



Proceedings of the 4th National Symposium on Agro-Technology and Rural Sciences

“Exploring Path for Food Security through Innovative Agriculture”

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**PROCEEDINGS OF THE 4th NATIONAL SYMPOSIUM ON
AGRO-TECHNOLOGY AND RURAL SCIENCES 2023**

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TABLE OF CONTENTS

Contents	Page No.
Editorial Board.....	I
Keynote Speakers.....	I
Organizing Committee.....	II
Panel of Reviewers	III
Message from the Vice-Chancellor.....	VI
Message from the Director.....	VII
Message from the Coordinator.....	VIII
Message from the Secretary.....	IX
Abstract Index	X
Authors Index.....	i-iii

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MESSAGE FROM THE VICE-CHANCELLOR

I am delighted to provide this message for the Fourth National Symposium of the Agro-Technology and Rural Sciences (NSATRS 2023) as the Vice-Chancellor of the University of Colombo. I immensely appreciate 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 4th consecutive year amidst a lot of challenges



prevailing within the country. NSATRS holds a prominent position in the annual university academic calendar, as it unveils appropriate and sustainable discoveries related to modern Agriculture, embarking on the development of various communities in Sri Lanka.

Dissemination of the innovative findings of efficient and effective research work related to Agriculture is the key to ensuring food security and safety. I believe that your chosen theme “Exploring path for food security and safety through innovative agriculture” which comes under five different disciplines; Food processing and post-harvest technologies, Livestock, fisheries and aquaculture, Innovations for sustainable agriculture, Agriculture economics, extension and entrepreneurship, and Crop production and protection technologies, enlightens the priorities of Sri Lankans in addressing food security and safety by practicing sustainable agricultural approaches. I firmly believe that this symposium provides a unique platform to bring researchers, entrepreneurs, innovative farmers, and the industry together to deliberate on the diverse areas of Agro-Technology while disseminating their knowledge and experience in research work. Further, I am enthused with the contribution and commitment made by the UCIARS, a center of excellence in the field of Agro-Technology, in creating scientists together with entrepreneurs for the betterment of Sri Lanka’s agricultural sector. It is noteworthy to say that the pivotal role played by UCIARS in developing Agricultural graduates as well as in research engagement over the past few years is incredible and the University of Colombo is indeed proud of it.

Your collective efforts to make the Fourth National Symposium on Agro Technology and Rural Sciences 2023 a success are highly appreciated and I send my best wishes for this great event of UCIARS.

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.

Prof. Asanga D. Ampitiyawatta

Director/ Chairperson

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

MESSAGE FROM THE COORDINATOR

It is with great honor and privilege for me to convey this message on the occasion of Forth National Symposium on Agro Technology and Rural Sciences 2023 (NSATRS 2023) on “Exploring Path for food security and safety through innovative agriculture”. 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 ensuring food security. The diversity of specializations and related themes will enable us to achieve our targeted mandate and vision.

This research conference will undoubtedly offer a forum for the exchange of knowledge, insights, and research discoveries. And will provide a forum specifically for young researchers to talk about the problems and potential directions in many agricultural research sectors to uplift agricultural productivity.

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 and support to maintain the quality of the research papers.

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. I congratulate to the organizing committee of the NSATRS 2023 and wish today's symposium, a grand success.

Dr. N. P. Vidanapathirana

Symposium Coordinator / NSATRS 2023

MESSAGE FROM THE SECRETARY

It is with great honor and pleasure to compile this message as the secretary of the 4th National Symposium on Agro-Technology and Rural Sciences (NSATRS 2023). The NSATRS 2023, now in its fourth consecutive year, is being organized around the timely and important theme of "Exploring Path for Food Security and Safety through Innovative Agriculture." Recognizing that



agriculture is the backbone of Sri Lanka's economy, our symposium aims to bring together academics, researchers, and professionals from diverse subject areas to promote new horizons that foster enhanced agricultural performance. We firmly believe that the implementation of clean and smart agricultural concepts, which are crucial for ensuring global food security and rural development.

I would like to express my heartfelt gratitude to all the members of the organizing committee of NSATRS 2023, as well as the academic and non-academic staff of UCIARS. Their dedication and sacrifice of valuable time have been instrumental in making this event a resounding success.

The organizing committee firmly believes that the time spent at the symposium will be highly productive, fostering enthusiasm among the participants and communities at large, and contributing to the advancement of the agriculture sector in Sri Lanka. We hope that NSATRS 2023 will offer ample opportunities for all of us to acquire new knowledge, reach new heights, and envision a brighter future for the agriculture sector in our country and look forward to future endeavors in the agriculture sector in Sri Lanka.

H.K.R.S. Kumara

Symposium Secretary / NSATRS 2023

ABSTRACT INDEX

AGRICULTURE ECONOMICS, EXTENSION AND ENTREPREURSHIP

EMPOWERING FARMERS AT THE CENTER OF INNOVATION, INCLUSIVE DIGITAL TRANSFORMATION OF AGRICULTURE

*P.W. Kumara, C. Padmini**, S. Dissanayake, and L. Hettiarachchi01

THE IMPACT OF PARTICIPATION IN AGRICULTURAL EXTENSION PROGRAMS ON FOOD PRODUCTION AMONG RURAL WOMEN FARMERS IN IMBULPE DS DIVISION IN SRI LANKA

S.D.D. Rathnachandra^{1}, S.H.P. Malkanthi¹*02

THE SLGAP-2021 AGRICULTURAL PROJECT IN THE GALLE DISTRICT OF SRI LANKA: AN EVALUATION OF THE SUCCESS AND FALIURE FACTORS

P.H.N. Rasanjalee^{1}, K.N.N. Silva¹ and S.D.W.Gunasekara²*03

INFLUENCE OF THE LOW-INPUT AGRICULTURAL MANAGEMENT PRACTICES ON KNOWLEDGE AND PREFERENCE FOR DIETARY DIVERSITY

*Tharsinithevy Kirupananthan**04

KNOWLEDGE AND ADOPTION LEVELS OF ENTREPRENEURS IN RELATION TO THE PALMYRAH NON-FOOD BASED PRODUCTION; A CASE STUDY IN TRINCOMALEE DISTRICT, SRI LANKA

B.P. Siriwardena^{1}, D. Sanjayan¹, K.G. Ketippearachchi¹*05

CROP PRODUCTION AND PROTECTION TECHNOLOGIES

OVEREXPRESSION OF RICE *BBX13* GENE IN Bg 250 SRI LANKAN RICE VARIETY TOWARDS THE DEVELOPMENT OF ABIOTIC STRESS RESISTANT RICE

K.G.W.W. Bandara¹, W.S. S. Wijesundera², G.H.C.M. Hettiarachchi^{1}*06

AYURVEDA PERSPECTIVE (*VRIKSHAYURVEDA*) ON CROP PRODUCTION AND CROP PROTECTION– A REVIEW

H.B.D. Kaushalya^{1}, W.A.S.S. Weerakoon¹*07

SPATIAL VARIATIONS OF START AND PEAK TIME OF SPIKELET OPENING OF SELECTED RICE VARIETIES: THEIR GRAIN STERILITY, HARVEST INDEX AND YIELD

Y.M.S.H.I.U. De Silva¹, L.C. Silva^{1}, W.M.W. Weerakoon^{1,5}, W.J. Nimanthika¹, I.
Dissanayake², H. Hewage³, V. Sivasthran⁴ and R.M.C. Rathnayake¹*08

ASSESSING THE EFFICACY OF 3G SOLUTION TO CONTROL ONION CATERPILLARS (<i>Spodoptera exigua</i> AND <i>Spodoptera litura</i>) IN CLUSTER ONION (<i>Allium cepa</i>) AT IRANAIMADU, KILINOCHCHI, SRI LANKA <i>J. Jayabawatharaniya¹, S. Rajeshkanna^{2*}, K. Varnika¹, S. Jayavanan¹</i>	09
EFFECT OF <i>Lantana camara</i> LEAF EXTRACT ON THE COWPEA WEEVIL (<i>Callosobruchus maculatus</i>) <i>Y. Kethziah¹, G. Hariharan^{1*}, and R.F. Niranjana¹</i>	10
STUDY THE EFFECTIVENESS OF PLANT BOTANICALS ON MAIZE WEEVIL (<i>Sitophilus zeamais</i>) CONTROL <i>K.D.B.V. Wijayasinghe^{1*}, M.H.S.M. Hettiarachchi¹, B.D.M.P.B. Dissanayake¹, W.M.C.B. Wasala¹, R.M.R.N.K. Rathnayake¹</i>	11
GROWTH, YIELD AND ECONOMIC PERFORMANCES OF <i>Brassica oleracea</i> VAR. BOTRYTIS UNDER THE PROTECTED HOUSE IN THE LOW COUNTRY WET ZONE OF SRI LANKA AS AFFECTED BY ARTIFICIAL LIGHT SUPPLEMENTATION AND SPLIT APPLICATION OF ALBERT’S FERTILIZER SOLUTION <i>W.M.A.M. Karunarathne^{1*}, S. Subasinghe¹, H.K.M.S.¹ Kumarasinghe, K.K.L.B.² Adikaram and M.K.D.K.² Piyaratne</i>	12
EFFECTS OF DIFFERENT ROOT INDUCING AGENTS ON CUTTING PROPAGATION OF TEA (<i>Camellia sinensis</i>) <i>H.H.N. Sumanasekara¹, L.M. Rifnas^{1*} and N.P. Vidanapathirana¹</i>	13
EFFECT OF SPLIT APPLICATION OF ORGANIC FERTILIZER JEEVAMRUTHA ON GROWTH AND YIELD OF RADISH <i>A.M.M. Sanoos¹, Brintha Karunarathna¹, T. Abirami^{1*}</i>	14
MORPHOLOGICAL CHARACTERIZATION OF TURMERIC (<i>Curcuma longa</i>) IN GAMPAHA AND KALUTARA DISTRICTS, SRI LANKA <i>I.S. Hettiarachchi, K.G. Ketipearachchi[*], N.P. Vidanapathirana, S. Subasinghe², B.P. Siriwardena</i>	15
EFFECT OF PLUCKING METHODS ON EFFICIENCY OF PLUCKING, YIELD AND QUALITY OF TEA (<i>camellia sinensis</i> L.) <i>J.L. Edirisooriya¹, S.L. Nawarathna^{1*} and G.G. Bandula²</i>	16
EFFECT OF DIFFERENT SOURCES OF NITROGEN FERTILIZER AND SOIL AMENDMENTS FOR GROWTH AND YIELD PERFORMANCES OF <i>Zea mays</i> UNDER DRY ZONE CONDITION <i>S.A.P. Nelka^{1*}, S. Subasinghe², N.P. Vidanapathirana¹, R. Hewawasam¹</i>	17

FOOD PROCESSING AND POST HARVESTING TECHNOLOGIES

CHANGES IN PHYSICAL PROPERTIES OF TWO DIFFERENT BANANA ACCESSIONS UNDER DIFFERENT STORAGE CONDITIONS

G.H.K.N.Asenika¹, A.Thusalini¹, D.M.N.H.Jayasuriya¹ and N.Kannan^{1*} 18

IN VITRO ANTIOXIDANT AND ANTIDIABETIC ACTIVITIES OF SELECTED HERBAL INFUSIONS

P.G. I. Dias^{1*}, R.A.U.J. Marapana², and R.M.U.S.K. Rathnayaka³ 19

DEVELOPMENT AND SENSORY ANALYSIS OF FIBER ENRICHED PANEER FROM BLENDING COW MILK & BUFFALO MILK

S. Suganya¹, S.Thanusan^{2*}, B.P.A.Jayaweera³, and S.Piratheepan¹ 20

CASSAVA COOKIES: A VALUE-ADDED PRODUCT OF CASSAVA (*Manihot esculenta*) GROWN IN SRI LANKA

H.R.H.D. Erabadupitiya¹, S.S. Hettiarachchi^{2*}, A.J.A.A. Siriwardhana¹ and
T.Liyanage² 21

MUNG BEAN FLOUR AS A BINDER FOR PORK SAUSAGE

W.H.H. Madhumali^{1*}, A. Gunarathne¹, M.P. Senanayake² 22

EXPERIMENTAL STUDY ON THE PACKED BED BEHAVIOR OF DRIED AND FRESH CAPSICUM ANNUM (RED CHILI)

B. M. K. Premanath^{1*}, M.N. Rajapakshe¹, B.M.W.P.K. Amarasinghe¹, G.K. Jayatunga² 23

EFFECT OF VARIOUS PROCESSING TECHNIQUES ON ANTI-NUTRITIONAL VARIABLES, IN VITRO NUTRIENT DIGESTIBILITY, BIO-ACCESSIBILITY OF NUTRIENTS, TECHNO FUNCTIONALITY, MOLECULAR AND STRUCTURAL INTERACTIONS OF FINGER MILLET (*Eleusine coracana*)

P.S.R. Fonseka^{1*} and K.D.P.P. Gunathilake¹ 24

POST-HARVEST QUALITY IMPROVEMENT OF COMMERCIALY IMPORTANT CUT ROSE CULTIVARS (*Rosa hybrida* L) WITH APPLICATION OF DIFFERENT SILICONE SOURCES

G.Y.A.D.D. Perera^{1*} and P.E. Kaliyadasa¹ 25

THE POTENTIAL APPLICATION OF GIZZARD FAT IN CHICKEN SAUSAGE PROCESSING

B.W.Y.N.B. Wijayathunga^{1*}, A. Gunarathne¹, U.S. Dissanayake² 26

INNOVATION FOR SUSTAINABLE AGRICULTURE

EFFECT OF WATER RETENTION BY WATER-REPELLENT AND NON-WATER REPELLENT LEAF LITTERS UNDER DIFFERENT LITTER DEPTHS AND WATER INPUT LEVELS

A. Sriskandarajah¹, D.A.L. Leelamanie^{1}, H.I.G.S. Piyaarawan¹ 27*

YIELD AND QUALITY OF GROUNDNUT OIL EXPELLED USING VIRGIN COCONUT OIL (VCO) EXPELLER

K.D.B.V. Wijayasinghe^{1}, C.K. Marasinghe¹, D.M.S.P. Bandara¹ and W.A.P. Weerakkody² 28*

FERTILITY MANAGEMENT OF DIFFERENTLY MANAGED RUBBER (*Hevea brasiliensis*) GROWING SOILS

K.H.D.M. Premarathna^{1}, R.P. Hettiarachchi², J.P.H.U. Jayaneththi¹ and D.M.S.H. Disanayaka¹ 29*

INFLUENCE OF SOIL AMENDMENTS AND THEIR HYDROPHOBICITY ON THE FORMATION OF SOIL AGGREGATES

I.S. Wijesingha¹ and D. A.L. Leelamanie^{1} 30*

GLIRICIDIA SEPIUM GREEN LEAF MANURE DECOMPOSITION AND MINERALIZATION UNDER DIVERSE NUTRIENT MANAGEMENT STRATEGIES IN IRRIGATED LOWLAND RICE CROPPING SYSTEMS

U.S. Herath^{1,2}, W.M.D.M. Wickramasinghe¹, L.M. Rankoth^{2,3}, and W.C.P. Egodawatta¹ 31*

ANALYSIS OF DECADAL CHANGES OF RAINFALL VARIABILITY IN THE SOUTHERN SRI LANKA

Ganadeepan Subramaniam¹, K.S.S. Atapaththu^{1}, Kelum Sanjaya¹, Xin Wang² and Tilak Priyadarshana¹ 32*

LIVESTOCK, FISHERIES AND AQUACULTURE

NUTRITIONAL EVALUATION OF SILAGES FROM PROMISING FODDER GRASSES IN KILINOCHCHI DISTRICT, SRI LANKA

S. Thanusan^{1}, H.M.C. Pushpakumara² and S. Piratheepan² 33*

STUDY THE GROWTH PERFORMANCE POST-LARVAE OF LOCAL BUTTER CATFISH (*Ompok bimaculatus*) UNDER DIFFERENT STOCKING DENSITIES IN CEMENT TANKS

M.D.L.P. Jayathilaka¹, A.R. Mudalige², S. Varthani^{1} and R. Nivetha¹ 34*

PREVALENCE OF GASTROINTESTINAL PARASITES IN FREE-RANGE GOATS (<i>Capra hircus</i>): A STUDY IN MIHINTALE VETERINARY DIVISION OF ANURADHAPURA DISTRICT <i>R.M.H.S. Rathnayake¹, H.K.R.S. Kumara^{1*}</i>	35
EVIDENCE OF MICROPLASTICS IN GIANT TIGER PRAWN, (<i>Penaeus monodon</i>) CAPTURED FROM NEGOMBO AND KOGGALA LAGOONS IN SRI LANKA <i>H.A.R.W. Kotuwegedara^{1*}, K. Radampola¹, P.B. Terney Pradeep Kumara²</i>	36
EVIDENCE OF MICROPLASTICS IN BLUE SWIMMING CRAB (<i>Portunus pelagicus</i>) AND MUD CRAB (<i>Scylla serrata</i>) CAPTURED FROM NEGOMBO LAGOON IN SRI LANKA <i>R.M.M.H.P. Ranathunga^{1*}, K. Radampola¹, P.B. Terney Pradeep Kumara²</i>	37
EFFECT OF DIFFERENT DAIRY CATTLE MANAGEMENT PRACTICES ON RAW MILK QUALITY IN SELECTED VETERINARY REGIONS IN HAMBANTOTA DISTRICT <i>R.V.P.K. Madhushani¹, R.M. Nikzaad¹, G.R. Rajapaksha², and Muneeb M. Musthafa^{1*}</i>	38
PERFORMANCE OF GIFT TILAPIA LARVAE FED WITH DIFFERENT CONCENTRATIONS OF <i>DAPHNIA MAGNA</i> COMBINED WITH FORMULATED LARVAL FEED <i>W.S. Sandamini[*], R.D. Perera, D. Sathees, B.P.A. Jayaweera</i>	39
EVALUATING OF FEEDING VALUES OF DIFFERENT DRYING METHODS OF ALTERNATIVE ROUGHAGES <i>S.Thanusan^{1*}, P.B.Lahiru², V.Kalaivizhi³ and B.P.A.Jayaweera²</i>	40
BENTHIC MACRO INVERTEBRATES AS A BIO INDICATOR TO ASSESS WATER QUALITY OF AQUATIC ECOSYSTEMS <i>A.G.S.D. De Silva^{1*}, S. Siyamalan², R. Thusyanthini¹</i>	41
INFLUENCE OF GRASS AND MAIZE SILAGE ON MILK YIELD AND MILK COMPOSITION OF DAIRY COWS <i>H.M.A.K.M. Herath¹, H.K.R.S. Kumara^{1*}, G.G.P.D. Kumara²</i>	42

“Exploring Path for Food Security through Innovative Agriculture”

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AGRICULTURE ECONOMICS, EXTENSION AND ENTREPRENURSHIP

EMPOWERING FARMERS AT THE CENTER OF INNOVATION, INCLUSIVE DIGITAL TRANSFORMATION OF AGRICULTURE

P.W. Kumara, C. Padmini*, S. Dissanayake, and L. Hettiarachchi

Sri Lanka Council for Agricultural Research Policy, Colombo, Sri Lanka.

Abstract

The Agricultural sector in Sri Lanka is contributing significantly to the economy of the country. There are many issues and challenges in Agriculture due to limited infrastructure, climate change, lack of technology and poor Information Communication Technology (ICT). ICT is expected to be instrumental in the achievement of the sustainable development goals, and targets of agri-businesses. Digital agriculture is the use of digital technologies such as mobile phones, sensors, and data analytics to improve agricultural practices and increase productivity. It can empower farmers by providing them with research information, real-time data on weather conditions, soil moisture levels, and crop growth. To identify how close the Sri Lankan farmers to digitalization of agriculture, a questionnaire was developed to measure digital literacy of farmers in Sri Lanka to adopt new technologies through a digital extension system. The sample size was 100 farmers in Hambantota, Monaragala, and Mathale districts. Out of the 100 farmers, only 45 farmers use smartphones. The farmers in this study were divided into three age groups (< 40, 41- 60, and > 60), and three education levels (Degree, Advance Level (AL), and Ordinary Level (OL) or below). The study revealed that 80% of farmers with higher education levels (Degree and AL) use smartphones. Farmers with Ordinary Level education or below reported owning a smartphone is 2%. The use of smartphones by age groups was also examined, and usage rates for those <40, 41-60, and >61 were, 75%, 40%, and 67% respectively. Consequently, there is no significant relationship with age of the farmers with usage of smart phones. However, farmers' awareness to digital agriculture is inadequate. Further poor availability and connections to technology hinder the transformation to digital agriculture in Sri Lanka.

Keywords: Agriculture Farmers, Communication Technology, Digital Literacy

THE IMPACT OF PARTICIPATION IN AGRICULTURAL EXTENSION PROGRAMS ON FOOD PRODUCTION AMONG RURAL WOMEN FARMERS IN IMBULPE DS DIVISION IN SRI LANKA

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Abstract

Better food production plays a vital role in food security in any society. It acts as a timely important requirement for the increasing population in Sri Lanka. While extension service is essential for ensuring food production, recently women farmers' contribution in agricultural activities is in a conspicuous situation. Thus, this study was conducted to identify the areas that are needed to be focused specially for women farmers through agricultural extension programs and to assess the impact of participation in agricultural extension programs by women farmers on food production in this area. A sample of 145 women farmers was randomly selected for the study, from randomly selected five Grama Niladhari (GN) divisions of Imbulpe DS division. Data was collected from a field survey using a pre-tested, self-administered questionnaire survey from May to August 2022. Data analyses were conducted using descriptive statistics and regression analysis. As per the results, majority of the women farmers have participated in most of the extension and training programs. Moreover, modern farming technologies, organic farming, application of agrochemicals and fertilizers and improved market systems were identified as the important areas that need to be focused through the agricultural extension programs. Also, a significant number of women farmers have used their knowledge received from the extension programs in their farming activities. Thus, they use the knowledge to increase food production in quantity as well as quality wise. And also, there is a strong, positive relationship between the participation in extension programs and enhancement of food production in this area. Therefore, providing up to date agricultural information to them, encouraging for registration in farmer organizations, persuading them for the participation in agricultural extension programs, organizing training programs to disseminate timely important agricultural information may lead to better food production by the women farmers and thus enhance the food security in this area.

Keywords: Agricultural extension, Food production, Imbulpe, Rural women farmers, Sri Lanka.

THE SLGAP-2021 AGRICULTURAL PROJECT IN THE GALLE DISTRICT OF SRI LANKA: AN EVALUATION OF THE SUCCESS AND FALIURE FACTORS

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Abstract

The contribution of the food and agricultural sector to the Sri Lankan economy is very low compared to the industrial and service sectors. Evaluation of SLGAP-2021 project will be helpful in better future implementation of the GAP related projects by giving recommendations. This research aims to identify the main factors affecting the success or failure of the project and success of achieving the intended objectives of the SLGAP-2021. A thirty sample of beneficiaries of the SLGAP-2021 was purposely selected and A pretested structured questionnaire was used to collect the data from the beneficiaries primarily. More than 50% of GAP farmers agreed that the SLGAP2021 project might help in reducing the cost of production and 76.7% of GAP farmers agreed that the SLGAP-2021 project benefitted to develop the farm income. Presently all the farmers are targeting the local market and no one is farming for the export market. Anyhow the highest percentage of GAP farmers had an intention to grow crops for the export market in the future. Only 10% of the farmers were producing value-added products. But Most of the farmers had a future intention to go for it. The present economic crisis, sudden pest attacks and difficulty of market entrance had negatively affected to agricultural activities. Furthermore, GAP farmers in the Galle district received less support from the banks. Finally, it can be concluded that there is more than a 50% success in achieving each and every objective of the SGAP-2021 Project and some external factors have affected negatively in achievement of the objectives.

Keywords: Agricultural Project, GAP Farmers, Project’s barriers, SLGAP-2021, Success factors

INFLUENCE OF THE LOW-INPUT AGRICULTURAL MANAGEMENT PRACTICES ON KNOWLEDGE AND PREFERENCE FOR DIETARY DIVERSITY

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Abstract

Assessing the dietary diversity of a vulnerable group of people would be useful to propose policy alternatives to enhance their food security and nutrition. This study has identified the knowledge and preference for dietary diversity, and low-input agricultural management practices of small-holding paddy-based farming households, in Batticaloa District, Sri Lanka. Also, it examines the importance of these practices for this dietary diversity. This is based on the qualitative method of data collection and analysis. Detailed responses from male and female household heads of paddy-based farming households obtained using a household-level interview guide. Further, focus group discussions with Agricultural Instructors and Farmer Organization Representatives were used. The recordings were transcribed into text. These transcripts analyzed in Nvivo qualitative analytical package to showcase codes and themes. The study found that farming households have exhibited that their foods should be free from chemical residues during the assessment of their knowledge of dietary diversity, healthy balanced diet, and preference for dietary diversity, among the other sets of responses. Also, the study has identified the local input agricultural management practices: Kana Jeevamirtham, land preparation using organic raw materials, using traditional varieties, produce and use of bio-pesticides, based on the few adopters of the sampled households. These practices reduce the need for agrochemicals and the need for ploughing in the long term, which results in healthy natural foods while saving the cost of production, which supports resource-poor farmers. This supports the consumption of residue-free foods as their knowledge and preference depicted on their dietary diversity. However, there may be issues in obtaining these local inputs. Farmers should be properly educated about these practices, and how to obtain the inputs needed, to enhance their dietary diversity via these lower-input agricultural management practices.

Keywords: Dietary diversity, Low-input agricultural management practices

KNOWLEDGE AND ADOPTION LEVELS OF ENTREPRENEURS IN RELATION TO THE PALMYRAH NON-FOOD BASED PRODUCTION; A CASE STUDY IN TRINCOMALEE DISTRICT, SRI LANKA

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Abstract

Palmyrah (*Borassus flabellifer* L.) is a tropical palm tree and perfectly useful tree for many purposes. The objective of the research is to explore the awareness levels and adoption levels of entrepreneurs on Palmyrah non-food based production in Trincomalee District, Sri Lanka. A survey was conducted with the 55 entrepreneurs in Trincomalee district, Sri Lanka. Stratified random sampling technique was practiced for selecting samples from the total population of the district. Pretested questionnaire was prepared with a Likert scale and distributed, and data were collected. Data were analyzed using SPSS statistical software package. The selected sample contains higher female respondents and most of them are belongs to the age category of 41-50. Further, most of the respondents are married and not highly educated. With regard to the knowledge levels and adoption levels, basic knowledge, training, encourage to production, marketing support, government support is having significant (p value < 0.05) somewhat awareness level and adoption level. The factors of Selection of quality raw materials, availability of creative and innovative skills, future perception of the trade, latest technologies are not significant (p value > 0.05) on awareness levels and adoption levels. Understanding of entrepreneur's knowledge levels and adoption levels are important to the further development of Palmyrah nonfood production in the region.

Keywords: Adoption, Awareness, Entrepreneurs, Nonfood production, Palmyrah

“Exploring Path for Food Security through Innovative Agriculture”

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CROP PRODUCTION AND PROTECTION TECHNOLOGIES

OVEREXPRESSION OF RICE *BBX13* GENE IN Bg 250 SRI LANKAN RICE VARIETY TOWARDS THE DEVELOPMENT OF ABIOTIC STRESS RESISTANT RICE

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Abstract

Productivity of rice is greatly affected by several abiotic stresses. Identification genes of transcription factors which regulate abiotic stresses could provide candidate genes to generate transgenic plants. Plant B-box (BBX) proteins, a subgroup of zinc finger transcription factor family play a key role in light, hormone, and abiotic stress regulatory pathways. Overexpression of *BBX* in *Arabidopsis thaliana*, *Chrysanthemum morifolium* and apple, confer abiotic stress tolerance in transgenic plants. Rice *BBX13* is a functional ortholog of *Arabidopsis* *BBX21* involved in abiotic stress regulation. The focus of the present study is to overexpress *OsBBX13* in Sri Lankan ultra-short duration rice variety Bg 250 towards the development of abiotic stress tolerance in rice. The *OsBBX13* was cloned into pCAMBIA 1303 vector and the recombinant construct was transformed into *Agrobacterium tumefaciens* GV3101 strain by freeze thaw method. *A. tumefaciens* harboring the recombinant construct was transformed into Bg 250 rice by *Agrobacterium* mediated *in planta* transformation. T₀ transgenic plants were identified by conventional PCR and results showed that 75% of the regenerated plants were transgenic. Phenotypic analysis of the T₀ transgenic plants revealed that the growth and development of transgenic plants with *OsBBX13* was similar to that of wild-type plants. Copy number of the transgene was determined by qPCR using the absolute quantification method and four transgenic lines revealed a single copy of the transgene. Phenotypic segregation analysis was carried out in T₁ generation of *OsBBX13* transgenic rice using 50 mg/L hygromycin to investigate transgene integration and inheritance. The transgenic lines which showed 3:1 hygromycin resistant: sensitive ratio, that carried a single copy the transgene was selected to obtain T₂ homozygous lines. Relative transcript levels of *OsBBX13* in T₂ transgenic rice lines were examined by reverse transcription-quantitative real-time PCR (RT-qPCR) using actin gene as reference. Relative gene expression was calculated by comparative C_T method. Transgenic line T₂₋₈ showed a 2.6-fold increase in the expression level of *OsBBX13* compared to the non-transgenic plants, confirming the successful overexpression of the *OsBBX13* in Bg 250 rice. The overexpression confirmed transgenic rice could be used to determine abiotic stress tolerance in Bg 250 transgenic rice.

Keywords: Abiotic stress, *OsBBX13*, PCR, Rice, Transgenic

AYURVEDA PERSPECTIVE (VRIKSHAYURVEDA) ON CROP PRODUCTION AND CROP PROTECTION– A REVIEW

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Abstract

Ayurveda, the science of life, has served humanity for thousands of years. Preserving the health of a healthy individual and treating the diseased has been the aim of Ayurveda. The preservation and growth of the plant kingdom for the benefit of mankind is equally important. *Vrikshayurveda* (Agriculture in Ayurveda) denotes the science of plant life. As per the World Bank statistical data, agriculture represents 4% of the world's gross domestic product (GDP) and in some least-developed countries; it can mean more than 25% of GDP. The world needs to deal with many problems related to agriculture, including coping with climate change, soil erosion, and biodiversity loss, meeting the rising demand, and investing in farm productivity. The appropriate management and care required for the growth of the plant kingdom were made possible by this holistic approach to science. The objective of this study has been aimed to review on Ayurveda system of medicine for crop production and crop protection. The study was carried out as a review study and data was collected from Ayurveda authentic texts, previously published research papers, and journal articles. As per the findings, *Vrikshayurveda* consists of a deep knowledge of the connection of plants with other plants, animals, soil, moisture, temperature, and other geological phenomena. In *Vrikshayurveda*, the cultivation of plant species such as ingredients and remedies are defined which include plant category, guidelines for sowing seeds, water control, soil conservation, ‘*Kunapa Jala*’ (Fertilizers used to domesticate the plant life), weedicides, the numerous sicknesses affecting the plants and their remedy, collection, selection, and storage of seeds, germination, numerous strategies of plant propagation, etc. *Vrikshayurveda* has stated all viable measures to preserve ecological balance to keep the harmony of nature. In recent years, there has been a developing demand for herbal and conventional holistic healing systems. At this level, it is essential to develop appropriate cultivation methodologies by integrating knowledge from each conventional and contemporary science that continues to contribute to conservation and sustainable agriculture.

Keywords: Ayurveda perspective, Crop production, Crop protection, *Vrikshayurveda*

SPATIAL VARIATIONS OF START AND PEAK TIME OF SPIKELET OPENING OF SELECTED RICE VARIETIES: THEIR GRAIN STERILITY, HARVEST INDEX AND YIELD

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Abstract

Grain sterility of rice has been reported in different regions of Dry and Intermediate Zone of Sri Lanka. Rice pollen become a sterile while synchronizing spikelet opening greater than 35 °C temperature and 75 to 85 % humidity. Variety IR64EMF is near isogenic line which consist of early morning flowering ability received from Japan. The objective was to compare the stability of spikelet opening times and environment interaction of tested varieties. Five rice varieties Bg358, Bg374, Bg11-802, IR64 and IR64EMF were screened in *Ambalantota*, *Batalagoda*, *Bombuwala* and *Samanthurai*. Randomized Complete Block Design used with three replications. All cultural practises were done as the recommendations of the Department of Agriculture, Sri Lanka. Time of first spikelet opening and peak opening in 3 consecutive days from sunset (minutes), grain sterility %, harvest index and grain yield (t ha⁻¹) were recorded. All data were subjected to Analysis of Variance using STAR statistical software (IRRI, Philippines) and to find the G × E interactions of stability of flowering time and grain sterility among the locations and varieties using multiplicative model in same software. The shortest variation of spikelet opening and Peak opening recorded in IR64EMF whereas 78 -118, 145 – 208 minutes from sunrise depending on the location. The highest spikelet opening and peak opening recorded in Bg11-802 and Bg358. IR64EMF recorded the lowest grain sterility (12.7 %) and highest harvest index (0.6). Flowering time start significantly correlate on grain yield by 0.36 of Pearson correlation coefficient respectively. Stability of spikelet opening and peak opening times of IR64EMF, was not significant. IR64EMF have stable flowering behaviour which can avoid HISS by escape synchronizing flowering time with time of maximum temperature. Incorporation of early morning flowering trait into breeding program could be the best avoidance mechanism to minimize spikelet sterility under future hot climate.

Keywords: Grain sterility, Spikelet opening time, Stability of spikelet opening, Yield

**ASSESSING THE EFFICACY OF 3G SOLUTION TO CONTROL
ONION CATERPILLARS (*Spodoptera exigua* AND *Spodoptera litura*)
IN CLUSTER ONION (*Allium cepa*) AT IRANAIMADU,
KILINOCHCHI, SRI LANKA**

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Abstract

Onion (*Allium cepa*) has been valued as a food and medicinal plant since ancient times. Red onion has an important role in the Sri Lankan diet and has a high-value cash crop in the dry and intermediate zone. *Vedhalam* is the most preferable and widely cultivated red onion cultivar in the northern side of Sri Lanka. The bulb size, maturation time and yield of this cultivar are higher than other cultivars. *Spodoptera exigua* and *Spodoptera litura* are considered as pests of onion and these pests cause severe economic losses. Organic-based insecticide products help farmers to grow more food on less land by protecting crops from hazardous pests, diseases, weeds and raising productivity and yield per hectare. This study was carried out to assess the efficacy of a 3G pesticide solution (Ginger, Garlic and Green chili extract) against onion caterpillars. The experiment was arranged in RCBD design with five treatments and three replicates. Four different concentrations of the 3G solution T1 (1% of 3GS), T2 (3% of 3GS), T3 (5% of 3GS), T4 (10% of 3GS) and control treatment as T5 (no treatment applied) were used. *Vedhalam* cultivar of cluster onion was grown for this experiment. Analysis of variance (ANOVA) was performed in SAS software version 9.4. Duncan's least significant differences (LSD) test among the treatments were calculated to show the best treatment using the same software. In around three month of cropping season (17th Feb 2022 to 25th May 2022) the lowest mean number of *S. exigua* (0.2) and *S. litura* (0.3) were recorded from the treatment T4 (10%) of 3GS which was significantly different among all other treatments. The highest number of *exigua* (2.5) and *litura* (2.5) populations were recorded from the control treatment, while the lowest number of damaged plants (1.2) were recorded from T4-10% of 3GS, while the highest number (3.9) was recorded from the control treatment (T5). Based on the results obtained in the present experiment it is revealed that 3GS pesticide is considerably effective for the control of onion caterpillars at the initial stage of pest.

Keywords: Onion, Onion caterpillars, Pesticide, *Vedhalam* cultivar, 3GS

EFFECT OF *Lantana camara* LEAF EXTRACT ON THE COWPEA WEEVIL (*Callosobruchus maculatus*)

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Abstract

Cowpea (*Vigna unguiculata*) is one of the most important seed legumes consumed in Sri Lanka to meet the dietary requirements of protein and micronutrients. However, cowpea is highly susceptible to the storage pest (cowpea weevil) (*Callosobruchus maculatus*), which leads to substantial economic losses. The application of synthetic insecticides to eradicate such insect pests leads to numerous detrimental impacts on the environment and humans. Therefore, the study aimed to examine the potential of two different types of *Lantana camara* leaf extracts to combat *C. maculatus* under laboratory conditions at 30±2°C and 70±5% RH. Different fractions of orange and pink flower types of *L. camara* leaf extracts were used as a botanical pesticide against *C. maculatus*. The botanicals were extracted using different solvents, viz., 15% methanol, 15% diethyl ether, and an aqueous solution. The experiment was laid out in a Complete Randomized Design (CRD) with seven treatments and three replicates where cowpea seeds were treated with orange flower type leaf extract by using methanol (T1), diethyl ether (T2), aqueous (T3) as solvents and pink flower type leaf extracts by using methanol (T4), diethyl ether (T5), aqueous (T6) and seeds without any treatments (T7) and the data were statistically analyzed using SAS statistical software version 9.1. The results of the adult mortality test indicated that 83.3% of deaths occurred in the methanol leaf extract of orange and pink flower types of *L. camara* three days after treatment. On the sixth day after treatment, 100% adult mortality was observed in the leaf extract fractions obtained using methanol or diethyl ether as solvents with orange and pink types of *L. camara*. Moreover, a minimum of 38.6% adult emergence was observed in F1 progeny of *C. maculatus* in the seeds treated with methanol extract of the orange flower type compared to the other treatments. The results of the investigation showed that botanical fractions, especially those from the orange flower type *L. camara* using methanol extract, could provide effective control against *C. maculatus* on cowpea seeds during storage.

Keywords: Adult mortality, Botanical extracts, *Callosobruchus maculatus*, *Lantana camara*, Methanolic extract

STUDY THE EFFECTIVENESS OF PLANT BOTANICALS ON MAIZE WEEVIL (*Sitophilus zeamais*) CONTROL

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Abstract

Stored pest damage is a serious problem in maize storage. Several techniques are used to control pest damage including synthetic chemicals, temperature control, carbon dioxide fumigation and hermetic storing methods. However, various adverse effects have been identified when using the above techniques. There is a worldwide concern on the use of plant products to control stored pests. In this context, the objectives of the present study were to identify the insect pests in maize storage and the effectiveness of botanicals; *Aegle marmelos* (Bael leaves), *Citrus aurantifolia* (Citrus leaves), *Pimpinella anisum* on control of maize weevil. (Infested maize samples collected from Anuradhapura district were used to identify the pests. Selected botanicals were applied to maize seeds triplicates under three concentrations; 1 %, 2.5 % and 5 % (wt/wt) and the maize weevil (10 nos.) were introduced to the bottles. Seed germination (%), moisture content (%), weight loss (%), grain damage (%) were recorded during the storage. Data were analyzed using complete randomized design, in triplicates. Results revealed that the most common storage pests of maize were *Sitophilus zeamais* (maize weevil), *Sitotroga cerealella* (grain moth) and *Tribolium castaneum* (red flour beetle). Further, germination percentage of all the treated and untreated maize samples was not significantly different while the moisture content decreased after three months of storage regardless of the treatments while the damaged grain percentage due to maize weevil and the percentage weight loss were identified as the most important parameters to consider. According to the results gained, percentage of weight loss was significantly lower in *Annona muricata* 2.5% (3.79 ± 1.19). During the observations, a strong odor was detected in maize seeds treated with *Pimpinella anisum* and *Citrus aurantifolia*. Due to that the samples treated with *Pimpinella anisum* and *Citrus aurantifolia* were not used in the further experiments. Among the other treatments, grain damage percentage and weight loss percentage were significantly lower in *Annona muricata* 5% and *Annona muricata* 2.5% and those two were selected for further studies.

Keywords: Maize, Plant botanicals, Stored pest, Synthetic insecticides

GROWTH, YIELD AND ECONOMIC PERFORMANCES OF *Brassica oleracea* VAR. BOTRYTIS UNDER THE PROTECTED HOUSE IN THE LOW COUNTRY WET ZONE OF SRI LANKA AS AFFECTED BY ARTIFICIAL LIGHT SUPPLEMENTATION AND SPLIT APPLICATION OF ALBERT’S FERTILIZER SOLUTION

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Abstract

Split fertilizer application and supplementary artificial light could be increased plant productivity, but this was not adequately addressed in Sri Lanka’s protected agriculture, particularly in the low country wet zone. Therefore, this research study was conducted to investigate the effect of artificial light supplementation and split application of Albert’s solution on the growth, yield and economic performances of cauliflower (*Brassica oleracea* var. botrytis) variety White Flash grown using coir dust media under controlled environmental conditions in the low country wet zone of Sri Lanka. An automated light system (grid of 60 W LED lights) was used to maintain a minimum of 3000 lux between 6:00 a.m. and 6:00 p.m. Another protected house was maintained under natural light. Albert’s solution was supplied twice and thrice separately at a rate of 1.5 g per plant per day, which was found to be the optimum level in our previous experiments. The experimental design was two-factor factorial completely randomized design with four treatments and five replicates. The interaction effect was not significant. However, the results showed that the highest values of plant height (21.91 cm), number of leaves/plant (34.44), leaf area (339.04 cm²), diameter of curd (17.01 cm), fresh weight of curd (423.72 g), and above-ground biomass weight without curd (975.40 g) were significantly increased for artificial light supplementation and the highest values of number of leaves/plant (32.81), leaf area (322.44 cm²), diameter of curd (15.04 cm), fresh weight of curd (379.86 g) and above-ground biomass weight without curd (912.95 g) were significantly increased for thrice a day split application of Albert’s solution. Though there was no interaction effect between artificial light supplementation and split application of Albert’s solution, the study suggests that artificial light supplementation using LED bulbs and split application of Albert’s solution separately enhanced the growth and yield of cauliflower under protected house conditions in the low country wet zone of Sri Lanka. The economic analysis revealed that the highest benefit-cost ratio was achieved with artificial light supplementation and three split applications of fertilizer. However, implementing solar-powered artificial light could reduce electricity costs and result in a more positive benefit-cost ratio.

Keywords: Albert’s solution, Artificial light supplementation, Automation system, Cauliflower, Growth and yield

EFFECTS OF DIFFERENT ROOT INDUCING AGENTS ON CUTTING PROPAGATION OF TEA (*Camellia sinensis*)

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Abstract

In commercial cultivations, vegetative propagation through rooting of cuttings is common, and IBA based rooting hormone is often used. However, due to the need for non-chemical alternatives in organic cultivations, organic rooting substances have become increasingly important. Hence considering this, an experiment was conducted to investigate the effectiveness of different root inducing agents on the propagation of tea cuttings. The nodal cuttings were pre-treated with six different root inducing agents including water (control), aloe vera gel, coconut water, honey charcoal mixture, potato juice and rooting hormone (0.3% IBA). Each treatment was replicated four times with 20 cuttings in each. The experimental units were arranged in a completely randomized design. Cuttings' survival percentage, rooting percentage, number of roots, root length, fresh and dry weight of the root were evaluated during three phases as 2nd, 4th and 6th week. The data were statistically analyzed using SAS statistical package and treatment means were compared using DMRT at a 5% significance level. The results revealed that there were significant differences between the treatments on cutting performances. The cuttings treated with rooting hormone showed the highest values in rooting percentage (55.8%), sprouting percentage (72.3%), during the 4th week and root length (2.1cm) and root dry weight (0.254g) during the 6th week. Moreover, coconut water and aloe vera gel showed not significantly higher values in most of the measured variables compared to the rooting hormone. Therefore, it can be concluded that coconut water and aloe vera gel can be considered as alternative rooting substances to the chemical-based rooting hormone for organic tea cultivations.

Keywords: Aloe vera gel, *Camellia sinensis*, IBA, Propagation

EFFECT OF SPLIT APPLICATION OF ORGANIC FERTILIZER JEEVAMRUTHA ON GROWTH AND YIELD OF RADISH (*Raphanus sativus* L.)

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Abstract

An experiment was conducted at Crop Farm, Eastern University Sri Lanka to study the effect of split application of organic fertilizer Jeevamrutha on the growth and yield of radish (*Raphanus sativus* L.). Treatments used in the experiment were recommended fertilizer (T₁), 10 t ha⁻¹ compost with 1500 l ha⁻¹ of Jeevamrutha as a basal (T₂), 10 t ha⁻¹ compost with 750 l ha⁻¹ of Jeevamrutha as a basal with 750 l ha⁻¹ of Jeevamrutha at 10 days after planting (T₃), 10 t ha⁻¹ compost with 500 l ha⁻¹ of Jeevamrutha as a basal with 500 l ha⁻¹ of Jeevamrutha at 10 and 20 days after planting (T₄) and 10 t ha⁻¹ compost with 375 l ha⁻¹ of Jeevamrutha as a basal with 375 l ha⁻¹ of Jeevamrutha at 10, 20 and 30 days after planting (T₅). The study revealed that the highest root diameter, length and root weight were noted in T₄. Further, the fresh weight of the leaf was significantly higher in T₁, T₃, T₄, and T₅. The total plant weight was significantly increased in T₁ and T₄. According to the results, it can be concluded that 10 t ha⁻¹ compost with 500 l ha⁻¹ of Jeevamrutha as a basal with 500 l ha⁻¹ of Jeevamrutha at 10 and 20 days after planting would be more appropriate split application of Jeevamrutha to obtain better growth and yield of radish compared to tested treatments.

Keywords: Jeevamrutha, Leaf weight, Root weight, Split application, Yield.

MORPHOLOGICAL CHARACTERIZATION OF TURMERIC (*Curcuma longa*) IN GAMPAHA AND KALUTARA DISTRICTS, SRI LANKA

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Abstract

Curcuma longa is a valuable spice crop grown in Sri Lanka. It is cultivated as mono crop or intercrop mainly in wet and intermediate zones in Sri Lanka. Morphological characterization is important to describe plant phenotypic variability. There was a lack of studies conducted on morphological characteristics of *Curcuma longa* in Sri Lanka. The present study is mainly focused to identify the morphological characteristics of *Curcuma longa* available in Kalutara and Gampaha Districts, Sri Lanka. Three DS (Divisional Secretariat) divisions were randomly selected from each district and four GN (Grama Niladhari) divisions were randomly selected from each DS division. Snowball sampling technique was used to select the sample for data collection. The study found that the *Curcuma longa* plants varied in height from 80.0 – 120.6 cm in Gampaha district and 71.0 – 115.0 cm in Kalutara district. The leaf shape varied from obtuse to lanceolate. The leaf length varied from 26.0 cm – 49.8 cm and leaf width varied from 8 cm – 15 cm in Gampaha district. In Kalutara district, leaf length varied from 35.0 cm – 54.0 cm and leaf width varied from 10cm – 18 cm. The inflorescence length varied from 9.00 - 22 cm and inflorescences were whitish light green to light green colour. Rhizomes were straight to curve in shape and Rhizome colour variations are light yellow to orange yellow. The fresh weight of rhizomes per plant varied from 2.23 kg – 6.56 kg in Gampaha district and from 2.5 kg - 5.25 kg in Kalutara district. According to the cluster analysis, accession from near locations was grouped into the same cluster. Thus, there were morphological variations of *Curcuma longa* plants grown in Gampaha and Kalutara district which can be used by breeders for improvement of the plants.

Keywords: *Curcuma longa*, Morphology, Sri Lanka, Turmeric

EFFECT OF PLUCKING METHODS ON EFFICIENCY OF PLUCKING, YIELD AND QUALITY OF TEA (*Camellia sinensis* L.)

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Abstract

Plucking is the first step in the manufacturing process of tea (*Camellia sinensis* L) and tea plucking is considered to be the most labour-intensive field operation in tea cultivation. Under average field conditions in Sri Lanka, the labour requirement for manual harvesting is about 10-12 workers per ha, which can be considerably reduced by mechanical harvesting. Introduction of new plucking methods to overcome above issue is a current need. Therefore, this study has been conducted to test different plucking methods to find out the effect of plucking methods on efficiency of plucking, yield and quality of tea (*Camellia sinensis* L.). The experiment was design according to RCBD and three replications were used. Treatments applied were T1; manual plucking, T2; shear plucking and T3; machine plucking. Data were collected for plucking round, time required for plucking, yield, number of poor-quality leaves and number of best quality leaves. The collected data were statistically analyzed using SAS statistical software version 9.1. The mean differences were compared using Duncan’s Multiple Range Test at 5% significance level. Based on the results, machine plucking was significantly decreased the time taken for plucking and total cost of harvesting of 100kg of leaves. Meantime, yield was significantly increased by machine plucking during the study period. However, manual plucking was significantly recorded the highest amount of best quality leaves and lowest number of poor-quality leaves. Further, manual plucking was significantly recorded the shorted plucking round. Hence considering the findings, it can be concluded that, machine plucking can be recommended to the tea land more than one acre to reduce the cost of plucking while manual plucking is recommended to small scale land less than one acre and it will induce the best quality tea harvest.

Keywords: *Camellia sinensis* L., Cost of plucking, Plucking method, Quality harvest

EFFECT OF DIFFERENT SOURCES OF NITROGEN FERTILIZER AND SOIL AMENDMENTS FOR GROWTH AND YIELD PERFORMANCES OF *Zea mays* UNDER DRY ZONE CONDITION

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Abstract

Zea mays is a commercially cultivated crop in the dry zone of Sri Lanka and exhibit a strong dependency on fertilizer application, particularly nitrogen to enhance its yield performance. However, excessive use of fertilizers beyond recommended levels has been observed to yield diminishing and increasing environmental losses. The study aimed to investigate the most appropriate nitrogen source combination for better performances of *Z. mays* under zone conditions by implementing various soil amendments. The experimental investigation took place at the agricultural land of the University of Colombo Institute for Agro-technology and Rural Sciences, Hambantota, dry zone of Sri Lanka. The study employed a factorial Complete Randomized Design with three distinct nitrogen fertilizer sources as Urea, Ammonium Sulphate $(\text{NH}_4)_2\text{SO}_4$, and Ammonium biphosphate $(\text{NH}_4)_2\text{HPO}_4$ alongside a control group. Additionally, three different soil amendments, namely cow dung, paddy husk charcoal and coconut shell charcoal were tested, each with five replications. Inorganic fertilizers followed the recommendations of the Department of Agriculture, Sri Lanka, and standard cultural practices were employed. The study involved collecting data on various parameters, including growth (plant height, number of leaves, plant biomass), and yield (fresh and dry weight). The statistical analysis was performed using Minitab 17 software, employing Turkey and Dunnett tests. The results indicated a significant difference ($p < 0.05$) between the treatments and the control group for all tested parameters. Specifically, the combination of Ammonium bi-phosphate $((\text{NH}_4)_2\text{HPO}_4)$ and cow dung (T9) exhibited a significant increase ($p < 0.05$) in both plant fresh and dry weights, suggesting its efficacy in promoting a robust root system for *Z. mays*. Moreover, the combination of Ammonium Sulphate $((\text{NH}_4)_2\text{SO}_4)$ and coconut shell charcoal (T7) was found to significantly enhance above-ground biomass and yield ($p < 0.05$) of *Z. mays* under the dry zone.

Keywords: Ammonium biphosphate $((\text{NH}_4)_2\text{HPO}_4)$, Fertilizer, Dry zone, Yield, *Zea mays*

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FOOD PROCESSING AND POST HARVESTING TECHNOLOGIES

CHANGES IN PHYSICAL PROPERTIES OF TWO DIFFERENT BANANA ACCESSIONS UNDER DIFFERENT STORAGE CONDITIONS

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Abstract

Banana storage is very challenging all over the world due limited cost-effective strategies. Therefore, this study aimed at exploring the effect of different storage conditions: cardboard boxes; banana sheath box and hands with no containers, to check the quality of two banana accessions: *Seeni* (ABB) and *Puwalu* (AAB). Hands were disinfected before imposing treatments. The quality parameters: moisture content of banana peel and pulp; dry matter content of banana peel and pulp, were measured at one day interval for six consecutive days. The result revealed that the storage box made with banana stem sheath retained the quality parameters: moisture content of pulp and peel; dry matter content of peel and pulp of varieties after six days of storage compared to other two treatments. Peel moisture content values of *Seeni* variety were 86.89±0.60 (Cardboard box), 86.44±1.06 (Banana sheath box), 83.97±1.79 (Control), and for *Puwalu* variety, peel moisture content values were 87.27±0.56 (Cardboard box), 87.58±0.48 (Banana sheath box) and 87.07±0.61 (Control). Pulp moisture content values of *Seeni* variety were 64.41±1.40 (Cardboard box), 63.32±1.28 (Banana sheath box) and 64.13±0.67 (Control), whereas for *Puwalu* variety, pulp moisture content values were 68.06±0.61 (Cardboard box), 66.69±0.31 (Banana sheath box) and 67.59±0.46 (Control). The pulp dry matter content values of *Seeni* variety were 35.80±0.609 (Cardboard box), 36.48±1.06 (Banana sheath box) and 36.70±1.79 (Atmospheric storage). The pulp dry matter content values of *Puwalu* variety were 31.93±0.56 (Cardboard box), 33.30±0.48 (Banana sheath box) and 32.38±0.61 (Control). For the *Seeni* variety, the pulp to peel ratio values were 2.2533 (Cardboard box), 2.205 (Atmospheric storage), 2.4267 (Banana sheath box) and for *Puwalu* variety, the values for pulp to peel ratio were 1.7383 (Cardboard box), 1.6508 (Banana sheath box) and 1.7067 (Atmospheric box). Based on the outcome of this study, banana sheath box is good at maintaining the moisture content and freshness of two banana varieties used in this study. It is, therefore, be used in sustainable way to store banana effectively.

Keywords: Banana, Eco-friendly, Physical properties, Postharvest handling, Storage methods

IN VITRO ANTIOXIDANT AND ANTIDIABETIC ACTIVITIES OF SELECTED HERBAL INFUSIONS

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Abstract

This study investigated the *in vitro* total phenolic content (TPC), antioxidant, and antidiabetic activities of five aqueous herbal infusions attained from the leaves of *Phyllanthus debilis*, *Gmelina arborea*, *Artocarpus heterophyllus*, *Osbeckia octandra*, and *Hemidesmus indicus*. The TPC was determined using folin ciocalteu reagent and antioxidant activities were evaluated by FRAP, DPPH+, ABTS+, and lipid peroxide inhibition (TBARS) assays. *In vitro* antidiabetic activity was assessed by α -glucosidase and α -amylase inhibition, glucose diffusion via dialysis membrane and glucose uptake by yeast cells assays. The highest values of TPC and the highest DPPH+ scavenging activity were recorded in *P. debilis* extract. *O. octandra* extract exhibited highest scavenging ability for ABTS+ with IC₅₀ of 36.33±0.24 µg/mL and best activity for FRAP assay (147.59±5.55AAE µg/HT). Lowest IC₅₀ value for TBARS assay was observed in *G. arborea*. The strong inhibition against α -amylase and α -glucosidase were displayed by *O. octandra* and *P. debilis* extract with IC₅₀ of 25.01±1.31µg/mL and 6.62±0.00 µg/mL, respectively. *A. heterophyllus* showed the highest values for glucose dialysis retardation index (35.38-47.63%) and glucose uptake by yeast cells tests. The correlation analysis indicated a significant positive relationship of TPC and FRAP values (r=0.919) and significant negative relationship between FRAP and ABTS+ scavenging activity (r=0.994) and TPC and ABTS+ scavenging activity (r=0.923). The results revealed water extracts of tested plants exhibited prominent antioxidant and anti-diabetic activities, particularly *P. debilis* and *O. octandra*. These plants can be used as potential natural antidiabetic agents and the functional benefits may deliver to the general population by incorporating them into foods and nutraceuticals.

Keywords: Antidiabetic, Antioxidant, Herbal infusions

DEVELOPMENT AND SENSORY ANALYSIS OF FIBER ENRICHED PANEER FROM BLENDING COW MILK & BUFFALO MILK

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Abstract

Paneer is an important indigenous product which is obtained by heat treating the milk followed by acid coagulation. The present study was undertaken to make paneer enriched with fiber otherwise it called as fiber deficient paneer. Addition of coconut milk powder increases the dietary fiber content and also rich in healthy saturated fats with no cholesterol. Coconut powder is in the form of fiber was included in the preparation of paneer. The objective of this study was to develop a fiber enriched paneer with coconut powder and analysis of its sensory attributes. Paneer is one such product which is a regular dietary favorite among the people. Paneer is prepared by combined action of acid coagulants and heat treatment of buffalo and cow milk or a combination thereof. Paneer is a highly perishable product and has limited shelf life, largely because of its high moisture content. A sensory evaluation was done by nine-point hedonic scale on 30 non trained panelists to select the preferable mixer of cow milk and buffalo milk. After that five different ratios of coconut powder were added (0%, 0.5%, 1.0%, 1.5% and 2.0%). Then another sensory evaluation was done by 30 non trained panelists to confirm the product's acceptability. Data was analyzed using SPSS statistical software version 6.0.10. According to the first sensory evaluation the most preferable mixer of cow milk and buffalo milk paneer was selected (75:25). According to the second sensory evaluation treatment 5 (2% coconut powder incorporated paneer) shows the greatest score for overall acceptability (9.85 ± 1.18) and all other attributes except appearance. The sensory attributes of 2% coconut powder incorporated paneer shows greatest mean ranks among all the treatments. Its shelf life was reported to be only seven days under refrigeration, though its freshness is lost within three days. The spoilage of paneer occurs mainly due to the growth of microorganisms, which bring about various physicochemical changes.

Keywords: Buffalo milk, Coconut milk powder, Cow milk, Paneer, Sensory evaluation

CASSAVA COOKIES: A VALUE-ADDED PRODUCT OF CASSAVA (*Manihot esculenta*) GROWN IN SRI LANKA

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Abstract

Cassava (*Manihot esculenta*) is widely grown in developing countries and serve as an essential food source for rural population. Apart from the tubers which are consumed after boiling or frying, value added products are introduced to gain more economic benefits. In Sri Lanka the value addition for cassava is very much limited and yet to be explored. This study aimed to extract cassava starch from locally cultivated plants and produce cookies by substituting wheat flour in different proportions. It further compared the physicochemical properties of these cookies as well as the wheat flour cookies in order to determine the appropriate level of cassava starch that could be incorporated to produce high-quality cassava cookies. The results were statistically analyzed using analyses of variance (ANOVA), and the mean values were compared with Dunnett's test ($p=0.05$) using the SAS software version 9.0. Cassava starch (CS) was extracted from cassava tubers using a simple wet milling method. Cookies were prepared with recipes having cassava starch and wheat flour in different proportions namely 1:3 (25% CS), 1:1 (50% CS) and 3:1 (75% CS); the control formula had no cassava starch. All the experiments were carried out in triplicate using complete randomized design (CRD). The moisture content of cookies varied from 2.20 ± 0.18 % (in 50% CS) to 3.27 ± 0.09 % (in 0% CS) yet complied with the Sri Lanka Standard (SLS) 251:2010. The pH value of the formulations with 0% CS (6.57 ± 0.09) and 25% CS (6.55 ± 0.84) significantly differed from the pH values of the formulations with 50% CS (6.95 ± 0.25) and 75% CS (6.88 ± 0.41). The pH value of cookies of all the formulations in this study complied with the Food and drug administration of the United States (FDA) standard. There was no difference in acid-insoluble ash content and it varied from 0.02 ± 0.01 to 0.03 ± 0.01 ($p=0.05$), complying with the SLS. Cookies showed light color with the increase in cassava percentage. Cookies with 50% cassava starch had the highest consumer preference reflected by the overall acceptability.

Keywords: Cassava, Cookies, Sensory analysis, Sri Lanka, Value-addition

MUNG BEAN FLOUR AS A BINDER FOR PORK SAUSAGE

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Abstract

Binders play a significant role in determining the physicochemical, textural and sensory attributes of sausage. The high cost of binders is one of the biggest constraints faced by sausage processors. Mung bean flour (MBF) with excellent gelling, pasting and binding properties could be a promising binder for sausage processing. Two levels of treatment (T1-3 % and T2-6%) of MBF were tested in reference to commonly used isolated soy protein (ISP) (2%) binder in pork sausage making. Proximate composition, water holding capacity, emulsion stability, cooking loss, pH and sensory attributes of formulated sausages were tested. The moisture and ash contents were not significantly ($p>0.05$). The highest protein content (19.27%) was found in sausages followed by T2 (17.72%) while slightly increased fat content (23.01%) was noticed in (T2). Moreover the fat content of T1 and the reference sample were 19.45% and 21.86% respectively. The addition of MBF produced sausage with high fiber (T1:0.012%, T2:0.022%). The highest water holding capacity was found in the control followed by T2. The lowest cooking loss was exhibited in T2. Adding MBF significantly reduced the pH of sausages and this was more in T2. Sensory evaluation data indicated that there were significant differences in color, flavor, texture and overall acceptability among the tested samples. In the overall evaluation of physical and sensory attributes, it can be concluded that product with 3% MBF gave the most desirable quality characteristics compared with the control and thus could be considered as potential alternative for ISP.

Keywords: Mung Bean Flour, Physicochemical Properties, Pork sausage Sensory Properties

EXPERIMENTAL STUDY ON THE PACKED BED BEHAVIOR OF DRIED AND FRESH CAPSICUM ANNUM (RED CHILI)

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Abstract

Red chili peppers are frequently used as a spice in many different cuisines. Use of a proper technique for drying chili is important for reducing postharvest losses. This study was conducted to investigate on the packed bed behavior of dried and fresh chili and determine the physical properties of chili, with the intention of using the results for packed bed dryer design. Pilot scale, packed bed of 0.15 m diameter was used to investigate the pressure drop across the packed bed as a function of the air velocity for dry and fresh chili, for several bed heights. Pressure drop across the bed (ΔP) were measured as a function of the superficial air velocity (v) for increasing and decreasing air velocities. New equations ($\Delta P \propto v^n$); modified version of the Burke Plummer equation; were developed by data fitting with the coefficient of determination (R^2) above 0.99 for both fresh and dried red chili. The value of ‘n’ was found to be 1.88 and 1.52 for fresh and dry chili respectively indicating fresh chili has a higher pressure drop than dried chili. The proportionality constants in the equations, which are functions of specific surface area, density of chili and the bed porosity and were found to be 1841 and 1550 for fresh and dry chili respectively. The porosity of the dried chili (0.764) is higher than that of the fresh chili pepper (0.638). Pressure drop results for low bed heights showed irregular pattern due to channeling and hence 30 cm or above are recommended as the suitable bed heights for packed bed operations.

Keywords: Burke Plummer equation, Chili, Packed bed behavior, Packed bed dryer, Superficial air velocity

EFFECT OF VARIOUS PROCESSING TECHNIQUES ON ANTI-NUTRITIONAL VARIABLES, *IN VITRO* NUTRIENT DIGESTIBILITY, BIO-ACCESSIBILITY OF NUTRIENTS, TECHNO FUNCTIONALITY, MOLECULAR AND STRUCTURAL INTERACTIONS OF FINGER MILLET (*Eleusine coracana*)

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Abstract

The impact of different processing techniques on the characteristic changes of finger millet flour was assessed. It provides additional knowledge of the functionality of finger millet and will increase its utilization and potential in the food industry and contribute to better food security. Anti-nutritional factors, *in vitro* protein and starch digestibility and *in vitro* protein bio-accessibility, molecular and structural interactions of soaked, germinated, fermented and a combination of aforesaid treatments of grains were studied. Alterations of techno-functional properties were determined as water absorption capacity, water solubility index, oil absorption capacity, paste clarity, swelling power, emulsion activity, emulsion stability, and viscosity. Scanning Electron Micrographs and Fourier Transform Infrared spectroscopy revealed structural variations and macromolecular arrangement of processed finger millet. Soaking, fermentation, and the treatment combination showed a reduction pattern of tannin and phytate contents. But saponin content was increased ($p < 0.05$) with time in the germinated finger millet sample (2.03 – 2.50%). All bioprocess techniques increased *in vitro* starch digestibility (6.18 to 9.95 g/100 g) and *in vitro* protein digestibility (65.68 to 90.56 g/100 g). Soaking, Germination, fermentation, and treatment combination significantly increased ($p < 0.05$) water sorption isotherm and oil absorption capacity and slightly modified the swelling power, emulsion capacity, and emulsion stability of finger millet flour while water absorption capacity, paste clarity and viscosity were decreased. The combination of soaking, germination, and fermentation greatly improved most of the functional properties of flour with reduced antinutrients. A combination of treatments could enhance the use of finger millet in novel food product development and could serve as potential ingredients with improved techno and bio functionality in value-added cereal products.

Keywords: Fermentation, Germination, Saponin, Soaking, Tannin

POST-HARVEST QUALITY IMPROVEMENT OF COMMERCIALLY IMPORTANT CUT ROSE CULTIVARS (*Rosa hybrida* L) WITH APPLICATION OF DIFFERENT SILICONE SOURCES

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Abstract

Rosa hybrida L. is a popular commercial cut flower having a high demand in local as well as global markets though their short lifespan limits overall performance as a cut flower. Pre-harvest silicon application is known to enhance quality of many greenhouses grown cut ornamentals. However, the improvement of post-harvest performance on silicon application at plant establishment is yet to be studied. Therefore, this study was conducted to evaluate the effect of different silicon treatments and its deposition on the post-harvest development (days to flower opening), water relations (water uptake to loss ratio, water balance, relative fresh weight), senescence (wilting, browning and vase life in days) of two cut rose cultivars Grand Gala (GG) and White Success (WS) in a greenhouse pot experiment set up in a Completely Randomized Design (CRD) with three replicated experimental units per treatment and analyzed using two way ANOVA. Two-month old bud grafted rose plants established in standard growth media containing top soil: cow dung: sand (5: 4: 2) were treated with three silicon sources; sodium silicate (Na_2SiO_3) as foliar spray (0, 50, 100 and 150 ppm), drenched with potassium silicate (K_2SiO_3) (0, 80, 150 and 200 ppm) both applied in weekly intervals for five weeks and Rice Husk Ash (RHA) was incorporated to growth media (0, 50, 80 and 100 ppm) at plant establishment. In both cultivars, several treatment combinations (K_2SiO_3 150 ppm, K_2SiO_3 80 ppm, RHA 100 ppm, Na_2SiO_3 100 ppm) significantly improved water relation parameters and vase life (\approx 11-12 days) with no effect on days taken for flower opening (\approx 5 days) ($p < 0.05$). Interestingly 150 ppm of K_2SiO_3 drench showed the highest significant improvement in cumulative water balance, resulting increased vase life of two cut flowers compared to its controls. It was evident that this was resulted due to reduced loss of water compared to uptake during vase period. Moreover, it significantly reduced the rate of wilting sign development and petal browning of GG but showed no significant effect on these parameters of WS ($p < 0.05$). At the end of study period more silicon was deposited in leaves treated with 150 and 200 ppm of K_2SiO_3 . The results indicate that application of silicon improves the post-harvest performance of cut roses expanding its potential usage.

Keywords: Drench, Potassium silicate, Rice husk ash, Vase life, Water balance

THE POTENTIAL APPLICATION OF GIZZARD FAT IN CHICKEN SAUSAGE PROCESSING

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Abstract

Fat is essential for sausage and the quality of fat plays a key role in determining the quality attributes of sausage and even affects the cost of production. Gizzard fat is a major slaughterhouse by-product that is commonly discarded as a waste. This study focused to investigate the use of gizzard fat as the major fat source in chicken sausage making by replacing the traditionally used source of fat, chicken skin. Sausage samples were prepared by incorporating gizzard fat at 50%, 75%, and 100% levels replacing the chicken skin and was compared with the control (100% chicken skin). Proximate composition water holding capacity, cooking loss, emulsion stability, pH, texture and sensory properties of sausages were tested. The texture of the sausages was measured with a texture analyzer. Sausages with gizzard fat (50%, 75% and 100%) significantly ($p<0.05$) reduced the moisture and protein contents but increased the fat content more than the control. The addition of gizzard fat improved the water-holding capacity and emulsion stability and reduced the cooking loss ($p<0.05$) of sausages than the in control. The incorporation of gizzard fat significantly ($p<0.05$) reduced pH and level of acidity increased with increasing level of gizzard fat. The hardness was significantly ($p<0.05$) increased as the level of gizzard fat increased. Sensory analysis revealed that the incorporation of gizzard fat had a significant effect on sausage color ($p<0.05$) while not influencing flavor, overall acceptability, texture, and juiciness compared to the control. The study concluded that incorporation of particularly at 75% and 100% levels improved the water holding capacity, fat content, emulsion stability, cooking loss (lower), hardness, and color indicating its potential application as a source of fat for chicken sausage manufacturing.

Keywords: Chicken sausage; Chicken skin; Gizzard fat; Physiochemical properties

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INNOVATION FOR SUSTAINABLE AGRICULTURE

EFFECT OF WATER RETENTION BY WATER-REPELLENT AND NON-WATER REPELLENT LEAF LITTERS UNDER DIFFERENT LITTER DEPTHS AND WATER INPUT LEVELS

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Abstract

Leaf litter fallen from plants can facilitate plant growth by altering temperature, moisture, and light availability. Characteristics of the litter might change the amounts of water retained in the litter layers and the proportion of water that passes through the litter layer. Water repellency is highly related to water movements. The movement of water through water-repellent and non-repellent leaf litter types are not well understood. This research was conducted to assess the effects of water-repellent and non-repellent litters on the trapping of moisture, considering the impacts of litter thickness and the amount of water inputs. Casuarina and pine leaf litters were used as water-repellent litter types. Acacia and Mahogany leaf litters were used as non-repellent litter types. Four levels of litter thicknesses (1, 3, 5, and 7 cm) and six levels of water inputs (25, 50, 100, 250, 400, and 550 ml) were used under laboratory conditions as pot experiments, in triplicate following CRD factorial design. A plastic pot (11.2 cm height; 11.2 cm diameter) filled with 500 g of air-dried sandy loam soil (9.3% moisture content, 1.26 g cm⁻³ bulk density, 2.46 g cm⁻³ particle density, and 49.03 % porosity, 5.73 pH, 64.27 µS cm⁻¹ EC). Different weights of dry leaves were used for different litter depths (1 cm: 7 g; 3 cm: 12 g; 5 cm: 25 g; 7 cm: 36 g). Litter samples were air-dried and broken into small pieces before making layers. Mahogany, the non-repellent litter type, showed the highest retained water (42 g at 550 ml water input level) followed by Acacia (21 g). Results revealed that repellent litters retained less amount of water compared to non-repellent litters. Mahogany has the largest leaf surface compared with Acacia, Casuarina, and Pine. The needle like structure and the water-repellent nature of the surface due to the waxes found in water-repellent litters might influence the retained amount of water and that might be the reason for water repellent litters to retain less amount of water compared with non-water repellent litters. Further experiments are required for clarifications on higher levels of water inputs and thicknesses.

Keywords: Litter thickness, Non-repellent litter, Trapping of moisture, Water repellent litter

YIELD AND QUALITY OF GROUNDNUT OIL EXPELLED USING VIRGIN COCONUT OIL (VCO) EXPELLER

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Abstract

Groundnut (*Arachis hypogaea* L.) belongs to Family Fabaceae, and it is one of the valuable oil crops that contain 45-48 % oil content. The total extent of cultivation of groundnut in Sri Lanka is about 2000 ha. Groundnut is consumed in boiled, raw as well as in roasted forms. Apart from these, due to the beneficial health effects of groundnut oil, the demand for using it as a coconut oil substitute is fast increasing. Taking these facts into consideration, a method was developed to extract oil from groundnuts using virgin coconut oil (VCO) expeller, and the yield and quality of oil were determined. The method was comprised of deshelling groundnuts, followed by pre-treating the same by steaming at three different steaming times: 10, 15, and 20 minutes. After the pre-treatment, the nuts were loaded into the hopper of the VCO expeller, and crude groundnut oil was extracted. Extracted crude oil samples were stored at room temperature (30 ± 2 °C) for sedimentation to obtain pure groundnut oil. The study revealed, no significant difference in the samples treated for 10 min ($34.62 \pm 1.29\%$) and 15 min ($34.47 \pm 0.11\%$) but the yield was significantly lower in samples treated for 20 min ($27.51 \pm 5.06\%$) with other two treatments and higher yield was obtained in 10 min steamed sample. Saponification values of samples steamed for 10 min (189 ± 3.6 mgKOH/g) and 15 min (189 ± 3.6 mgKOH/g) were not significantly different, but it was significantly lower in the samples treated for 20 min (180 ± 0.58 mgKOH/g). The differences of refractive index and specific gravity among samples steamed for different times were not significantly different.

Keywords: Oil expeller, Refractive index, Specific gravity

FERTILITY MANAGEMENT OF DIFFERENTLY MANAGED RUBBER (*Hevea brasiliensis*) GROWING SOILS

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Abstract

Rubber (*Hevea brasiliensis*) is one of the most important cash crops in Sri Lanka. Recently, the growth of immature rubber plants has declined due to low fertility level of rubber growing soils. The yield of mature rubber plants is heavily affected the growth rate of the immature rubber plants. This study was conducted to assess the soil fertility status of immature rubber plantations managing under two different management practices such as properly adopted soil conservation practices and no any soil conservation practices in *Homagama* rubber-growing soil series. This soil series is considered as the lowest fertile rubber growing series which belongs to Red Yellow Podzolic (RYP) great soil group. Soil samples were collected as three replicates under two management practices and analyzed for pH, soil Organic Carbon (SOC), exchangeable Potassium (K), Magnesium (Mg), Ammonium- N ($\text{NH}_4^+\text{-N}$), Nitrate-N ($\text{NO}_3^-\text{-N}$), and soil texture. The data were subjected to comparisons between two practices. The results revealed that the rubber growing soil in *Homagama* series was significantly higher in SOC (1.79%), and exchangeable K (41.27 ppm) under proper soil conservation practices compared to no soil conservation. Moreover, the pH (4.4-6) showed optimum range for rubber plants under both management practices. However, other tested soil properties were not significantly different ($p>0.05$) among the two practices in *Homagama* series. Overall, the results directed with well-managed soil environments generate the optimum conditions for SOC, exchangeable K and pH which tends to increase the fertility level of immature rubber growing soils thus paving a path towards the highest economic yields of rubber.

Keywords: Good agricultural practices, *Homagama* soil series, Immature rubber plants, Soil fertility.

INFLUENCE OF SOIL AMENDMENTS AND THEIR HYDROPHOBICITY ON THE FORMATION OF SOIL AGGREGATES

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Abstract

Soil aggregate formation is a natural phenomenon that is affected by numerous factors such as organic materials and inorganic ions. Soil hydrophobicity improves soil aggregate stability. However, the evidence available on its relation to aggregate formation is contradictory. This study aimed to determine the effects of organic and inorganic soil amendments on the formation of soil aggregates. The formation of aggregates was tested using four soil amendments, namely cattle manure (CM), hydrophobic leaf litter (*Casuarina equisetifolia*, CE), biochar prepared from CE leaf litter (BC_{CE}), and quick lime (CaO) (initial moisture contents of CM, CE and BC_{CE} were 12.1, 16.8, and 6.5% respectively). Sieved (<2 mm) surface soil was mixed with 3% of CM, CE and BC_{CE}, and 1% of CaO. Surface soil was used as the control. Soils were moistened to 80% of the field capacity and incubated for 5 weeks in containers. The moisture content was maintained by spraying water on moisture-loss basis. After 5 weeks, aggregates were separated into the 3 size categories (<3, 3-6, 6-10 mm). The samples with CE showed the highest formation of aggregates (5.0% w/w), followed by CaO (3.4%), CM (3.0%), control (2.9%), and BC_{CE} (2.4%). Only CE amendment was significantly higher compared with the control ($p < 0.05$). However, CE, CaO and CM treatments showed significantly high aggregate formation compared with BC_{CE}. The 3-6 mm size aggregates showed the highest proportion (42-51%) among the formed aggregates. Results revealed that the CE (water-repellent litter) was the best amendment to promote aggregate formation. It was not clear whether the water-repellent nature influenced the aggregate formation. Results further revealed that while all other amendments positively influenced aggregate formation, BC_{CE} negatively influenced the aggregate formation. Further experiments are necessary to identify the formation trends of aggregates in relation to the soil amendments considering longer time periods.

Keywords: Aggregate formation, Soil aggregates, Soil amendments

GLIRICIDIA SEPIUM GREEN LEAF MANURE DECOMPOSITION AND MINERALIZATION UNDER DIVERSE NUTRIENT MANAGEMENT STRATEGIES IN IRRIGATED LOWLAND RICE CROPPING SYSTEMS

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Abstract

The application of green manure has been an integral approach to the nutrient cycling process of agroecosystems, opening avenues towards improving fertility and fertilizer substitution. The decomposition and nutrient mineralization are governed by soil microbial activity, which apparently depends on nutrient management approaches; conventional, and organic. This experiment was conducted to study the decomposition and N mineralization of *Gliricidia sepium* green leaf manure in contrasting nutrient management systems in an irrigated rice ecosystem for a period of eight weeks. Litterbags containing fresh *G. sepium* leaves were placed in two soil depths, namely, topsoil (0-15 cm) and subsoil (15-30 cm), in a lowland rice land under three different nutrient management systems; 100% of Department of Agriculture (DOA) recommended inorganic fertilizer application (conventional nutrient management system -CNM), 50% of DOA recommended inorganic fertilizer with organic fertilizer application (integrated nutrient management system - INM), and 100% organic fertilizer application (organic nutrient management system-ONM). The systems were arranged in a randomized complete block design with six replicates. The decomposition and N mineralization followed a similar biphasic pattern with an initial higher and slower latter phase in all three nutrient management systems for both depths, but among the three nutrient management systems a significant difference existed. ONM recorded higher rates and a shorter time for 50% and 80% reduction of biomass and N than INM and CNM. Moreover, decomposition and nutrient release rates of litter bags placed on topsoil were significantly ($p<0.05$) higher than the subsoil placement. Within 4-5 weeks after incorporation, approximately 80% of N, quantitatively 49-53 kg N ha⁻¹ was released into the soil solution, irrespective of the system. With appropriate rates and frequency of application and the depth of placement, *G. sepium* leaf green manure can provide a substantial amount of N and may synergize with mineral fertilizers to deliver N in lowland rice-based systems.

Keywords: Decomposition, *Gliricidia sepium*, Lowland rice cultivation, N Mineralization, Nutrient management

ANALYSIS OF DECADAL CHANGES OF RAINFALL VARIABILITY IN THE SOUTHERN SRI LANKA

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Abstract

Rainfall is a primary source of water not only for rain-fed and irrigated agriculture systems but also for many other industries that rely on hydroelectricity in Sri Lanka. Globally, there is a temporal and spatial variation in the rainfall pattern and no exception for the Sri Lankan context. The variation in the rainfall pattern has paramount validity in the fields of agriculture, fisheries and disaster management. Present study aimed to analyze the spatial and temporal variations in rainfall of the Southern Sri Lanka over the last 30 years. Daily rainfall data during the period of 1990-2020 were purchased selecting ten Weather stations (Baddegama Estate Dandeniya Tank, Galle, Hambantota, Lunugamwehera, Mawarella Estate, Yala Depedena Group, Pelawatte, Kalutara-P.W.D) distributed in the Southern Sri Lanka from the department of meteorology. Monthly, annual and monsoonal rainfall were calculated, while the missing data was filled using standard methods. The Mann-Kendall and Sen's slope methods were employed to explore the monthly, annual and monsoonal trends. Inter-decadal rainfall variability was compared by calculating mean annual data for the period of 1991 – 2000, 2001 – 2010 and 2011 – 2020. The ArcGIS was used to plot the spatial distribution of mean decadal rainfall. The inverse distance weighting (IDW) method was used to interpolate the mean annual rainfall values at regular intervals. There was a spatial variation in the trend observed in the annual rainfall patterns of the Southern region, where Baddegama, and Mawaralla exhibited an increasing trend. Dandeniya exhibited a downward trend, while there is no any specific pattern in the rainfall of other stations. The maximum and the minimum rainfall of the Southern region in the last three decades were detected in Mawarella and Yala respectively. The annual average rainfall of Mawaralla during the studied three decades were 4644.95 mm, 4099.09 mm and 4530.42 mm respectively, while the minimum rainfall found in Yala during the same time periods were 975.12 mm, 955.45 mm and 989.76 mm respectively.

Keywords: Mawaralla, Rain-fed agriculture, Rainfall, Sri Lanka, Yala

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LIVESTOCK, FISHERIES AND AQUACULTURE

NUTRITIONAL EVALUATION OF SILAGES FROM PROMISING FODDER GRASSES IN KILINOCHCHI DISTRICT, SRI LANKA

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Abstract

Four promising fodder grasses (CO3, CO5, Red Napier & Super Napier) were identified in the Kilinochchi District according to the concern of the farmer. Silages of these four fodder grasses were prepared and nutritional composition of each silages evaluated. Inadequate quality forage and the lower availability of forage crops is considered as a limiting factor for livestock production. Introducing of different silage grasses helps to overcome these problems all over the dry zone. In dry zone of the Sri Lanka, insufficient fodder production is one of the main factors restricting dairy production. Silage is a feed that has been preserved by acidification as a result of fermentation in the absence of oxygen. "Ensiled forage" or "silage," can remain intact for up to three years when storing properly. The lack of high-quality forages and their accessibility may be a factor in Sri Lanka for lower dairy productivity of livestock. The main objective of this study is to find out the nutritional characteristics of silage made from different grass (Indian red napier, CO5 grass and other napier grasses, CO3 and super napier) grown in Northern part of Sri Lanka. Matured grasses were harvested and four silage samples (T1, T2, T3 & T4) were prepared according to the standard procedure. The proximate composition of different types of silage made from different grasses were significantly different ($p < 0.05$). Among the silages, CO5 had the highest percentage of crude protein (CP) (16.07 %) and moisture (75.04 %) meanwhile super napier had the highest percentage of fiber (31.43%), lowest percentage of ash content (2.5%) and lowest percentage of fat content (1.16%). Based on the above results, we can conclude that super napier silage have higher nutrient value compared with other silages. The optimum pH value of silage sample should be (3.8-4.2). The highest pH was recorded for CO5 grass & all other remaining samples shows the same value as 3.9. Therefore, the silage made from super napier can be suggested for the Kilinochchi district farmers to provide better yield and growth performances.

Keywords: CO3, CO5, Fodder, Red Napier, Silages, Super Napier

STUDY THE GROWTH PERFORMANCE POST-LARVAE OF LOCAL BUTTER CATFISH (*Ompok bimaculatus*) UNDER DIFFERENT STOCKING DENSITIES IN CEMENT TANKS

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Abstract

Even though high stocking densities of the fish have been achieved by intensive management, this stocking density may interfere with the growth and survival of fish. This study describes the effect of stocking density on total length, weight gain and survival of Butter catfish (*Ompok bimaculatus*). Groups of post-larvae (PL) were reared at seven different stocking densities (0.25, 0.5, 0.75, 1, 1.25, 1.5 and 1.75 PL/ L) for 50 days until become the fingerling stage with three replicates with the feeding was done throughout the day with a two-hour gap between the feeding. Around 95 fish can grow very well in 126 litres of water, stocking density had a significant effect on Butter catfish growth performance (condition factor=0.39 gcm⁻¹) and survival rate (86.3 %). The fish condition factor also affected by stocking density. Increasing stocking density suppressed the fish growth. The study revealed that the stocking density of 0.75 PL/ L was the best for the intensive management of *Ompok bimaculatus*.

Keywords: Cement tanks, *Ompok bimaculatus*, Intensive management, Stocking densities

PREVALENCE OF GASTROINTESTINAL PARASITES IN FREE-RANGE GOATS (*Capra hircus*): A STUDY IN MIHINTALE VETERINARY DIVISION OF ANURADHAPURA DISTRICT

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Abstract

The purpose of this study was to investigate the prevalence of gastrointestinal parasites in goats under the free-range farming system in the Mihinthale veterinary division. To achieve this objective, 50 goat farms were randomly selected, and fecal samples were collected directly from the rectum of each selected animal using disposable medical gloves. The samples were placed in sterilized containers and immediately transferred to a 4°C iced container until dispatched to the Parasitology Section of the District Veterinary Research Investigation Centre in Kurundhankulama, Anuradhapura for carpological examination. The study found that 76% of the goats were infected with gastrointestinal parasites, while 24% tested negative. The most common gastrointestinal parasite found was *Haemonchus contortus*, with an incidence of 65.78%, followed by *Oesophogostomum* spp. at 18.42%, and *Trichostrongylus* spp. at 15.78%. The study also found that recently dewormed goats (< 3.08 mean weeks) had the highest incidence of nematodes. Most farmers used Levamisole and Oxclozanide as a dewormer (85%), but the highest success rate was seen with Levamisole and oxclozanide combined with Ivermectin (before or after one week), which had an 80% efficacy rate. There was a significant difference ($P < 0.05$) between the type of dewormer used and the parasite egg count. Poor farm management practices, such as poor feeding, unhygienic watering, and inadequate housing facilities, would be contributing factors to the high prevalence of nematodes among the goats. The study concludes that *Haemonchus contortus* is the major parasite in the goats of the study area, and improved farm management practices and regular deworming are necessary to control gastrointestinal parasites in goats.

Keywords: Deworming, Farm management, Gastrointestinal parasites, Goats

EVIDENCE OF MICROPLASTICS IN GIANT TIGER PRAWN, (*Penaeus monodon*) CAPTURED FROM NEGOMBO AND KOGGALA LAGOONS IN SRI LANKA

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Abstract

Microplastics (MPs < 5 mm) are ubiquitous pollutants globally present in both marine and freshwater environments. MPs available in the water column and sediments can be accumulated in certain aquatic organisms through their feeding mechanisms. The effects of ingested microplastics includes disruption of metabolism, growth and reproduction of organisms. The trophic transmission of MPs also causes bioaccumulation or biomagnification of microplastics leading to accumulate MPs in top predators. The present study was conducted to examine the abundance and diversity of MPs in *Penaeus monodon* (giant tiger prawn), water, and sediments collected in Negombo (NL) and Koggala (KL) lagoons in Sri Lanka. Acid digestion protocols were used to extract MPs. Availability of MPs were examined in gills, gastrointestinal tract (GIT) and hepatopancreas of *P. monodon* captured from both lagoons. MPs abundance was comparatively higher in the gills than hepatopancreas and GIT for both lagoons. The MPs abundance of prawn (MPs individual⁻¹) in NL was significantly higher (33.00±5.54) than that of KL (17.73±5.90). MPs abundance of water and sediments of NL were 70.67±12.50 MPs L⁻¹ and 217.00±54.67 MPs kg⁻¹ respectively while these values were significantly higher than that of KL (31.00±7.00 MPs L⁻¹, 109.00±25.06 MPs kg⁻¹). Fragments were the most dominant type of MPs followed by fibers in both lagoons. The number of fragments in *P. monodon*, water, and sediment of NL was significantly higher than those in KL. The predominant colors were identified as red, black and blue in *P. monodon*, water and sediment in both lagoons. Fiber MPs were comprised with large (>750µm), medium (250-750µm) and small (<250µm) sizes. Results suggest that *P. monodon* is vulnerable to MPs contamination. Further studies are recommended to assess the baseline information found in the present study by revealing the possible pathways, sources and impacts of MPs.

Keywords: Abundance, Gastrointestinal tract, Hepatopancreas, Microplastics, *Penaeus monodon*

EVIDENCE OF MICROPLASTICS IN BLUE SWIMMING CRAB (*Portunus pelagicus*) AND MUD CRAB (*Scylla serrata*) CAPTURED FROM NEGOMBO LAGOON IN SRI LANKA

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Abstract

Plastic particles smaller than 5 mm are grouped as Microplastics (MP) which are widely distributed throughout marine, freshwater and terrestrial environments and emerging pollutants of global importance. MPs can be ingested by aquatic organisms mistakenly and when humans consume aquatic organisms, there is a possible chance to transfer these MPs via trophic transfer. In this study, we report for the first time that microplastics have accumulated in *Portunus pelagicus* (PP) and *Scylla serrata* (SS) in Negombo lagoon, Sri Lanka. The quantity and diversity of MPs in Gill, gut and hepatopancreas of PP and SS were investigated by using 10 sample from each crab species. Nitric acid digestion protocol was used to isolate MPs by digesting organic matters. Based on the result which we observed, it can be accurately stated that both species of crabs have accumulated 100% MPs. This means that the crabs have ingested or absorbed a significant amount of microscopic plastic particles, which can have harmful effects on their health and the ecosystem. The abundance of MPs in PP and SS were 180.80±51.26/individual and 294.20±81.85/individual respectively. Furthermore, abundance of MPs in gill (69.90±34.67 PP, 147.50±44.5 SS) were significantly higher than gut (39.90±16.58 PP, 62.50±21.1 SS) and (44.30±12.60 PP, 85.30±26.55SS) in both crab species. The analysis involved the collection of water and sediment samples from various three locations of Negombo lagoon and the subsequent examination of their microplastic content. MPs were mainly fragments followed by fiber of different color range. Red, black and blue identified as predominant color PP, SS, water and sediment sample. When comparing two crab species in Negombo lagoon, PP has higher MP abundance than SS. The presence of microplastics in edible crab species poses a threat to food safety. Further research on microplastics in different edible aquatic species is crucial to understand the potential human health risks associated with their ingestion and to guide future policies and regulations to mitigate these risks.

Keywords: Microplastic, Negombo lagoon, *Portunus pelagicus*, *Scylla serrata*

EFFECT OF DIFFERENT DAIRY CATTLE MANAGEMENT PRACTICES ON RAW MILK QUALITY IN SELECTED VETERINARY REGIONS IN HAMBANTOTA DISTRICT

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Abstract

The dairy industry is currently expanding in Hambantota district. However, milk producers and customers who collected milk from Hambantota raised concerns about milk quality. Therefore, this study was carried out to evaluate the effect of different dairy cattle management practices on raw milk quality. The study was conducted in the Hambantota district - Southern Province and covered five veterinarian regions. From convenience sampling method five veterinarian regions were selected and simple random sampling method was used to identify the smallholder dairy farms for milk collection. The total number of 450 milk samples was collected, obtained from 30 small-scale dairy farms operating under three different farming systems: intensive (n=5), semi-intensive (n=10), and extensive (n=15). Milk samples were analyzed at the laboratory of Malindu Dairy (PVT) LTD (MDL) in Agunukolapalassa. One-way ANOVA using Post-hoc Least Significant Difference (LSD) and Student's T-test were used to compare milk quality parameters among farming system and standard value. All the statistical analyses were performed at significant level 0.05 ($P < 0.05$). According to the results, milk KQ and SNF % values are higher than in the extensive systems compared to intensive and semi-intensive systems. Significantly high lactometer reading was recorded in extensive farming system. There are no significant differences between all three farming systems on Fat %, TS %, Lactose %, Protein %, Water %, Alcohol and COB. Most of the milk samples in this study area were acceptable good quality level. In all the milk samples, protein, lactose, fat, SNF and TS levels were significantly ($P < 0.05$) higher than standard value. Further lactometer reading and Keeping Quality (KQ) were recorded highest value in extensive farming system than other farming systems and standard value. According to my findings, the extensive farming system's milk quality is higher than the other dairy cattle farming systems in Hambantota selected area. In future, welfare studies of the farming system have to be considered for the improvement of milk quality.

Keywords: Dairy industry, Farming systems, Milk composition, Milk quality, Smallholder dairy farms

PERFORMANCE OF GIFT TILAPIA LARVAE FED WITH DIFFERENT CONCENTRATIONS OF *Daphnia magna* COMBINED WITH FORMULATED LARVAL FEED

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Abstract

GIFT Tilapia (*Oreochromis niloticus*) is a rapidly growing freshwater fish. The performance of GIFT tilapia depends on the quality of fry and fingerling. Low survival rate and poor performance during the larval stage of GIFT tilapia is reported in Sri Lanka. The nutritional implications may be attributed to the poor survival rate and performance of larvae. Water flea *Daphnia magna* has high nutrient content and is appropriate for feeding larvae according to the gape of size fish larvae. This study was conducted using a completely randomized experimental design with three treatment and three replicates. This research was conducted to investigate the effect of supplementing commercial larval feed with different rates of *Daphnia magna* on performance of larvae. Day-old (three days) larvae (n=10000, at 48 fish L⁻¹) were allocated to three treatments with three replicates under each. Water quality during the research was maintained at temperature 28⁰C, pH 7, the DO 0.3 ppm. Larvae in the control (T₁) received commercial larval feed at 12% of body weight. Larvae in T₂ and T₃ received commercial diet 12% + five *Daphnia*, and commercial diet 12% + ten *Daphnia* per larvae per day respectively. Standard length and body weight were measured at 21days of larval culture and Length gain rate (LGR) Body weight index (BWI), Body weight gain (BWG), Daily growth rate (DGR) Specific Growth rate (SGR) were assessed. Initial mean weight and mean standard length were 0.03(±0.00)g and 0.90(±0.09)mm respectively. Data were analyzed by using IBM SPSS Statistics 20. The highest values of stander length (3.9±0.134cm), body weight (0.38±0.008g), BWI (0.35g), Length gain (3.00cm), LGR (76.92%), BWG (343g), DGR (2.85%), SGR (12.09%/day) and Survival rate (98%) were recorded in T₃. The lowest values of Standard length (2.20±0.143cm), body weight (0.20±0.012g), BWI (0.17g), LGR (59.09%), BWG (149g), DGR (0.80%), SGR (9.03%/day) and Survival rate (88%) were recorded in T₁ (P ≤ 0.01). Larvae in T₃ have reached the fry stage (weight of 0.3g and length of 3.5cm) even before 21 days. It was concluded growth performance and survival rate of the GIFT tilapia larvae can be improved by providing formulated feed at 12% of body weight supplemented with 10 *Daphnia magna* per larvae per day.

Keywords: *Daphnia magna*, Tilapia, Live Feed, Larvae, Fry

EVALUATING OF FEEDING VALUES OF DIFFERENT DRYING METHODS OF ALTERNATIVE ROUGHAGES

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Abstract

Dairy industry is the most prioritized livestock sub sector in economy of Sri Lanka. Lack of good quality forage is a major constraint to profitable dairy production. There is a need for convenient forage conservation method which require less labour and time. This study was designed to evaluate feasibility of conserving roughages in dry pellet. Four forages varieties; *Gliricidia sepium*, Hybrid Napier Grass (CO3 and CO4), and *Leucaena leucocephala* (Ipil Ipil) were harvested at correct maturity and dried in oven (control), sun dried (T1), and dried in specially developed solar drier (T2) for experiment. Dried forage samples were pelleted and analysed for crude protein, energy, ash, keeping quality, aroma, acceptability and palatability of dairy cows. T-tests were carried out using SAS 9.2 and SPSS to analyse the palatability and dry matter change. There was a significant difference ($P<0.05$) in palatability between the pellet and mash form of forages. Pelleted forage meal recorded better palatability than the fresh forages. Among the four types *Gliricidia sepium* is the most palatable forage pellet, but there was no significant different ($P>0.05$) of palatability based on drying method. The dry matter content was significantly different based on drying method ($P<0.05$). Average dry matter yield of samples sun-dried (T1), dried in the solar drier (T2), and oven-dried (control) were 21.47% and 17.86% and 24.25%, respectively. Dry matter yield loss of the developed solar dryer is low when compared to sun drying. Average required amount of wet forages to produce the 1 kg of dry forage pellet is 4.66 kg and cost of production of dry grass meal pellet was Rs 28/kg. Average weight of the pellet was 652 kg/m³. Under room condition, pelleted forage meal can be stored over 3 months without mould formation and off-colour development. Sun drying is convenient but solar drying more effective in terms of dry matter recoveries. The study indicated that pelleted grass meal is acceptable, economical, and high in quality and potential alternative method for forage conservation.

Keywords: Conservation, Drying, Forages, Palatability, Pellet

BENTHIC MACRO INVERTEBRATES AS A BIO INDICATOR TO ASSESS WATER QUALITY OF AQUATIC ECOSYSTEMS

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Abstract

Water quality is commonly determined by physical, chemical, and biological parameters. Traditional water quality assessment approaches are largely based on monitoring its physiochemical parameters. However, these parameters are functions of natural and anthropogenic impacts and consequently vary in a short time. Therefore, water quality assessment merely based on physicochemical parameters will not give a realistic picture of the water quality. Thus, bio-monitoring of water quality with the aid of bioindicators species or indicator communities (fish, algae, bacteria, and macroinvertebrates) have been widely coming into practice. Assessing water quality with bioindicator organisms is a promising tool due to several reasons such as the sensitivity of organisms to environmental changes, the low cost of the assessments, and their correlations to the physical and chemical parameters of water. Annelida (oligochaetes and polychaetes), arthropods, crustaceans (amphipods and decapods) and, mollusca (gastropods and bivalves) are the most common phyla of benthic organisms that can be found in aquatic ecosystems. Benthic macroinvertebrates are generally considered the descriptive indicators of environmental conditions of the aquatic ecosystem. For example, tubificidae (oligochaeta) are indicators of heavy pollution of freshwaters, chironomidae (diptera) are indicators of average contamination, and ephemeroptera, plecoptera, trichoptera, and odonata are indicators of clean waters. Further, the tube length of caddis fly larvae varies with the dissolved oxygen level in aquatic water. Therefore, monitoring of water quality using benthic macroinvertebrates is a successful method to determine the health status and the biological richness of aquatic water bodies because the survival of benthic macroinvertebrates depend on the water quality and sediment characteristics, fast responses to anthropogenic activities and natural stresses, and shifts in macroinvertebrate communities can help to identify the impacts of pollution as well as the effectiveness of pollution control activities. However, there are lacks of research related to water quality assessment using benthic macroinvertebrates in the Sri Lankan context. Therefore, this review article is aimed to explore the role of monitoring benthic macroinvertebrates in water quality assessment in aquatic ecosystems in Sri Lanka.

Keywords: Benthic macroinvertebrates, Bioindicators, Sri Lanka, Water quality

INFLUENCE OF GRASS AND MAIZE SILAGE ON MILK YIELD AND MILK COMPOSITION OF DAIRY COWS

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Abstract

Forage availability during the rainy season can be conserved as hay or silage to provide feed for animals in the dry season. This study aimed to investigate the impact of grass and maize silage on milk yield and milk composition in dairy cows. Sixteen lactating dairy cows of the Jersey Sahiwal crossbreed weighing approximately 400±10 kg, were selected for the experiment. The study employed a randomized complete block design (RCBD) with four treatments: T1: Maize silage + Total Mixed Ration (TMR); T2: Pakchone silage (Supper Napier) + TMR; T3: Pakchone + Maize silage (50:50) + TMR; T4: TMR only (Control). Each treatment had four replicates, which were randomly assigned. The experiment was conducted over a period of 30 days, during which daily measurements of feed intake, milk composition, and milk yield were recorded. The results indicated that average feed intake did not significantly differ among the treatments, despite the supplementation with different types of silage. The treatments did not have a notable effect on milk yield and composition, except for milk fat content. Cows fed with maize silage exhibited a significant improvement ($p<0.05$) in milk fat content compared to the control group. Based on these findings, it can be concluded that incorporating super Napier silage in cow feed can yield favorable results in dairy farming.

Keywords: Dairy cows, Forage quality, Milk composition, Milk yield, Silage

AUTHORS INDEX

Name of the Author	Page No.
Abirami T.	14
Adikaram K.K.L.B.	12
Amarasinghe B.M.W.P.K.	23
Asenika G.H.K.N.	18
Atapaththu K.S.S.	32
Bandara D.M.S.P.	28
Bandara K.G.W.W.	06
Bandula G.G.	16
Brintha Karunarathna	14
De Silva A.G.S.D.	41
De Silva Y.M.S.H.I.U.	08
Dias P.G.I.	19
Disanayaka D.M.S.H.	29
Dissanayake B.D.M.P.B.	11
Dissanayake I.	08
Dissanayake S.	01
Dissanayake U.S.	26
Edirisooriya J.L.	16
Egodawatta W.C.P.	31
Erabadupitiya H.R.H.D.	21
Fonseka P.S.R.	24
Ganadeepan Subramaniam	32
Gunarathna A.	26
Gunarathne D.M.A.	22
Gunasekara S.D.W.	03
Gunathilake K.D.P.P.	24
Hariharan G.	10
Herath H.M.A.K.M.	42
Herath U.S.	31
Hettiarachchi G.H.C.M.	06
Hettiarachchi I.S.	15
Hettiarachchi L.	01
Hettiarachchi M.H.S.M.	11
Hettiarachchi R.P.	29
Hettiarachchi S.S.	21
Hewage H.	08
Hewawasam R.	17
Jayabawatharaniya J.	09
Jayaneththi J.P.H.U.	29
Jayasuriya D.M.N.H.	18
Jayathilaka M.D.L.P.	34

Exploring Path for Food Security through Innovative Agriculture”

4th National Symposium on Agro-Technology and Rural Sciences – 2023
University of Colombo Institute for Agro-Technology and Rural Sciences – Sri Lanka

Jayatunga G.K.	23
Jayavanan S.	09
Jayaweera B.P.A.	20, 39, 40
Kalaivizhi V.	40
Kaliyadasa P.E.	25
Kannan N.	18
Karunarathne W.M.A.M.	12
Kaushalya H.B.D.	07
Kelum Sanjaya	32
Kethziah Y.	10
Ketippearachchi K.G.	05, 15
Kotuwegedara H.A.R.W.	36
Kumara H.K.R.S.	35, 42
Kumara G.P.D.	42
Kumara P.W.	01
Kumarasinghe H.K.M.S.	12
Lahiru P.B.	40
Leelamanie D.A.L.	27, 30
Liyanage T.	21
Madhumali W.H.M.	22
Madhushani R.V.P.K.	38
Malkanthi S.H.P.	02
Marapana R.A.U.J.	19
Marasinghe C.K.	28
Mudalige A.R.	34
Muneeb M. Musthafa	38
Nawarathna S.L.	16
Nelka S.A.P.	17
Nikzaad R.M.	38
Nimanthika W.J.	08
Niranjana R.F.	10
Nivetha R.	34
Padmini C.	01
Perera G.Y.A.D.D.	25
Perera R.D.	39
Piratheepan S.	20, 33
Piyaratne M.K.D.K.	12
Piyaruwan H.I.G.S.	27
Premanath B.M.K.	23
Premarathna K.H.D.M.	29
Pushpakumara H.M.C.	33
Radampola K.	36, 37
Rajapaksha G.R.	38
Rajapakshe M.N.	23
Rajeshkanna S.	09

Exploring Path for Food Security through Innovative Agriculture”

4th National Symposium on Agro-Technology and Rural Sciences – 2023
University of Colombo Institute for Agro-Technology and Rural Sciences – Sri Lanka

Ranathunga R.M.M.H.P.	37
Rankoth L.M.	31
Rasanjalee P.H.N.	03
Rathnachandra S.D.D.	02
Rathnayaka R.M.U.S.K.	19
Rathnayake R.M.C.	08
Rathnayake R.M.H.S.	35
Rathnayake R.M.R.N.K.	11
Rifnas L.M.	13
Sandamini W.S.	39
Sanjayan D.	05
Sanoos A.M.M.	14
Sathees D.	39
Senanayake M.P.	22
Silva K.N.N.	03
Silva L.C.	08
Siriwardena B.P.	05, 15
Siriwardhana A.J.A.A.	21
Sivasthran V.	08
Siyamalan S.	41
Sriskandarajah A.	27
Subasinghe S.	12, 17
Suganya S.	20
Sumanasekara H.H.N.	13
Terney Pradeep Kumara P.B.	36, 37
Thanusan S.	20, 33, 40
Tharsinithevy Kirupanathan	04
Thusalini A.	18
Thusyanthini R.	41
Tilak Priyadarshana	32
Varnika K.	09
Varthani S.	34
Vidanapathirana N.P.	13, 15, 17
Wasala W.M.C.B.	11
Weerakkody W.A.P.	28
Weerakoon W.A.S.S.	07
Weerakoon W.M.W.	08
Wickramasinghe W.M.D.M.	31
Wijayasinghe K.D.B.V.	11, 28
Wijayathunga B.W.Y.N.B.	26
Wijesundera W.S.S.	06
Wijeysingha I.S.	30
Xin Wang	32



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