORMATION OF LAWS IN NORTHERN PROVINCE, SRI LANKA**

A.G.S.D. De Silva<sup>1\*</sup>, M.A. Samarasekara<sup>2</sup> and R. Thusyanthini<sup>1</sup>

<sup>1</sup>*Sri Lanka School of Agriculture, Department of Agriculture, Paranthan, Sri Lanka*

<sup>2</sup>*Cinnamon Hotel Management Ltd., Colombo 03, Sri Lanka*

### **Abstract**

Destructive fishing techniques are causing severe negative impact on the marine ecosystem in terms of marine biodiversity and benthic habitats, sustainability of target fish and their population dynamics and social and economic viability of local fishing communities in Northern, Sri Lanka. The major causes for destructive fishing in northern region is the growing population increasing the demand for fish, lack of alternative jobs for early dropout school children, increased gear efficiency, policy failure of existing laws, poaching by Indian and Sri Lankan southern migratory fishers. The dynamiting, bottom trawling, monofilament net, stake net, brush pile fisheries, purse seines and scuba diving have been identified as the most common destructive fishing practices in the northern region, and their damages the marine ecosystem are irresponsible. Many destructive fishing practices are unintentionally killed the target and non-target both fish and other marine organisms, hamper to local fishing activities, especially operations of gill nets and fiber plastic boats and threaten to environmentally sensitive marine ecosystems such as extensive fishing coral reefs, seagrass beds, coastal lagoons, estuaries, sea sponges, mangroves, salt marshes that are highly restricted to northern, Sri Lanka. Fisheries and Aquatic Resources Act No.2 of 1996 as amended by the Ministry of Fisheries and Aquatic Resource and Fauna and Flora Protection Ordinance were indicated five fishing methods and harmful materials in Sri Lanka namely fishing with moxi nets and trammel nets, application of push nets for fishing, harpooning of marine mammals such as dugong, whales and dolphins, fishing with gill nets in corals or rocky areas and usage of monofilament nets that are prohibited, while describing penalties for any violations. However, the Fisheries Act has not clearly indicated the destructive fishing methods that are not permitted within territorial water in Sri Lanka and it has been not clearly mentioned the penalty system for usage of destructive fishing techniques. Many researchers have shown those existing legal regimes were not strengthening to control the destructive fishing practices, and there were many loopholes in Sri Lankan legislation. Therefore, this article reviews the necessity of law reformation to control the destructive fishing practices in northern Sri Lanka.

**Keywords:** Destructive fishing, Ecological impacts, Fishing communities, Legislation, Northern Province.

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**GROWTH AND YIELD PERFORMANCES OF *Evolvulus alsinoides*.  
Linn (VISNUKKRANTHI) AS AFFECTED BY DIFFERENT  
METHODS OF IRRIGATION AND WEED MANAGEMENT**

P.G. Samarawickrama<sup>1</sup>, S.L. Nawarathna<sup>1\*</sup>, S. Subasinghe<sup>2</sup>. and N.P. Vidanapathirana<sup>1</sup>

<sup>1</sup>*Department of Agro-Technology, Institute for Agro-Technology and Rural Sciences,  
University of Colombo, Sri Lanka.*

<sup>2</sup>*Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka.*

**Abstract**

*Evolvulus alsinoides* Linn is extensively used as traditional medicine in various culture including Sri Lanka. It is commonly known as ‘Vishnukranthi’ and it widely use for various pharmacological activities due to its chemical constituents. Therefore, Sri Lanka spend huge amount of foreign exchange for herbal raw material importations, because of no systematic cultivation has been developed so far even though this plant can be seen in natural habitat. Preliminary studies showed that weed management and irrigation as serious constraints for mass scale cultivation. So, this study is focused on identification of appropriate weed management method and irrigation system for mass scale cultivation. Experiment was designed according to split plot design with 03 replicates. According to that two main plots as Manual Irrigation (M1) and Sprinkle Irrigation (M2). Also five sub plots as control treatment (T1), polyethene mulching (T2), rows seeding and use weeder for weed management (T3), two inter cultivation after bed preparation before planting in weekly interval (T4) and transplanting (T5). Sprinkler irrigation or manual irrigation are not significantly affected to the *Evolvulus alsinoides* Linn cultivation while weed management practices significantly alter the yield and growth parameters of the *Evolvulus alsinoides* Linn. Transplanting was showed highest significant plant growth, no. of leaves and no. of branches. Also, polyethene mulching, rows seeding and use weeder for weed management, two inter cultivation after bed preparation before planting in weekly interval and transplanting are showed significantly highest fresh weight, dry weight and root weight. Therefore research concluded that, all four weeding methods are positively impacted on harvest.

Keywords: Commercial production, *Evolvulus alsinoides* Linn, Irrigation system, Weed management

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# **SMART FARMING AND ADVANCED AGRICULTURE**

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## **PRELIMINARY STUDY ON PERFORMANCE OF STRAWBERRY (*Fragaria* species) UNDER CONTROLLED ENVIRONMENTAL CONDITIONS WITH DIFFERENT ROOTING MEDIA IN DRY ZONE**

M.V. Weeraman<sup>1\*</sup>, H.M.C.M. Jayawardena<sup>2</sup>, and L. Pradheeban<sup>1</sup>

<sup>1</sup>*Department of Agronomy, Faculty of Agriculture, University of Jaffna, Sri Lanka.*

<sup>2</sup>*Agriculture Research Station, Rahangala, Sri Lanka*

### **Abstract**

Strawberry (*Fragaria ananas*), is a highly demanded and sweet tasted commercial crop grown in temperate regions belonging to the family Rosaceae. Micro-climate around the plant is very important to successful growth in tropical regions. Strawberry cultivation is also possible in dry zone under controlled conditions with day temperature 23-28°C and night temperature 5-10°C are ideal. This was manipulated in the research study area around 30°C in the day time and 23°C in the night time. This research was conducted to study the impact of different rooting media on the performance of strawberry cultivar; Camarosa which is a short-day variety adapted to warm climatic conditions. The treatments were T<sub>1</sub> (50% Compost + 50% Top Soil), T<sub>2</sub> (50% Compost + 50% Coir Dust), T<sub>3</sub> (50% Compost + 50% Sugar Bagasse) and T<sub>4</sub> (50% Compost + 50% Half Burnt Paddy Husk). It was arranged in Completely Randomized Factorial Design and treatments were repeated ten times among four treatments. Average plant crown diameter, Average number of runners per plant, the average number of leaves per plant and flowering %, and determination of nitrogen, phosphorus, potassium, organic matter content (%) through chemical analysis was obtained as data. Data was subjected to analysis using SAS 9.1 version and Duncan Multiple Range Test (DMRT) mean separation was done to determine the suitable treatment (rooting media combination) for strawberry cultivation under controlled conditions in dry zone. Results revealed that, maximum crown diameter (10.93 mm) by T<sub>3</sub> and minimum (7.20 mm) at T<sub>2</sub>. A maximum number of strawberry leaves (4.6) obtained by T<sub>1</sub> and minimum (1.3) was observed in T<sub>4</sub>. Runners resulted as an average of three runners per plant in November increasing to five in January. Flower bud initiation was started in December 2021 and it was continued until the end of January 2022. The highest amount of nitrogen (31.5 ppm) was recorded in T<sub>3</sub> and phosphorus (32.5 ppm), and potassium (86.8 ppm) were recorded in T<sub>2</sub>. The organic matter percentage (34.7%) was highest in T<sub>3</sub>. It can be concluded that strawberry plants were performed best with 50% Compost + 50% Sugar Bagasse (T<sub>3</sub>) treatment in 1:1 ratio among different rooting medium for the growth and quality attributes of strawberry.

Keywords: Compost, Dry zone, Rooting media, Strawberry, Sugar bagasse

## **PLANT SURVIVAL RATE OF *Oryza rufipogon* ASSESSED BY RECIPROCAL COMMON GARDEN EXPERIMENT**

P. Wijerathna<sup>1</sup>, S. Sandamal<sup>1,2</sup>, A. Tennakoon<sup>3</sup> and D. Ratnasekera<sup>1\*</sup>

<sup>1</sup>*Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Sri Lanka*

<sup>2</sup>*State Key Laboratory of Systematic and Evolutionary Botany, Institute of Botany, Chinese Academy of Sciences, Beijing, China*

<sup>3</sup>*Department of Biosystems Technology, Faculty of Technology, Eastern University, Sri Lanka*

### **Abstract**

The *Oryza rufipogon* Griff. is a perennial and widely distributed progenitor of Asian cultivated rice. Wild populations of *O. rufipogon* show the sympatric distribution with annual *O. nivara* in many parts of the globe. Sri Lanka has allopatric distribution throughout the island, offering a unique working environment for studying speciation and adaptation. This study focused on determining the ability of local adaptation and speciation by comparing the plant survival rate of *O. rufipogon* in native (Wet zone) and introduced (Dry zone) environments. Reciprocal common garden experiment was conducted in both low country dry zone (DL5), Hambantota and low country wet zone (WL1a), Akuressa of Sri Lanka. Each site included three replicated plots consisting of 30 individuals per plot. Growth parameters were recorded over a period of one year. Plants were irrigated in the first six months after transplanting. In the remaining period, plants were left in its natural condition to investigate the species' survival rate. The results indicated that *O. rufipogon* in WL1a shows the highest survival rate (92%) whereas in DL5 a comparatively low survival rate (83%) was reported before flowering under irrigated conditions. After converting the irrigated field to natural conditions, surviving plants died gradually in DL5. After one month and two months under natural conditions, plant survival rates in DL5 were 80% and 63%, respectively. Plant survival rates were statistically significant after three months and four months under natural conditions when compared to that of the WL1a (independent t-test). The plant survival rate of *O. rufipogon* under location-specific conditions in wet and dry zones in Sri Lanka was distinguishable. Conclusively, *O. rufipogon* has a lower ability to survive in the dry zone. Their adaptability to local conditions is also extremely limited. Thus, advanced systematic approaches are required to assess speciation and adaptation in this wild taxon.

Keywords: Adaptation, Speciation, Sri Lanka, Survival rate, Wild rice

## **THE EFFECT OF GAMMA RADIATION IN AGRICULTURAL CROPS**

S.C.N. Jayaweera, N. Dahanayake\* and P. Javundirarasa

*Department of Agricultural Biology, University of Ruhuna, Kamburuitiya, Sri Lanka*

### **Abstract**

The Gamma ( $\gamma$ ) radiation is an environmentally vital form of ionizing radiation as it is able to damage the macromolecules such as DNA, proteins, and lipids due to its excessive frequency, short wavelength, and high energy photons. In this review, we report the main results from studies on the effect of  $\gamma$ -irradiations on plants, focusing on mutagenesis, modifications of growth and development, seed germination, and changes in biochemical pathways especially physiological behaviour. Gamma irradiation is one of the main physical mutagens and it is capable of hydrolyzing chemical bonds, thereby bud wood can produce higher frequencies of mutation. Such exposures lead to stimulated new desire characters viz. semi-dwarf growth, self-compatibility, self-thinning, early maturity, fruit color, high yields, and disease resistance. Gamma irradiation can hydrolyze chemical bonds and cleave big molecules into smaller fragments that can be electrically charged or uncharged in the cells as free radicals. These radicals can damage or modify key components of plant cells, as well as change one or more physiological and biochemical characteristics that affect plant cellular structure and metabolism, such as thylakoid membrane dilation, anti-oxidative system modulation, photosynthesis alteration, and phenolic compound accumulation. In addition, gamma irradiation can stimulate specific morphological parameters and may increase the plant yield through the growth, development and ability to withstand everyday stress factors such as temperature, water, and light intensity. Even though, higher doses of  $\gamma$ -rays showed inhibitory effect toward seed germination and seedling growth, low gamma dose exposure elevated the germination percentage in seeds. Despite the fact that gamma radiation is a technology with immense applications in agriculture, its potential use is still limited, largely due to lack of information awareness about optimal radiation doses that vary from crop to crop. A comparison of various studies revealed how the effects observed after exposure were strongly influenced by several factors. Some are related to plant characteristics (species, varieties, stage of development, genomic composition, and etc.) and some are related to radiation characteristics (quality, duration of exposure, dose). Therefore, experiments on Gamma radiation in plants bring up a new avenue of research for future study.

Keywords: Biochemical, Gamma radiations, Germination, Mutation.

## **MORPHOLOGICAL SEX EXPRESSION OF *Carica papaya* L. AND ITS RELATIONSHIP WITH THE PREVAILED WEATHER CONDITION**

E.U.U. Rathnathunga\*, W.H.N.Y. Hewage and E.P.S. Chanadana

*Department of Biosystems Technology, Faculty of Technology, University of Ruhuna,  
Karagoda-Uyangoda, Kamburupitiya, Sri Lanka*

### **Abstract**

*Carica papaya* L. is a gynodioecious plant which has three sex forms: female (F), male (M), and hermaphrodite (H). Sri Lanka possesses a rich diversity of recommended hybrids, locals and wild cultivars. The objectives of the study were to distinguish the variation of the morphological characters and to determine the relationship with the prevailed weather condition of the H and the F plants of the papaya *Red lady* (R) and a local variety (L). The research was conducted at the Faculty of Technology, University of Ruhuna, Karagoda-Uyangoda, Kamburupitiya of IL1A agroecological region in Randomized Complete Block Design (RCBD) of 30 replicates in each variety with 1.8 m X 1.8 m spacing. The morphological characteristics of the plant height (PH), stem diameter (SD), leaf number (LN), leaf length (LL), chlorophyll content (SR), flower number (FN) and the fruit number (FR) were measured at 3<sup>rd</sup>, 6<sup>th</sup>, 9<sup>th</sup>, 12<sup>th</sup> and 15<sup>th</sup> month of growing (MG). The weather data of the temperature, relative humidity (RH), evaporation and rainfall were obtained. The PH, SD and FR are significantly positively correlated between all plant types. The F and H of local variety are significantly positively correlated with the 08:30 am RH, 03:30 pm RH and average RH for all seven morphological characters. The LL and FR were negatively correlated with the rainfall and the FN was negatively correlated with the evaporation for all plant types. The H of the L was significantly higher at the 15<sup>th</sup> MG. The SD of the R was significantly higher at the 6<sup>th</sup> MG. The SR of the R was significantly lower till the 12<sup>th</sup> MG and the H plant of L was significantly higher at the 15<sup>th</sup> MG. The FN of the R was significantly higher at the 9<sup>th</sup> MG while the F of the R produced significantly lower FN and the H of the R produced significantly higher FN at the 15<sup>th</sup> MG. The F of the R produced significantly higher FR till the 12<sup>th</sup> MG while H of the R produced significantly lower FR at the 15<sup>th</sup> MG. The study reassures the importance of the improvement of local varieties and understanding its yield potential in the development of related industrial products such as papain enzyme and for numerous different aspects.

Keywords: *Carica papaya* L., Correlation, Hermaphrodite plants, Local variety, Morphology

**DETERMINATION OF HIGH PERFORMING SRI LANKAN  
TRADITIONAL RICE ACCESSIONS: AT AGRICULTURE  
FACULTY, UNIVERSITY OF RUHUNA, DURING MAHA SEASON  
2020/2021**

H.M.A.S.B. Jayasinghe<sup>1</sup>, E.U.U. Rathnathunga<sup>2</sup> and S. Geekiyanage<sup>1\*</sup>

<sup>1</sup> *Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna,  
Kamburupitiya, Sri Lanka*

<sup>2</sup> *Department of Urban Bioresources, Faculty of Urban and Aquatic Bioresources  
University of Sri Jayewardenepura, Gangodawila, Nugegoda*

**Abstract**

There is a lack of information on the high performing traditional rice accessions for specific agro-ecological regions. An experiment was conducted using five *Ma wee* accessions (4134, 4561, 4666, 8541 and 8543) and check variety Bg 300 at Faculty of Agriculture, University of Ruhuna in *Maha* season 2020/2021 to evaluate the selected agronomic and yield characters and the genetic diversity of them for determination of the best performing accessions. The experiment was conducted in two phases as in field and photoperiod chamber. Two weeks old rice seedlings were transplanted in a randomized block design with five blocks in field and in a completely randomized design with five replicates in chamber with constant photoperiods of 11:50, 11:45 and 11:40 hours. Selected agronomic and yield characters were measured under both conditions and analyzed using ANOVA for effect of accession and photoperiod on the selected characters. Means were separated for significant differences. Correlations between selected two characters were determined. The Principal Component Analysis was conducted and a dendrogram was developed through Cluster Analysis. In field plots, quantitative agronomic and yield characters of days to flowering (DF), plant height at flowering, grains per panicle (GP), productive tillers at harvest and culm circumference were significantly varied among six accessions. There was a positive correlation between DF and GP. In the chamber, days to fifth leaf (DFL) were significantly delayed under the photoperiod of 11:40 hours in accessions 4134, 4666 and 8543 while significantly different DFLs were recorded from accession 4134 for three photoperiods. Plant height at the fifth leaf was significantly different among accessions 4134, 4561, 8541 and Bg 300. DF were significantly delayed under 11:50 hours in accessions 8541, 8543, 4561 while 4561 did not flower within the experimental period of 150 days. Four clusters were formed at rescaled distance of 10, where accessions 4561 and 8541, which exhibited lodging tolerance and high yield potential respectively were independently clustered.

Keywords: Agronomic characters, Cluster analysis, Photoperiod, Sri Lankan traditional rice, Yield

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## **FOOD SCIENCE AND TECHNOLOGY**

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## **ANTIMICROBIAL ACTIVITY OF BIODEGRADABLE PACKAGING FILM DEVELOPED USING PALMYRAH TUBER STARCH, ESSENTIAL OIL AND CHEMICAL PRESERVATIVES**

N. Sobini<sup>1,2\*</sup>, P.C.Arampath<sup>1</sup>, B.Anuluxshy<sup>2</sup> and S.Srivijeindran<sup>2</sup>

<sup>1</sup>Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya, Sri Lanka.

<sup>2</sup>Palmyrah Research Institute, Kandy Road, Kaithady, Jaffna, Sri Lanka

### **Abstract**

Food packaging materials are an integral component in the food supply chain to ensure food quality, safety and for the protection of the food products. Novel food packaging materials are designed to improve the quality characteristics, preservative or protective properties of packaged foods. Starch is the most abundance biopolymer used for the formulation biodegradable and edible films. Active ingredients, such as essential oil and preservatives are able to incorporate for the formulation of edible film in order to achieve better performances. This study investigated the effectiveness essential oil and chemical preservatives against *E. coli*, *Psuedomonas aeruginosa*, and *Bacillus brevis*. The antimicrobial activity of packaging films formulated with different concentration (0.25, 0.5, 1.0, 1.5% w/w) of clove oil, cinnamon oil, sodium metabisulphite, sodium benzoate and potassium sorbate was investigated using the disc diffusion test. Antimicrobial activity of the film incorporated with the combination of above preservatives also evaluated to study the synergetic effect of them. Diameter of the inhibitory zone observed against *E.coli* for the film incorporated with clove oil with the concentration of 1.0 % and 1.5% is 18mm and 20mm respectively. Diameter of the inhibitory zone observed against *Bacillus brevis* for the film incorporated with clove oil with the concentration of 1.0 % and 1.5% is 8mm and 20mm respectively. Inhibitory zone was observed against *E.coli* for the film incorporated with cinnamon oil with the concentration of 1.0 % (17mm) and 1.5% (24mm) and also a clear zone was observed against *Bacillus brevis* for cinnamon oil with the concentration of 1.0 % (8mm) and 1.5% (17mm). While inhibition zone (8mm) was observed only for the 1.5% of clove oil and cinnamon oil against *Psuedomonas fluorescens*. Inhibitory zone was not observed for any of the films prepared with preservatives such as sodium metabisulphite, sodium benzoate and potassium sorbate. In conclusion, active biodegradable packaging films with antimicrobial properties are able to be formulated and developed using clove oil, cinnamon oil and other food grade chemical preservatives. The best formulation was the starch (4.0%), gelatin (1.0%), glycerol (1.5%), clove oil (1.5%) or cinnamon oil (1.5%).

Keywords: Active film, Biodegradable, Essential oil, Palmyrah tuber starch

## **MANUFACTURING OF TURMERIC POWDER USING THE TURMERIC GROWN IN SEMI-ARID ZONE OF SRI LANKA**

D.M.C.C. Gunathilake\*

*Department of Agro-Technology, University of Colombo Institute for Agro-Technology and  
Rural sciences, Hambantota*

### **Abstract**

This research study was conducted to identify correct powder manufacturing procedure for making of high-quality turmeric powder using semi-arid zone grown turmeric of Sri Lanka. Processing steps namely, harvesting, sorting, cleaning, curing (boiling), cutting in slices, drying, grinding and sieving were identified as correct turmeric powder processing steps. Harvesting was done when, turmeric leave's colour changed to yellow and start drying. After harvesting, damaged rhizomes were separated. Good rhizomes were washed ×clean thoroughly and carefully removed all impurities attached to rhizomes. Cleaned rhizomes were boiled for 50 min to proper gelatinization. Boiled rhizomes were cut manually into 2mm -4mm size slices. Cutting pieces (2mm -4mm size) were dried in solar dryer until moisture content reach to 9% and it took 4 days. Dried turmeric slices were ground using pin-mill and sifting through 400µm sieves. Ground powder was packed in poly-propylene bags. In this experiment, turmeric powder was produced as SLS: 613:1983 standards, accordingly, moisture content (MC) and particle size of turmeric powder were kept 9.00%wb and 400µm respectively. (MC should be 9.00% or less and particle size should be less than 425µm as a SLS: 613:1983 standards). Storage MC of the powder under ambient condition was evaluated and found that it was increased from 9.00%wb to 13.96%wb for 6 months' storage under ambient condition of Hambantota, Sri Lanka.

Keywords: Powder, Powder quality, Processing steps, Turmeric

## **IMPACT OF COVID-19 PANDEMIC ON ACCESS TO FOODS, DIETARY HABITS AND NUTRIENT INTAKE OF ADULTS IN SRI LANKA**

U.R.Chandimala<sup>1\*</sup>, V.S.Jayamanna<sup>2</sup> and S.Dhushane<sup>1</sup>

<sup>1</sup>*Institute for Agro-Technology & Rural Sciences, University of Colombo, Weligattha New Town, Hambantota, Sri Lanka*

<sup>2</sup>*Department of Food Science & Technology, Faculty of Agriculture, University of Ruhuna, Mapalana, Kamburupitiya, Sri Lanka*

### **Abstract**

Most of the countries over the world have been establishing firm actions such as lockdowns or curfews with the declaration of novel coronavirus outbreak as a pandemic by WHO. An online survey was piloted using 14200 respondents from 11 districts in Sri Lanka representing various socio-economic backgrounds to study the impact of COVID-19 pandemic on dietary habits, access to food items and nutrient intake of adults in Sri Lanka. Simple random sampling, stratified sampling and cluster sampling were adopted to choose the sample based on the population in 440 Grama Niladhari divisions. Non-parametric statistical approaches (Wilcoxon Signed Rank test and Mann Whitney test) were used to analyze the data at 5% significant level. Increase in consumption of home-made foods, fresh foods, immunity boosting foods and nutritional supplements along with a decrease in consumption of processed foods were considered as positive changes in dietary habits of the adults in Sri Lanka. Increased consumption of snacks additional to three main meals while spending a sedentary lifestyle has increased the risk of diet related non-communicable diseases. Food inflation was increased during the pandemic period. People have cut down the consumption of some food items due to increased prices and substituted some foods due to unavailability. Home delivery facility aided in maintaining the access of public to foods. The study revealed that the daily nutrient intake of Sri Lankan adults was not up to a satisfied level when compared with the nutritional guidelines for a healthy life. In summary, COVID-19 pandemic period had caused repercussions in the food supply, access of public to the foods and utilization within the country.

Keywords: COVID-19, Dietary habits, Food access, Nutrient intake, Socio-economic

## **DEVELOPMENT OF NUTRITIOUS CURRY CUBES BY USING MUNG BEAN (*Vigna radiata*) AND COWPEA (*Vigna unguiculata*)**

B.P. Siriwardena<sup>1\*</sup>, R.W.M.R.L.Warnasooriya<sup>1</sup>, S.M.A.C.U. Senarathne<sup>2</sup>, N.P. Vidanapathirana<sup>1</sup> and K.G. Ketipearachchi<sup>1</sup>

<sup>1</sup>*Department of Agro-Technology University of Colombo Institute for Agro-Technology and Rural Sciences, Weligatta New Town, Hambantota*

<sup>2</sup>*Food Research Unit, Department of Agriculture, Gannoruwa, Peradeniya*

### **Abstract**

Mung bean (*Vigna radiata*) and cowpea (*Vigna unguiculata*) are two legumes that have nutritional properties useful for humans. Although it is nutritious, cowpea and mung bean are less popular among people due to the time taken for prolonged soaking and cooking. Thus, this research was directed to create a novel, value-added, ready to cook, nutritious curry cube by using mung bean and cowpea. The experiment was conducted at the Food Processing Laboratory, Food Research and Development Unit, Gannoruwa. The ingredient combination was selected using preliminary studies and several sensory assessments after carried a 5-point hedonic scale by 30 panelists for sensory parameters such as aroma, taste, appearance, and overall acceptability. Curry cubes have been prepared through the method of steaming and deep-frying. Five mixing ratios (w/w) of mung bean and cowpea (100:0, 75:25, 50: 50, 25:75, 0: 100) were evaluated for sensory properties after preparation of curry cube (30 g) integration with other ingredients (chopped onion (10 g), curry powder (2.5 g), turmeric powder (1 g), chili powder (2.5 g) and salt (3g)). Friedman's Non-parametric analysis method was used to analyze data. Curry cube prepared by mixing mung bean 50 % (w/w) and cowpea 50% (w/w) with the other ingredients was selected as the best proportion according to the sensory evaluation. The most acceptable product was vacuum-packed and evaluated the shelf life up to 3 weeks at ambient environmental conditions. Proximate evaluation was carried out and results were recorded. Values for moisture, total fat, crude fiber, total ash, and crude protein contents were 14.05%, 20.38%, 3.74%, 3.75%, and 20.38 % respectively. Corresponding to the microbiological outcomes, the product was microbiologically secure for consumption up to 2 weeks after storage period. This study revealed that there is a great possibility to producing nutritious curry cubes using mung beans and cowpea.

Keywords: Cowpea, Curry cube, Mung bean, Nutritious, Sensory evaluation

## **USEFUL ROLE OF FUNGI IN FOOD PROCESSING**

S.C.N Jayaweera <sup>1</sup>, P.A.B.N Perumpuli <sup>2\*</sup> and N. Dahanayake<sup>1</sup>

<sup>1</sup>*Department of Agricultural Biology, University of Ruhuna, Kamburuitiya, Sri Lanka*

<sup>2</sup>*Department of Food Science and Technology, University of Ruhuna, Kamburuitiya, Sri Lanka*

### **Abstract**

Fungi perform a key role in environmental sustainability and act as a valuable option for bio discovering novel food components, enzymes, additives, drugs, and antimicrobials. Now a day, fungi have been pioneered in the food sector and have become a routine part of human life due to their metabolic versatility to produce various types of bioactive components of food. This review is to explain major fungal applications in the field of agri-food sector. In food biotechnology, these eukaryotic organisms are consumed either directly as a fresh fruiting body or indirectly as wide range of fermentation based food products. The fruiting body is usually the consumed component in fungal species such as *Pleurotus cystidiosus* *Agaricus bisporus* and *Lentinus edodes* are considered as edible. Since mushrooms include a variety of proteins, polysaccharides, and vitamins, their consumption have led to a developed, well-balanced diet. Fermentation is complex microbial processes that convert sugars which are found in food either into organic acids or alcohols, and thereby enhancing the sensory properties of food product. Industrially, there are different types of fermented products available, such as cheese (*Penicillium roqueforti*), tempeh (*Rhizopus oligosporus*), bread (*Saccharomyces cerevisiae*), red mold rice (*Monascus purpureus*) fermented beverages and many more. Almost all types of alcoholic beverages are produced using either *Saccharomyces* yeast (*Saccharomyces cerevisiae*) or moulds (*Aspergillus oryzae*). In addition to these, fungi are also known to secrete some useful enzyme viz. lipases, pectinase, hemicellulases, and amylases. Mushrooms with medicinal impact, i.e., *Sclerotium rolfsii*, *Dabaryomyces hansenii*, are used to produce nutraceutical and pharmaceutical products as an economically feasible option. Besides these major food related applications, they also produce many other economically important fungal byproducts such as lovastatin (*Monascus purpureus*), peptides (*Aspergillus clavatus*), pyrazines (*Penicillium vulpinum*) and organic acids (*Aspergillus niger*) like citric acid, gluconic acid which share a significant economic and nutraceutical value. Despite the fact that a number of fungal species have been founded so far, still some of their food industrial applications are partially explored. Hence, understanding of the functional and role of fungal- foodsystems are very important to new innovative food industry.

Keywords: Food processing, Fungal biotechnology, Fungi

## **REVIEW: VALUE ADDED PRODUCTS DEVELOPED BY TURMERIC**

M.M.N.T. Bandara<sup>1</sup>, N. Dahanayake<sup>2\*</sup> and S. Subasinghe<sup>3</sup>

<sup>1</sup>*Faculty of Graduate Studies, University of Kelaniya, Sri Lanka*

<sup>2</sup>*Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Sri Lanka*

<sup>3</sup>*Department of Crop Science, Faculty of Agriculture, University of Ruhuna, Sri Lanka*

### **Abstract**

Turmeric is important commercial crop which is highly used in south Asian and middle eastern culinary as a key spice. India is the major turmeric producing country which accounts for about 78% of the global production. Similar to the production, a large portion is used within the country. The processing of turmeric follows several steps including boiling, frying and polishing to obtain turmeric powder before they are used as a spice. Also, it adds the distinctive yellow color to the food. There are many medicinal properties associated with its major chemical compound curcumin, namely antioxidant, anti-microbial, anti-inflammatory, anti-carcinogenic and anti-diabetic activity. Although turmeric was first used only as a food coloring agent unknowingly it contained many health benefits. Therefore, it later used widely in ayurvedic medicine as a dietary supplement for a variety of health-related conditions including arthritis, allergies, depression and many more. Further, turmeric is also used as a dye in coloring clothes in some regions of India. It reduces facial hair growth, acnes and improve complexion. Therefore, is it traditionally used as a cosmetic which now a days has the trend to use as one of the main ingredients in many skin care products. In addition to these uses there are many products which have been made from turmeric. One such product is turmeric oleoresin, which used as a food coloring agent and an aromatic agent in food industry of western countries. It is made out of a turmeric extract from hydrocarbons and is a resin like viscous material. Haldi drops, prepared with turmeric, saffron, cinnamon, cardamom and black pepper in combination with milk is a traditional Indian beverage which used to cure several diseases. The value-added products of turmeric can be developed in a broader scale and can increase the use of turmeric worldwide.

Keywords: Cosmetic, Curcumin, Spice, Turmeric

## **AN INVESTIGATION ON THE SENSORY QUALITY PARAMETERS OF MUFFINS INCORPORATED WITH CANISTEL FRUIT FLOUR (*Pouteria campechiana*)**

H.K.L. Madushani, U.L.A. Majeed\* and A.M.M. Asmath

*Department of Biosystems Technology, Faculty of Technology, South Eastern University of  
Sri Lanka*

### **Abstract**

Canistel is an indigenous, inexpensive and an underutilized fruit commodity that is readily and freshly available in Sri Lanka. It has a potential nutritional value and various health benefits due to the presence of functional and nutraceutical compounds in it. The researchers focus on how it could be incorporated into food preparations that would benefit for a wider society. Hence, this study focused to develop flour and study the possibility of using it as a food ingredient particularly for bakery industry. A good quality canistel fruits were selected, peeled, sliced, and soaked for a few minutes in NaCl solution to remove the latex. The slices were then dehydrated for 36 hours at 60°C and ground into a fine powder. The quality of the muffins developed from the blends of wheat flour: canistel flour at five different ratios such as 100:0, 80:20, 70:30, 60:40 and 50:50 % respectively, were investigated to evaluate the sensory properties of muffins including the characters such as: texture, color, odor, taste, mouthfeel and overall acceptability. The sensory evaluation was conducted with 40 untrained panelists who scored against various quality attributes on a 9-point Hedonic scale to determine the consumer preference. The data generated were statistically analyzed with SPSS (version 25). The results obtained revealed that a significant difference ( $p < 0.05$ ) was observed among different treatments in terms of all sensory quality parameters. The muffins developed with 70:30 percent wheat: canistel flour blend secured the highest scores for texture, taste, odor, mouthfeel and overall acceptability. The use of more than 30 % canistel flour in muffins reduced the acceptance due to the formation of yellow coloring and bitter flavor. No significant difference in the sensory score was observed between control sample and the blended with 20% of canistel flour. Accordingly, it could be concluded that a muffin developed with 30 % canistel flour replacement becomes an accepted blend. Therefore, underutilized canistel fruit could be utilized for the development of bakery products with impaired gluten content.

Keywords: Bakery products, Canistel flour, Muffins, Sensory



## **BENEFITS OF MICROGREENS TO COMBAT AGAINST EMERGING HEALTH CHALLENGES WITH RELATION TO *HARITHA VARGA* IN AYURVEDA; A REVIEW**

M.D.P. Ishara<sup>1\*</sup> and Y.S.G. Wimalasiri<sup>2</sup>

<sup>1</sup>Lecturer (Probationary), Institute of Indigenous Medicine, University of Colombo,  
Rajagiriya, Sri Lanka

<sup>2</sup>Senior Lecturer, Institute of Indigenous Medicine, University of Colombo, Rajagiriya,  
Sri Lanka

### **Abstract**

Epidemiological studies have shown that consumption of fruits and vegetables are associated with reduction of chronic diseases. People are observing for new developments of food which can fulfill nutritional requirements of human being as well. Functional foods are very important for human health instead of its nutrition requirements. Microgreens are an exotic genre of edible greens which can be considered as relation with uncooked food form in Ayurveda, the *Haritha varga*. *Haritha varga* further describes the food which can be used as a spice and herb. This review explained on benefits of Microgreens to combat against emerging health challenges with relation to *Haritha Varga* in Ayurveda and to study on pharmacodynamics properties of commonly used *Haritha varga*. Literature has been collected from authentic texts, previous research evidences, journals and authentic web sites. Microgreens are rich with antioxidants, vitamins, minerals, higher amounts of phytonutrients and minerals as Calcium, Magnesium, Iron, Manganese and Zinc. Microgreens are beneficial to protect the body from many disease conditions as heart diseases, Alzheimer’s disease, diabetes, cancer, chronic kidney diseases and lead for healthy bones, eyes and boosting immunity of people. *Haritha varga* works as an appetizer and fragrant which are not very pungent. The concept of microgreens is new to the society and the people are not clearly aware on the benefits of microgreens. Ayurvedic concept of *Haritha Varga* can utilize to emboss the concept of microgreens to the society. Therefore, it can conclude that based on nutritional and health benefits of microgreens, it is important to popularize among general public as a trending functional food.

Keywords: Functional food, *Haritha varga*, Microgreens



## **EXTRACTION OF YELLOW COLORANT FROM THE PEEL OF BANANA (*Musa Spp.*) AND DETERMINATION OF CAROTENOIDS**

K.Y. Gallage<sup>1</sup>, S. Weerasinghe<sup>1</sup>, U. R. Chandimala<sup>1\*</sup> and H. Weerathunga<sup>2</sup>

<sup>1</sup>*Institute of Agro Technology and Rural Sciences, University of Colombo, Hambantota, Sri Lanka*

<sup>2</sup>*Industrial Technology institute, Colombo, Sri Lanka*

### **Abstract**

Banana (*Musa spp.*) is grown worldwide mainly as a fruit crop. Peels form about 18–33% of the whole fruit and are discarded as waste. Banana peel is enriched with many bioactive compounds along with color pigments such as carotenoids. The total peel waste resulting from high banana production is not utilized in a proper manner in Sri Lanka. This study was conducted to extract natural yellow colorant from banana peel. Ambul (A), Puwalu (P) and Cavendish (C) varieties were selected and yellow colorant was extracted using the solvents; T1: (hexane+acetone) and T2: ethanol. The dehydrated extracts were dissolved in ethanol to calculate the total carotenoid pigment concentration. The highest carotenoid pigment concentration was observed in T2 extract of (A) ( $0.43 \times 10^{-3} \pm 0.10$  g/mL), followed by T1 extracts of (A) ( $0.30 \times 10^{-3} \pm 0.08$  g/mL), (P) ( $0.17 \times 10^{-3} \pm 0.06$  g/mL) and (C) ( $0.13 \times 10^{-3} \pm 0.04$  g/mL) varieties.  $\beta$ -carotene level of each variety was measured using the spectrophotometric method at optimum extraction conditions. The  $\beta$ -carotene level among samples was in a range between  $1.03 \times 10^{-4}$  to  $2.45 \times 10^{-4}$  mg/mL. The highest  $\beta$ -carotene level was observed in (A) variety. Antioxidant activity of each variety was calculated using DPPH assay and values were in a range between 0.01 to 3.29 mg Trolox/g. According to Chroma meter values, the most intense yellow color was recorded in (A) variety under T1 treatment. The study concludes that Ambul banana peel is a highly potential source for the extraction of natural industrial yellow colorant. Also, this can be identified as a sound method of managing banana peel waste in Sri Lanka.

Keywords: Banana peel, Carotenoid, Extraction, Yellow colorant

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**EMPOWERING RURAL COMMUNITY  
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## **MAKING THE ENGLISH LANGUAGE TEACHER THE BEST FRIEND: THE IMPACT OF BUILDING CONFIDENCE TO SPEAK ENGLISH**

A.U. Attanayake\*

*Department of Teaching and Learning, The Ohio State University, USA*

### **Abstract**

Research over 10 years reveals that Sri Lankan students generally show a reluctance to speak English for the fear of being ridiculed by society for mistakes resulting from their lack of confidence to speak English. A needs analysis done with a student cohort of 317 at the University of Colombo Institute for Agro-technology and Rural Sciences (UCIARS) showed that the most desired skill among the students was speaking. It was found out that despite being the most sought-after skill, the reason for not speaking English, was fear, shyness and uncertainty, which resulted in a lack of confidence to speak English. With the aim of building student confidence to speak English, a special course namely ‘Building Confidence to Speak English, was introduced. It was conducted as a 60-hour-long intensive course for one month online due to the pandemic. A special teaching methodology was employed with teachers been trained for each activity in the modules. Student feedback revealed that students have built confidence to speak English in a variety of contexts including inside the classroom in front of the teacher and peers; outside the classroom with teachers and peers and with anyone who spoke English. Moreover, the results showed that the special teaching methodology used for building confidence to speak English was greatly admired by the students; the students found that the way their teachers taught them was excellent and that they considered their teachers their best friends. It was evident that the appreciation the students developed towards their teachers because of the way they taught English in the Building Confidence course was extended to developing a liking to learn English with a novel perception that English was not a difficult subject anymore, a view that was opposite to what students had prior to studying in the course.

Keywords: Best friend, Confidence, Ridicule, Speaking English

## **AGROCHEMICAL POISONING AMONG PADDY FARMERS IN HOROWPATHANA AGRARIAN SERVICE CENTRE DIVISION IN ANURADHAPURA DISTRICT, SRI LANKA**

S. Rathnayake<sup>1\*</sup>, S.J. Rathnayake<sup>2</sup>, U.I. Dissanayeke<sup>1</sup> and A. Warnasooriya<sup>3</sup>

<sup>1</sup>*Department of Agricultural Extension, Faculty of Agriculture, University of Peradeniya,  
Peradeniya, Sri Lanka*

<sup>2</sup>*National Hospital, Kandy, Sri Lanka*

<sup>3</sup>*Department of Computing, Faculty of Applied Sciences, Rajarata University, Sri Lanka*

### **Abstract**

Agrochemical poisoning is a main occupational hazard for farmers. Use of agrochemical for paddy production was an important management practice in Sri Lanka. A study was conducted in Horowpathana Agrarian Service Division in Horowpathana Divisional Secretariat Division, Anuradhapura district, Sri Lanka to investigate the prevalence and prevention of agrochemical poisoning among paddy farmers. It followed a mixed method research design. A face-to-face questionnaire survey was done using a pre-tested, structured questionnaire. A sample of 100 paddy farmers was selected with systematic random sampling. Key informant discussions with officers and focus group discussion with farmers were also carried out. Data were analyzed using quantitative and qualitative methods. The findings showed the majority (38.4%) of respondents were belonged to 42-52 years age group. About 85% of the respondents were full time paddy farmers with the average of 26 years of experience. The majority (77.7% of respondents) had cultivated 0-2 ha of paddy lands during *Maha* season. About 98% of the respondents had not being admitted to hospital due to agrochemical poisoning. The questionnaire survey brought evidence on symptoms of mild to moderate agrochemical poisoning such as headache, fainting and vomiting. However, focus group farmer participants have experienced above symptoms frequently during agrochemical applications. About half (50.6%) of the respondents are using personal protective equipment. Awareness on agrochemical handling, storing and post-application practices was assessed using eight questions. Remarkably low awareness was observed for few elements of agrochemical handling and storing and it was statistically significant ( $p=0.000$ ,  $p<0.01$ ). About 85.1% of the respondents had not received any awareness on safe handling of agrochemicals. Therefore, farmer awareness is required on safe practices in agrochemical usage and it is suggested to use *Kanna* meetings as a platform for this purpose.

Keywords: Agrochemicals, Occupational Hazards, Paddy farmers, Poisoning, Sri Lanka

## **GAMIFICATION IN ESL CLASSROOM TO TEACH GRAMMAR: A CASE STUDY BASED ON PART-TIME STUDENTS AT UNIVERSITY OF COLOMBO INSTITUTE FOR AGRO-TECHNOLOGY AND RURAL SCIENCES**

D. Jayarathna<sup>1\*</sup>, S. Ubeyasiriwardana<sup>2</sup> and K.L.M.I. Dilanthi<sup>3</sup>

<sup>1</sup>*Department of Marketing, University of Ruhuna, Matara, Sri Lanka*

<sup>2</sup>*Biz Zone Business Academy, SLIM Accredited Study Center, Chilaw, Sri Lanka*

<sup>3</sup>*Department of English Language Teaching, University of Kelaniya, Kelaniya, Sri Lanka*

### **Abstract**

The aim of the present study is to examine the efficacy of utilizing games in teaching grammar in English as a Second Language (ESL) classrooms. The study included a purposive sample of 67 first-year part-time undergraduates studying at the University of Colombo – Institute for Agro-technology and Rural Sciences (UCIARS) in the academic year 2020/21. These participants took part in the English Language Enhancement Programme offered during their first academic year. They were divided into six parallel groups based on a placement test. Incorporating games in an ESL class can help learners attain the objective of teaching that is to make students active participants in the learning process and keep them engaged. This research employed both qualitative and quantitative methods to gain a better grasp of the subject. The research tools included a pre-test questionnaire, a post-test questionnaire, and observations. A pre-test questionnaire with 9 closed-ended questions and 3 open-ended questions was provided through Google forms prior to the intervention to collect information on the students' previous grammar learning experiences and their perspectives on learning grammar. To address the linguistic challenges of the students, the questionnaire was transliterated into Sinhala and Tamil. Following the intervention, a post-test questionnaire was administered to the participants in order to ascertain their perceptions on learning English grammar using games in order to assess whether teaching grammar through games was productive. Furthermore, the researchers conducted observations employing lecture recordings to examine the impact of grammar games on student performance. According to the findings of this study, games can be utilized as stimulants and educational tools to provide learners with satisfaction, interest, enthusiastic involvement, and motivation when teaching English grammar. Games strengthen linguistic abilities and foster good interpersonal skills. Additionally, the students exhibited positive attitudes towards learning English through games. The study shows that the utilization of grammar games plays a vital role in inspiring learners to learn English as well as building their confidence in speaking English and increasing their willingness to communicate in English. Furthermore, the researchers propose employing grammar games upheave not only learner interest in learning, but also their confidence in speaking English.

Keywords: Confidence, ESL Classroom, Gamification, Grammar Games

## **PROBLEMS FACED BY THE SMALL SCALE RICE MILLERS IN AMPARA DISTRICT, SRI LANKA**

A. Asmiya\*, M. Mufeeth and A.M.M. Asmath

*Department of Biosystems Technology, South Eastern University of Sri Lanka Oluvil,  
Sri Lanka*

### **Abstract**

The Rice milling industry is the largest agro-based industry in Sri Lanka. It involves converting raw paddy to edible form for consumption. Rice mills in the Ampara district are operating in both small and large economies of scale. However, the evidence shows that the number of operating small-size rice mills has declined in this district. Therefore, the present study identified the challenges faced by the small-scale rice millers. The study targeted continuously operating small-scale rice mills in six division secretariats namely Nintavur (41/51), Kalmunai (9/11), Addalaichenai (10/13), Sammanthurai (18/22), Karaithivu (10/12) and, Damana (12/15) in the Ampara district, and was selected using a proportionate sampling technique based on the number of operating small-scale rice mills in a particular region. In total 100 small-scale rice mill owners were inquired about the challenges faced during milling, marketing, and purchasing paddy. Adminstrating a pretested questionnaire data was collected physically from each rice mill owner and analyzed according to the frequency distribution using the statistical software SPSS (ver.25). Results indicate that small-scale rice millers in the Ampara district face difficulties in paddy purchasing, milling, and marketing of rice. Most of the rice millers faced interrupted electricity supply and higher electricity costs during the paddy milling process. After milling, credit sales (70%) and higher competition (50%) with large-scale rice mills were encountered as prominent marketing problems. Further, rice price fluctuation and an unstable market (45%) were the major barriers to rice marketing. The study indicates that the non-competitive market structure established by large-scale rice millers should be empirically addressed in order to take preventative actions to ensure the long-term sustainability of small-scale rice mills.

Keywords: Ampara district, Paddy, Problems, Rice millers, Sri Lanka

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**University of Colombo**  
**Institute for Agro-Technology and Rural Sciences,**  
**Weligatta New Town, Hambantota,**  
**Sri Lanka.**