

Book of Abstracts
4th International Conference on Agriculture and
Forestry 2017
(ICOAF - 2017)

24th – 25th August 2017

Colombo, Sri Lanka

Committee of the ICOAF - 2017

The International Institute of Knowledge Management (TIKM)

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Official website of the conference

www.agroconference.com

Book of Abstracts of 4th International Conference on Agriculture and Forestry 2017

Edited by Dr. Samih Abubaker, Prof. D.K.N.G. Pushpakumara and Others

ISBN 978-955-4903-74-6

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Published by The International Institute of Knowledge Management (TIIKM), No: 531/18, Kotte Road, Pitakotte, 10100, Sri Lanka

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Fax: +94(0) 11 2873371

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MESSAGE FROM THE CONFERENCE CO-CHAIR

I am greatly honored to welcome each of you to the 4th international Conference on Agriculture and Forestry` in Colombo city, Sri Lanka. This event is a real fruitful mutual work between the International Institute of Knowledge Management in Sri Lanka and the partnership of Al- Balqa` Applied University in Jordan. Both institutions were precisely designed the conference with a vision of mandating synergies; the synergy of theory and application, the synergy of research and practice, and the synergy of academia and community services. In this regard, I would like to extend Al-Balqa Applied University President, Professor Abdallah Al-Zoubi greetings to all of you for your support in realizing this conference. He also hopes that this success case will be replicated and yearly seen.

As we know, with rapid increases in the world population, a challenge for food production concerns are growing. However, governmental as well as non-governmental institutions are aware of the importance of this issue. To raise awareness of `Current Challenges and Future Perspectives of Agriculture`, this conference offers you a unique opportunity to gather here to share experiences and discuss evolving strategies for agriculture, which definitely will result in the improved outcomes for our globe. The diversity of specializations will enable us to achieve our targeted mandate and vision. It covers 15 relevant themes in fields of agriculture and forestry endeavor. More than 120 Authors and attendees, from six continents including unique Key Note speakers, will show us their recent developments in their fields of important topics in the world of farming.

I would like to extend my deep appreciation to the organization and scientific committees. Thanks and acknowledgement are due to the logistics and secretary for their support and continuous follow up, that makes it a success case.

Last but not the least, I would like to assure that our role will not end at this stage, we are totally committed to follow up all the details during the days of the conference, including our social event and field trip. International Institute of Knowledge Management in Sri Lanka and Al- Balqa` Applied University in Jordan believe that the success of this gathering is a meaningful joint work; looking towards more fruitful future cooperator for the benefit of our regions and the globe as well.

My personal respect and thanks goes out to all of you.

Dr. Samih Abubaker,
Former Dean,
Faculty of Agricultural Technology,
Al-Balqa` Applied University,
Jordan.

MESSAGE FROM THE SUPPORTING MINISTRY

It is a great pleasure to deliver a message for this invaluable event. A conference demonstrates the sharing of knowledge. A conference will provide improvisations to implement innovations with the intermediation of intellectuals' ideologies.

The 4th International Conference on Agriculture and Forestry 2017(ICOAF 2017) will be a great arena to open new ventures to flow fresh ideas, opinions and thoughts to develop our own motherland and the whole world at large. It is our duty encourages these kinds of events to get the utmost contribution of the academicians, researcher, professionals, and the university students for the development of the community.

The 4th International Conference on Agriculture and Forestry 2017(ICOAF 2017) carries a timely importance theme "Current Challenges and Future Perspectives of Agriculture." From this kind of conference with the assistance of intellectual we can find the extent of interrelationships and as policy makers we can generate fruitful insights to be focused in order to implement to develop the life styles of the general community.

It is nice to see that The International Institute of Knowledge Management (TIKM) has taken initiations to have a knowledge gathering and sharing momentum like this. I take this opportunity to thank and appreciate the organizers – TIKM, for their effort to enhance the true value of education & knowledge fields in Sri Lanka as well as in the world. As the related representative governing body of the Democratic Socialist Republic of Sri Lanka for this particular field, the Ministry of Agriculture will give their fullest support with hearties wishes to conduct such conference in the future too.

Mr. B. Wijyaratne,
Secretary,
Ministry of Agriculture,
Govijana Mandiraya,
Sri Lanka.

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KEYNOTE SPEECHES

BIO- WASTES MANAGEMENT FOR SUSTAINABLE UTILIZATION

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ABSTRACT

This synthesis contains a brief appraisal of bio- wastes management implemented in many places in the world. Based on the evidence collected, it provides a summary of compost production as bio fertilizers and it`s effects on plant production strategies and soil quality and fertility. Recent studies showed that the aggregate waste production of world cities reach as much as 1.3 billion tons of solid waste per year. This volume is expected to increase to 2.2 billion tones by 2025. Generally, global solid waste stream contains nearly 50% as organic origin. As a result, the recycling and composting industry is now becoming a global business with international markets with supply and networks transportation. It can be concluded that augmenting bio-compost approach with lesser use of agrochemicals that threaten food quality and ecosystem, would formulate a road map for increasing productivity and profitability of farming business and would improve the resilience of global food systems. Strategies to expand and commercialize innovations in agricultural R&D technologies, especially those related to bio- waste management for sustainable agriculture will result in improvement of plant health, water and soil quality and improve land management become urgent.

SCIENTIFIC RESEARCH AS A STRATEGY FOR SUSTAINABLE DEVELOPMENT IN DEVELOPING COUNTRIES

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ABSTRACT

The major international, collective achievement in 2015 was the adoption of the United Nations Sustainable Development Goals (SDGs). Over 190 Government's around the world committed to delivering the 17 Global Goals, underpinned by 169 targets, by 2030. These included, amongst other things, ending poverty, zero hunger and decent work for all and economic growth.

The recent academic literature on economic growth shows that technology, research and development and "know-how" are key factors which explain why some countries are rich, or, at least, on the trajectory to becoming middle-income countries, whilst others remain poor. Hausmann et al. have also shown a strong correlation between what they term Economic Complexity Index and GDP per capita and concluded that the more kinds of economic activities that any given country is able to perform, the more likely it is to have a higher per capita income.

Scientific research, therefore, can and, indeed, will have to play a major role in meeting the challenges for sustainable development. In many poor countries, agriculture remains a key sector of the economy and the major source of rural employment. Increasing agricultural productivity through technological and social innovation is a necessary pre-condition for achieving economic development for poor countries. However, for this to be sustainable, the social, economic and environmental dimensions must be addressed in an integrated way.

Since the 1960s, the International Rice Research Institute (IRRI) has been at the forefront of applied agricultural research for development. Its work helped to avoid famine in the 1960s and 1970s through the introduction of new semi-dwarf rice varieties such as IR8 and through building the scientific capacity of national agricultural research and extension systems and, through this, helped to usher in the Green Revolution in India, Bangladesh and other rice producing countries. More recently, working closely with national partners, IRRI is helping to introduce innovations into rice-based agri-food systems, such as Stress Tolerant Rice Varieties (STRVs), but now with a more integrative, multi-disciplinary approach addressing the issues of environmental stress, climate change, nutrition and gender equity. IRRI's Mission set out in its new Strategic Plan 2017-2023, is consciously aligned with the delivery of the SDGs.

ORAL PRESENTATIONS

EFFECT OF SPRAYING WITH SOME PLANT AQUEOUS EXTRACTS ON GRAFTED WATERMELON PLANTS

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ABSTRACT

The effect of nettle *Urtica dioica*, licorice *Glycyrrhiza glabra* and fenugreek *Trigonella foem graecum* extracts as foliar application on grafted watermelon plants *Citrullus lanatus* L.cv. Turkish was investigated during the growing season, 2016. Seedlings of watermelon grafted were transplanted on 25 May 2016, two weeks later were sprayed with the extracts above mentioned plants at rate of 25 gm/l. The first one at 3-4 true leaf stage, while the second at the flower bud initiation. The results revealed a positive effect of plant extracts in term of vegetative growth, yield, quality and minerals content of watermelon as compared to control. Nettle extract enhanced all traits and superior than other treatments. Twice application gave the highest values in plant length (cm), number of branches / Plant and chlorophyll content (spad), 314.00, 3.962 and 57 respectively. Also this treatment gave the best values, 7.245 (kg), 26.29(cm), and 14.38% in fruit weight, fruit diameter and TSS respectively. Minerals content of N, P and K showed appositive effect trends in response to the applied extracts.

Keywords: Grafting, Extracts, Watermelon, Nettle, Licorice, Fenugreek

HANDPICKING IS AN EFFICIENT PRACTICE FOR BLISTER BEETLE *Mylabris pustulata* (MELOIDAE: COLEOPTERA) IN GARDEN

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ABSTRACT

Blister beetle is a highly movable Coleopteran insect. Adults mainly feed on floral parts while grub exhibits predacious habit. Management of this beetle in the garden which predominantly contains flowering plants is a serious concern. Application of chemical pesticides is costly comparatively while it leads to environmental hazards. By considering these aspects, the experiment was conducted to evaluate the infestation pattern and efficiency of handpicking. For infestation estimation, two severely affected plants species were selected and assessed in terms of damaging parts in flower and count of beetle. *In vitro* study was conducted to examine the feeding preference by introducing the beetles into four different plants species. Four replicates were maintained. Results were analyzed statistically using one-way ANOVA in SPSS. Handpicking was performed up to seven days continuously. The results revealed most of the flower parts damaged by this beetle except sepal and ovary. In field level, beetle infestation high in shoe flower and the highest damage percentage obtained as 54.6% per plant. *In vitro* study also confirmed that the shoe flower is highly preferred by this beetle and among the shoe flower species, shoe flower yellow and shoe flower big pink scored 100% damage. Handpicking reduced the number of beetles significantly since it was noted that the number beetles were high in some random plants up to three days. After the fourth day, the population was minimized to zero. Results suggested, handpicking is an efficient management practice for the large beetle in the garden level within 0.5 ha.

Keywords: Blister Beetle, Handpicking, Damage, Shoe Flower, Garden

**IMPACT OF ORGANIC APPLICATION FOR CONTROLLING DAMPING OFF IN
TOMATO (*Lycopersicon esculentum L.*)**

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ABSTRACT

Although tomato is commercially grown across the globe, there is no place where the plant is free of disease. One of the major diseases causing seedling loss in nursery stage is damping-off. In the past, farmers have relied strictly on fungicides to reduce disease incidence from start point. Farmers are practicing beyond use of inorganic application from the initial stage of the cultivation. However recently people are concern for environmental health and it makes alternative management strategies more desirable. Therefore, investigation of organic method for controlling damping-off of tomato in nursery stage is a current need. Recently, there is no proper method of controlling damping-off in nursery stage other than use of inorganic methods. This has created unrealistic problem to produce organic quality vegetables to the market. It has introduced vermiwash, “jeewamurthum” and bio char as organic applications for controlling damping-off of tomato variety “Thilina” in this study. In addition to that, fungicide “Captan” was also used as a treatment. The study revealed that organic applications used in this study significantly controlling damping-off incidents in tomato in nursery stage compared with other treatments. Application of vermiwash has promoted the seed germination and growth parameters such as seedling height, root volume. Further, “jeewamurthum” enhanced the cumulative leaf number of seedling. Therefore, it can be concluded that application of vermiwash, jeewamurthum, bio char significantly controlling the damping-off of tomato and accelerate growth performance of seedlings.

Keywords: Tomato, Damping-Off, Vermiwash, “Jeewamurthum”, Bio Char

**DEVELOPMENT OF FEASIBLE METHOD TO ENHANCE STORABILITY OF
HIGHLY DEMANDED SWEET ORANGE VARIETY “SISILA” WITH PROTECTING
FRUIT QUALITY**

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ABSTRACT

Current experiment was done at Regional Agricultural Research and Development Center, Bandarawela, Sri Lanka to evaluate durability and fruit quality of sweet orange fruits. Fruits at 50% maturity stage were selected and six different treatments were applied to find the best storage conditions where, ambient temperature packed in transparent polythene (T1), stored in ambient temperature packed in black polythene (T2), stored in ambient temperature without packing (T3), stored in refrigerator packed in transparent polythene (T4), stored in refrigerator packed in black polythene (T5) and stored in refrigerator without packing (T6). Physiological characters (weight, firmness, juice content and rotten %) and biochemical characters (TSS, pH and Acidity) of the initial and stored fruits were examined on every 7th day for a period of 35 days. In addition to that, sensory evaluation was conducted to find out consumer preferences. According to the results, black polythene covered samples stored in refrigerator condition (T5) were shown highest shelf life of fruits for 35th day. During storage period minimum weight losses (from 85.1g to 73.1g), highest TSS (11.2), gradually decreasing of firmness, increase of pH (from 2.6 ± 0.1) and reduction of acidity (from 1.6 ± 0.1 to 1.2 ± 0.06) were observed in fruits stored in refrigerator with packed of black polythene with 0% of rotten fruits. Specially, glossy appearance yellow colour was successfully developed in fruits with this treatment as naturally ripen fruits. Sensory evaluation was supported to prove the quality of black colour polythene covered fruit stored in refrigerator by given significantly higher ($P > F 0.05$) values such as 98% peel colour appearance, taste (88) and juice content (88). Therefore, stored in refrigerator packed in black polythene were the best quality fruits.

Keywords: Sweet Orange, Packing Materials, Storage Condition, Duration, Fruit Quality

**THE INDUSTRIAL STRUCTURE OF KEFIR PRODUCTS FROM INDONESIA
ETTAWAH GOAT MILK IN SMALL AND MEDIUM ENTERPRISES IN MALANG
REGION**

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ABSTRACT

Goat milk in Indonesia is very popular because of the belief in the community will the benefits of goat milk as a source of good nutrition for endurance. On the other hand, dairy products are highly perishable due to the nutritional content generally preferred by protein and fatty breaking microorganisms. Therefore, most of the milk industry needs to process milk into more durable products, such as pasteurized milk, yogurt or kefir. In this study conducted an analysis of SMEs who process goat milk into dairy products kefir to know its market potential in Malang Raya region. The results showed that market share is controlled by Sukatawasari enterprise with the market share was 26%, and the rest is shared between 5 other enterprises. Industrial structure is a strict oligopoly market structure because the CR4 value was 60 <CR4 <90, so the competition is quite tight even though the enterprise is only 7 enterprises. While the index of HHI (Hirschmann-Herfindahl Index), Sukatawasari also has the highest of 676. While the market entry barrier level was based on the value of MES, Sukatasari also has the highest MES was the value of 26%. In conclusion that SMEs of goat dairy products in the form of kefir have a big chance because the industry is still few, but on the other hand, the potential of market penetration was difficult enough. Therefore, a more diverse market strategy is required in order to minimize the level of market barriers.

Keywords : Goat, Indonesia, Kefir, MES, Milk, SME's

**CAPTIVE BREEDING OF RETICULATED PYTHON FOR BIOLOGICAL
RODENTICIDE *Sarcocystis singaporensis* PRODUCTION IN INDONESIA**

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ABSTRACT

The parasitic protozoan, *Sarcocystis singaporensis* is known as promising biocontrol agent against rats. This particular parasite is a highly host-specific and reproduces sexually inside the intestine of live pythons (*Python reticulatus*). Therefore in order to mass produce *S. singaporensis* we need to keep numbers of pythons in captivity. The aim of this study was to investigate capacity of captive bred reticulated python in producing *S. singaporensis*. Series of data were collected and analyzed from production facility of biological rodenticide in North Sumatera, Indonesia. The results showed that the pythons started to produce *S. singaporensis* when they reached size of 1.5m in length with total parasite 3.15×10^9 sporocyst per year. Parasite production was increased gradually and reach the highest number of parasite (4.31×10^9 sporocyst per year) when they reached size of 2.5-3.5m. However, the parasite production was decreased (0.59×10^9 sporocyst per year) when the pythons reached their size of >3.5m. The total parasite production by single python during its captivity period in 4 years was equal with 40,300 baits. Commercialization aspects of this biological rodenticide in Indonesia will be discussed in presentation.

Keywords: Reticulated Python, Production, Biological Rodenticide, *Sarcocystis singaporensis*

COFFEE HULLS AS A LOW-COST DAIRY CATTLE FEED SUPPLEMENT IN NORTHERN THAILAND

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ABSTRACT

Coffee hulls (parchment) are a byproduct of the coffee growing and processing industry that are often discarded, burned, or left to become environmental pollutants. In northern Thailand, a burgeoning coffee growing and processing sector is becoming inundated with the waste products of the coffee milling process. Simultaneously, the dairy sector is experiencing increasing demands for its goods and increasing costs for its feed inputs, notably in the form of feed concentrates. The purpose of this experiment was to determine if coffee hulls could be fed to dairy cattle in northern Thailand without reducing milk quality while utilizing a free or lower-cost feed input to help cut dairy farmers' costs. In 2016, 19 dairy cattle were fed 1kg of coffee hulls per day for one month while reducing their feed concentrate intake by the same amount. The experiment was repeated in 2017 with 16 dairy cows. Milk quality (fat, crude protein, lactose, total solids, and somatic cell counts) of each cow in the experiment was independently analyzed by a laboratory before and after the experiment. Across both years, there were no significant differences in milk quality before and after the cows' feed ration was changed with the addition of coffee hulls. Thailand currently has 600,000 dairy cows, and that number is growing; the addition of free or low-cost roughage to the feed ration (such as coffee hulls) has the potential to reduce dairy farmers' costs, create a market for waste coffee products, and reduce environmental wastes.

Keywords: Coffee Hulls, Dairy Cattle Feed, Waste Reclamation, Milk Quality, High-Value Crop

AVAILABILITY OF WASTE FEED MATERIALS FOR LIVESTOCK AT THE MARKETS AROUND THE EASTERN UNIVERSITY PREMISES

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ABSTRACT

A study was conducted at eighty market sellers of four major markets from two Divisional Secretariats divisions in Batticaloa district to identify the availability of feed waste using a pretested structured questionnaire. Collected data was analysed using SPSS software. Descriptive statistics and frequency analysis were done. Aspects of socioeconomic characteristics of farmers, monthly income, quality of feed waste, customer demand for feed waste and problems were studied. The study revealed that 75% of the market sellers were male and majority of market sellers were involved as own business (96%) and only less numbers involved in farming. The age of the respondents was 41.5 years old and 81% of the market sellers were married. The average monthly income was Rs. 25500/= and 37% of sellers were 10-20 years in experience. Mostly available feed wastes were vegetables (41.3%) followed by fish, fruits and meat were 22.5%, 17% and 16.3% respectively. Mostly available vegetable wastes were brinjal, tomato, and onion. Pineapple waste was more common in fruit waste. Among the animal feed waste fish was mostly available. Further results revealed that 85% of feed waste was with low quality level and 90% of the respondent was not demanded market level for feed waste. Lack of education of the sellers, low quality of available feed waste, lack of waste treatment facilities, lack of demand for waste feed, poor hygiene and marketing exploitation were most important constraints.

Keywords: Feed Waste, Market, Sellers

**TREATING THE WHEAT STRAW WITH WATER AND LIQUID MOLASSES UREA
TO INCREASE THE INTAKE AND DIGESTIBILITY IN COW CALVES**

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ABSTRACT

Feeding trial with 4 x 4 Latin Square Design was conducted with four cow calves and four rations to compare the intake and digestibility of soaked and sprayed wheat straw with Molasses Urea Block (MUB) and Molasses Urea Liquid (MUL) supplementation at calves' body maintenance level. Forage quality indices, feed value and energy values were predicted by dry matter intake (DMI) and digestibility. Rations A and B with wheat straw (sprayed or soaked) were supplemented with MUB and Rations C and D as same but with MUL to furnish deficit nutrients required for calves maintenance and microbial growth. Rations containing MUL supplement were notably higher ($P < 0.001$) for DMI and all other parameters than the MUB rations. Highly ($P < 0.05$) significant differences were detected for digestibility of dry matter, organic matter, acid detergent fibre and neutral detergent fibre between rations fed either with MUB or MUL. Soaked straw with MUL was being consistently the highest ($P < 0.05$) for dry matter digestibility (20 and 13 %) sprayed and soaked straw fed with MUB. Ingredients composition of the rations affected ($P < 0.01$) the digestibility of crude protein, crude fiber, ether extract and nitrogen free extract and comparison of rations revealed the maximum total digestible nutrients in Ration D (55.7%) but biologically inconsequential amongst the Rations A, B and C (41.70, 43.94 and 52.20%, respectively). A similar trend was seen in digestible energy; metabolise-able energy and net energy for maintenance and net energy for gain. Relative feed value, quality index and relative forage quality were substantially improved when straw (sprayed or soaked) was fed with liquid molasses-urea supplementation.

Keywords: Rations, Digestibility, Nutrients, Roughages, Block, Animals

QUALITY OF MILK PASTEURIZATION OF GINGER IN COLD STORAGE

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Utilization of natural materials, such as ginger as a flavor and preservative is one alternative in maintaining the quality of pasteurized milk. Ginger is a widely obtained plant in Indonesia that contains antibacterial compounds that can prevent microbial growth so as to provide lasting effect on pasteurized milk (Maitimu et al., 2012). The ethanol extract and chloroform ginger appeared to inhibit the growth of bacteria *Klebsiella pneumonia*, *Salmonella thyphimurium*, *Bacillus cereus*, *Enterococcus fecalis* and *Staphylococcus aureus* (Nalbantsoy et al., 2008). The purpose of this research is to know the physicochemical quality which includes the specific gravity, viscosity and protein content, and the microbiology quality and the existence of *Escherichia coli* as one of the requirements of quality of pasteurized milk worth of consumption. The material used in this research is pasteurized milk with ginger flavor and kept at cold temperature for 4 weeks for 30 days. The method used in this study is a survey with gradual observation starting before being stored, 6 days, 12 days, 18 days, 24 days, and 30 days. Data analysis is quantitative. The results of this study indicate that the longer the storage showed a decrease in viscosity and protein content, but up to day 30 there was no *E. coli* on ginger pasteurized milk kept at 4 ° C.

Keywords: Ginger, Pasteurization, Storage, Cold Temperature

**IN VITRO ANTAGONISM OF FIVE RHIZOBACTERIAL SPECIES AGAINST
ATHELIA ROLFSII COLLAR ROT DISEASE IN SOYBEAN**

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ABSTRACT

Beneficial bacteria have ability to control a wide range of pathogenic microorganisms as antagonists or as Plant Growth Promoting Rhizobacteria (PGPR) to improve plant growth. Five species of bacteria were isolated from rhizospheric soils of soybean and peanut field from several locations in North Sumatra. On the basis of morphological and biochemical characteristics, the bacteria were identified as *Aeromonas hydrophila*, *Burkholderia cepacia*, *Serratia ficaria*, *Pantoea* spp. 2, and *Vibrio alginolyticus*. These species were tested *in vitro* against the causal pathogen of collar rot disease of soybean, *Athelia rolfsii*. In Indonesia, the yield loss due to *A. rolfsii* collar rot disease can reach 5- 55%. Meanwhile, the 5% disease intensity has been affected the soybean yield economically which reduce the soybean production or no yield was produced. The five species of bacteria were subjected to screening of antagonistic activity against *A. rolfsii* *in vitro* with dual culture-technique. Of the five species, *Pantoea* spp. 2 and *S. ficaria* were the most effective antagonistic bacteria to control *A. rolfsii*. *Pantoea* spp 2 and *S. ficaria* produced inhibiting zone against *A. rolfsii* 97.83% and 96.97% respectively. All bacterial species showed their antagonistic activity significantly with the inhibiting zone percentage was more than 60%. The experimental results suggested that all bacterial species have future potency as biocontrol agent to reduce *A. rolfsii* collar rot disease of soybean.

Keywords: Rhizobacteria, *Athelia rolfsii*, *In Vitro*, Antagonist, Soybean

IMPROVED REGENERATION RESPONSE FROM ANTHR-DERIVED CALLUS OF INDICA RICE WITH DESICCATION AND ABSCISIC ACID STRESS

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ABSTRACT

Another culture is a technique to directly produce homozygous diploid plants, through regeneration from haploid microspores and subsequent doubling of the chromosomes. The japonica varieties of rice are more responsive than indica varieties to another culture. Among the indica types also some genotypes have been identified with good callus induction potential but the regeneration phase is very difficult (Talebi *et al*, 2007). This study investigated the effectiveness of two stress treatments; desiccation and Abscisic Acid (ABA) stress to enhance regeneration ability of anther-derived callus in indica rice. Calli were first induced on N₆ medium (Chu, 1978) from cultured anthers of indica rice varieties, Dahanala, Herath Banda, Dikwee and the F1 generation of a cross between At 303 and Dahanala using standard procedures (Silva and Ratnayake, 2009). A total of 100 calli from the four genotypes were stressed by subjecting to 24 h desiccation on sterile filter paper and transferred to the regeneration medium. A similar number of calli were transferred directly for regeneration without desiccation. Of the desiccated calli 48 survived and 16 of these developed green spots indicating shoot initiation whereas all 100 calli placed directly on the regeneration medium degenerated and none survived. Further, the desiccation treatment was combined with ABA stress, and applied on calli induced from F1 anthers (of the At 303 × Herath Banda cross). ABA stress was induced by placing 15 desiccated calli on regeneration medium with 100µM ABA for 7 days and thereafter transferred to ABA-free medium. Fifteen more calli were placed after desiccation on regeneration medium without ABA. When desiccation was combined with ABA stress, 50% more calli showed a regeneration response compared to the calli subjected to desiccation only. Thus, 24 h desiccation and ABA stress (100µM ABA for 7 days) can be used to improve the regeneration potential of anther-derived callus of indica varieties.

Keywords: Anther Culture, Regeneration, Stress Treatments, Desiccation, Abscisic Acid

LIGNIN BASED POLYURETHANE FOAMS

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ABSTRACT

Polyurethane foams are extremely versatile resources with applications ranging from insulation, furniture, automotive to packaging materials. The depletion of petrochemical resources as well as increasing environmental concerns have created interests in developing bio-based foam formulations. Polyurethane foams are synthesized by reacting an isocyanate with a polyol in varying proportions. Various types of foams can be created (flexible, rigid, and semi rigid) depending on additives, properties of polyols, and properties of isocyanates. The objective of this work is to create a bio-based rigid polyurethane foam that replaces 100% of the petrochemically derived commercial polyol with unmodified lignin, a primary waste product of the pulp, paper, and bioethanol industries. High abundance, water resistance, and reinforcing capability of lignin make it a viable bio-based alternative for replacing the polyol portion of polyurethane foams. Various commercial lignins: Kraft, Protobind, organosolv, etc. will be used as the polyol fraction in the formulation of rigid polyurethane foams. Various analytical techniques such as: Fourier transformed infrared spectroscopy (FTIR), scanning electron microscopy (SEM), nuclear magnetic resonance spectroscopy, thermogravimetric analysis (TGA), dynamic mechanical thermal analysis (DMTA), and compression force deflection testing were used in order to evaluate foam properties. Until now, only 35% of unmodified lignin has been successfully incorporated into rigid foams. This study hopes to successfully replace 100% of the polyol portion with lignin, creating a more environmentally end product with similar properties as traditional petrochemically derived foams. Future implications of this work would be to

Keywords: Biobased, Foam, Lignin, Polyurethane, Renewable

**STUDY ON RISK IDENTIFICATION AND PESTICIDE USAGE IN PADDY
CULTIVATION IN ALAYADIVEMBU DIVISIONAL SECRETARIAT DIVISION OF
AMPARA DISTRICT, SRI LANKA**

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ABSTRACT

Synthetic pesticide application has been the chief method of pest control in paddy cultivation in Sri Lanka. In this context, the objectives of the study were to (i) assess the kind of risk exposures on paddy cultivation and identification of predominant pests in the Alayadivembu Divisional Secretariat (DS) division of Ampara and (ii) evaluate the coping mechanisms used for pest management. Stratified random sampling method was used to select 100 farmers from the Alayadivembu DS division which is a predominantly paddy cultivating area. Pre-tested structured questionnaires were used to collect data during *yala* 2016 cropping season. Descriptive statistics, chi-square and probit model were used for analyzing data. The results of the study indicate that the foremost cause of risk was weeds (96%) such as Jungle Rice (72%) followed by Wrinkle Duck Beak (56%) and Umbrella Sedge (52%). The other causes of risks were insects (88%) namely Brown Plant Hopper (70%) and Thrips (50%) while Fungi attacks were insignificant. Percentage of farmers having more than 5 years of experience in paddy cultivation was 80%. The average extent of cultivation was 5.35 acres where only 18% of respondents' cultivated land size was greater than 10 acres. All the farmers (100%) applied chemical pesticides where 74% of farmers used mechanical means as well to manage these risks. Only 32% of farmers received extension service. Chi-square analysis indicates that monthly income and knowledge on organic farming were significantly ($p < 0.05$) influenced by extent of paddy cultivation and educational level respectively. Results of probit analysis reveal that educational level, farming experience and access to extension service had a positive and highly significant ($p < 0.01$) relationship on correct identification of risk, whereas family size had a negative significant ($p < 0.05$) relationship on it.

Keywords: Paddy, Pesticide, Pests, Risk Identification, Socio-Economic Factors

**EFFECT OF THERMAL THERAPY TREATMENTS AND TISSUE CULTURE ON
FREEING GRAPEVINE INFECTED WITH GRAPEVINE FANLEAF VIRUS**

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ABSTRACT

A study was conducted to investigate the effect of thermal therapy treatments, meristem tip culture, and the combination of these two methods on freeing the infected grapevine *Vitis vinifera* L. from grapevine fanleaf virus (GFLV). Infected source plants were exposed to temperature regimes. The absorbance value at 405nm of the virus in infected plants decreased as the exposure temperature increased. For plants exposed to 37 and 40C, the virus absorbance value decreased abruptly to about 50% within the first two weeks. Presence of the virus at the end of the incubation period falls below the detection levels. Using the alternate low and high temperatures at 18 C for 10 weeks followed immediately by 40C for 6 weeks resulted in eradication of the virus. Plants incubated first at high temperature (40C) for 6 weeks, died. Meristem tips from 0.3 to 1.2 mm long were cultured from heat treated and non-heat treated grapevine plants known to be infected with GFLV. Regenerated plantlets were tested for the presence of virus by serological and biological assays. Results revealed that the possibility of elimination of GFLV increased as the length of excised meristem decreased. Virus occurrence in plantlets that developed from 0.3 mm long meristem was always lower than those which developed from 1.2 mm long meristem. The absorbance value of the virus was greatly reduced in the plants regenerated from tip meristems taken from source plants that were heat treated. The study demonstrated the value of meristem culture coupled with thermotherapy to get free grapevine of GFLV.

Keywords: Grapevine, GFLV, thermal therapy, tissue culture

EFFECT OF DIFFERENT HERBIVORE INDUCTION IN PLANTS OF DIFFERENT DEVELOPMENTAL STAGES, AND CONSEQUENCES FOR FLOWER-ASSOCIATED ORGANISMS

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ABSTRACT

Herbivore induced plant responses (HIPRs) do not only influence the herbivores that attack leaves and carnivores but it can also influence the behavior of flower mutualists and antagonists. In field of plant-herbivore interactions we know that induction by herbivores can have positive or negative effect on flower-associated organisms, but this has never been studied using a single plant species, and tested whether this can be correlated with the identity of the attacker or plant ontogenetic stage in which plant was induced. Here, I investigated how plants induced by 3 herbivore species (*Athalia rosae*, *Lypaphis erysimi* and *Delia radicum*) at 3 ontogenetic stages (vegetative, bud, and flowering stages) affects the behavior of flower-associated organisms. I hypothesized that plant responses to herbivory and consequences for flower mutualists and antagonists but might vary depending on the herbivore identity and plant ontogenetic stage. To test my hypothesis, I designed a common garden experiment adjusted with Latin square design (LSD) where plants of 3 different developmental stages were induced by a chewer herbivore, a sucking herbivore and a root herbivore. In field study, I recorded the attraction and monitored the visitation of pollinators groups to flowers of *Brassica nigra* as well as the attraction of pollen beetle *Meligethes aeneus*. Pollinator groups/species observed were mainly honeybees (*Apis mellifera*), bumblebees (*Bombus* sp.), syrphid flies (mainly *Eristalis* sp.), and solitary bees. My results show that the number of pollinator visiting flowers of plants induced by the different herbivore species was similar to that visiting flowers of control plants, irrespectively also of the ontogenetic stage in which the plant was induced by herbivory. It could be there were no induced changes which would affect the attraction of pollinators or the induced changes could be perceived but were no reason to change the behavior. However, I found different induction by 3 herbivore species at 3 ontogenetic stages differentially affect the number of flower visited by pollinators. For instance, my results show that pollinators visited more flowers of plants induced by the sucking herbivore *L. erysimi* than flowers of plants induced by the root herbivore *D. radicum*. I speculate that *L. erysimi* infested plants produced higher sugar content in nectar and pollen, than plants induced by other herbivores. I found that overall pollinator community composition was affected by the induction by 3 herbivore species and the 3 ontogenetic stages in which plants were induced. I speculate that this changed might be changed in flower traits more specifically flower color, flower number, and also volatile compounds (VOC) profile that could have altered with different herbivore induction at plant ontogenetic stage. My results show that, pollen beetle attraction was similar for infested and control plot. It could be there were no induced changes which would affect the attraction of pollen beetle or the induced changes could be perceived but

were no reason to change the behavior. To sum up, my project show that 3 herbivores species that I studied did not interfere with attraction of pollinators, and infested plants attracted as many pollinators as did non-infested plants, irrespectively of the plant ontogenetic stage in which the plant was induced. However, herbivore induction leads to changes in composition of the pollinator community. Future direction should focus on changed in flower traits (morphology, nectar and pollen composition) and pollination efficiency of different pollinators group.

Keywords: Herbivore Induced Plant Responses, Herbivory, Plant Ontogeny, Pollinator Community Context, Pollinators, Pollen Beetle

**MORPHOLOGICAL TRAITS AND FRUIT QUALITY OF *Syzygium cumini* IN
NATURAL ECOSYSTEM AND HOME GARDEN**

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ABSTRACT

Syzygium cumini is a multipurpose tree found in littoral forest of sandy sea shore vegetation, waste land and home garden. It is an underutilized seasonal fruit *in Jaffna and* one of the widely used medicinal plants in the treatment of diabetes. Availability of these fruits in markets is restricted by seasonality and peak season is observed during September to November. This study was aimed to evaluate morphology, fruit quality and harvest calendar of *Syzygium cumini*, and compare these parameters between the plants found in natural ecosystem and the home garden.

Qualitative morphological traits, leaf blade shape, leaf base shape, leaf colour, leaf apex, leaf arrangement, leaf type, leaf margin and quantitative traits of leaf petiole length, leaf length, leaf breadth and inflorescence length were studied. Among these morphological parameters leaf length, leaf petiole length, and inflorescence length of *Syzygium cumini* from natural ecosystem were shown statistically significant different ($p=0.05$) from home garden.

More than 300 fruits were collected from both habitats separately and graded as ripened, mature and non-ripened. Ripened fruits were selected to determine fruit quality. Moisture content, ash content and wax content of fruits collected from natural ecosystem were 85.584%, 3.554%, and 5.284% while these parameters were 82.644%, 2.196%, and 2.05% respectively for fruits collected from home garden. There was significant different ($p=0.05$) observed for the parameters of total soluble solids (TSS), titratable acidity (TA), pH, ash, wax and weight of seeds collected from natural ecosystem and home garden. Glossy appearance was observed in fruits collected from natural ecosystem due to high wax content and fruit availability was early in home garden. However, based on the fruit quality parameters including taste, TSS and TA, quality of fruits from both habitats were acceptable. Thus this study suggests the need of growing *Syzygium cumini* in home gardens to increase the fruit availability.

Keywords: Leaf and Inflorescence Traits, Fruit Quality, Taste, Total Soluble Solids, Titratable Acidity and Wax Content

EVALUATION OF DIFFERENT PROPAGATION TECHNIQUES FOR MASS PRODUCTION OF JASMINE (*Jasminum sambac*) UNDER DRY ZONE CONDITIONS

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ABSTRACT

Jasmine is an essential oil bearing plant belongs to family *Oleaceae* and mainly used as decorative flowers, medical motives and religious purposes. *Jasminum sambac* Linn. is one of the important Jasmine species which is commonly known as Motia or Lily jasmine native to India. At present, there is a high demand for this flower in Sri Lankan floriculture market due to its various uses. Sri Lankan demand could not fulfil by local supply of *Jasminum sambac* and it is fulfilling mainly by importing from India. Although Sri Lanka has favourable climatic and environmental conditions for cultivating *Jasminum sambac*, due to lack of farmers' enrolment and lack of proper propagation techniques for mass production are some of the main drawbacks. The main objective of this study was to develop a feasible propagation technique for mass production of *Jasminum sambac* under dry zone conditions. Three different potting mixtures and four cutting types were used with ten replicates in a Randomized Complete Block Design under propagator and non-propagator condition as two experiments. Semi hard and hard wood cuttings were showed the best performance under both conditions ($p = 0.000$). There was no interaction observed between medium and cutting type under propagator condition but an interaction could be seen under non propagator condition. The best medium for root induction was coir dust: sand; 1:1 medium under both conditions ($p < 0.05$). Hundred percent rooting percentages could be observed in semi hard wood cutting in coir dust: sand; 1:1 medium under both conditions.

Key words: *Jasminum sambac*, Mass Production, Cutting Type, Medium, Propagator And Non-Propagator Condition

**MEDICINAL POTENTIAL AND THREATS TO FLORISTIC DIVERSITY OF
DISTRICT ZHOB, BALOCHISTAN**

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ABSTRACT

The aim of study was to document the medicinal potential and threats to floristic diversity of District Zhob, Balochistan. The results of the current study provide rich information about the traditional uses of Medicinal Plants in Zhob district. In the current ethnobotanical data documentation a total of 70 medicinally important plants species were collected from the study area. This was the first attempt of Medicinal plants documentation in the study area. The finding of this study shows that local communities of Zhob District are still using the traditional medicines for the treatment of different ailments. It is because the basic health facilities are not available in the study area. Our results also show that local communities have rich traditional knowledge about the medicinal plants. Traditional knowledge usually transfers from generation to generation but now this TK is decreasing due to modernism and urbanization. So there is a dire need of documentation and conservation of this knowledge among the local communities. The study area has rich diversity of Medicinal Plants, but there are number of threats to this diversity of Medicinal Plants. These threats are Deforestation, overhunting, overgrazing and lack of awareness of local communities about the sustainable use extensive exploration of the local flora.

Keywords: Medicinal Potential, Threats, Floristic Diversity

BIODEGRADATION OF PHENOL BY TWO PROTEOBACTERIA: *Klebsiella variicola* AND *Ochrobactrum intermedium*

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ABSTRACT

Biodegradation of pollutants has drawn worldwide attention over conventional physicochemical treatments as promising environmental clean-up solution. Many bacteria inhabited in petroleum contaminated environments recorded to have the potential of degrading phenol. The current study focused to study the biodegradation capacity of phenol by the bacteria isolated from local petroleum contaminated sites. Previously identified two bacteria; *Klebsiella variicola* and *Ochrobactrum intermedium* grown in the concentration of 1700 mg/L phenol were subjected to phenol degradation study. They were isolated from wastewater collected from oil contaminated site in Sapugaskanda and hospital waste contaminated canal in Narahenpita, Sri Lanka respectively. Bacteria were inoculated to Mineral Salt Media containing 1700 mg/L phenol as the sole carbon source and incubated at room temperature with continuous agitation. Samples from the cultures were drawn aseptically at regular time intervals and tested for the residual phenol in the media by 4-aminoantipyrine colorimetric assay. Two Proteobacteria tested; *Klebsiella variicola* and *Ochrobactrum intermedium* degraded 100% of 1700 mg/L phenol in 144 hours and 120 hours respectively. The study confirmed the ability of degrading phenol by these bacteria at the level of 1700 mg/L. These bacteria could be possibly used in bacterial consortia used to treat wastewater contaminated with phenol and phenolic pollutants in future.

Keywords: Bacteria, Biodegradation, Narahenpita, Phenol, Sapugaskanda, Wastewater

ISOLATION OF ANTIOXIDANTS FROM *Aesculus indica*

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ABSTRACT

Aesculus indica belong to family Hippocastanaceae and is an important medicinal plant since ancient times. This research work is carried out in order to find flavanoid contents, phenolic contents, sterol, tannins, sterols and finding pigments that include chlorophyll a, chlorophyll b, β -carotene and lycopene. The antioxidant activity like DPPH and ABTS were determined, phenolic compounds were determined using HPLC. The phenolic compounds were determined in crude extract and also in different fractions i-e ethyl acetate, chloroform, n-hexane and aqueous fraction. The total phenolic contents were determined by Folin-Ciocalteu reagent methods. The total phenolic contents of extracts was expressed as mgGAE/g and were found to be (78.34 \pm 0.96) in crude extract, in chloroform (65.45 \pm 1.29) in n-hexane (37.85 \pm 1.44) and in aqueous(50.23 \pm 2.431).The flavanoid contents of extracts was expressed as quercetin and were found to be 85.30 \pm 1.20 in crude , 77.50 \pm 1.12 in chloroform, 53.80 \pm 1.07 in ethyl acetate , 26.30 \pm 1.35 in n-hexane and 37.78 \pm 1.25 in aqueous fraction. The pigments like chlorophyll a, chlorophyll b, β -carotene and lycopene were estimated by using UV/Visible spectrophotometer at 433, 505, 645 and 663nm respectively. The extract was subjected to HPLC analysis for antioxidants concentration and Quercetin, Phloroglucinol, Mandalic acid and Hydroxy benzoic acid were detected at 10.062, 30.597, 35.490 and 36.211 respectively, retention times. The fractions were subjected to HPLC analysis for antioxidant concentrations Quercetin, Mandalic acid, Hydrobenzoicacid, Chlorogenic acid and Rutin were detected at different retention times. .Different percentage of ethyl acetate were subjected to HPLC for antioxidants concentration from 20%,25%,30%,35% mandalic acids were detected at retention time35.490.from 40%,45% and 50% quercetin were detected at retention time 10.062.

**SCREENING OF LEAF EXTRACT OF FIVE MEDICINAL PLANTS ON THE
CONTROL OF RICE WEEVIL, *Sitophilus oryzae* (L.) (Coleoptera : Curculionidae)**

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ABSTRACT

Sitophilus oryzae (L.) is a serious pest of stored rice. Many studies were proved as plant products are superior to synthetic pesticides as they are cheap, easily available and ecologically safe. In this study leaf extract of medicinal plants *Acalypha indica*, *Murraya koenigii*, *Justicia gendarussa*, *Pongamia pinnata* and *Piper longum* from different solvents was assessed on the basis of mortality of adult rice weevil. Ten numbers of 1-3 days old adult insects were exposed to rice (10 g) treated with 0.025g/ml, 0.075g/ml, 0.125g/ml, 0.175g/ml and 0.225g/ml of methanolic leaf extract and 2.5ml, 5ml, 7.5ml, 10ml, 12.5ml of aqueous leaf extracts (1:10 w/v) separately. The number of dead insects were counted after 7 hrs, 24 hrs, 48 hrs, 72 hrs and one week of treatment. Each was replicated three times along with the solvent control.

It was found that mean percentage mortality was increased with dose. Highest mortality was observed after one week of exposure in rice treated with of methanolic leaf extract (52%-72%) than the rice treated with aqueous leaf extract (10%-43%). Methanolic leaf extract of *A. indica* at highest concentration (0.225g/ml) showed highest toxic effect on adult rice weevil (72%) followed by *Pongamia sp.* (63%), *Justicia gendarussa* (60%), *Murraya koenigii* (56%) and *Piper longum* (52%) after one week of treatment. While only 43% mortality was observed in rice treated with 12.5 ml of 1:10 W/V aqueous leaf extract of *A. indica* followed by *Murraya koenigii* (14%), *Pongamia sp.* (14%), *Justicia gendarussa* (13%) and *Piper longum* (10%). It was concluded that *Acalypha indica*, *Murraya koenigii*, *Justicia gendarussa*, *Pongamia pinnata* and *Piper longum* possess insecticidal activity and potential of insecticidal activity depend on the solvent used. Methanolic leaf extract of *Acalypha indica*, *Murraya koenigii*, *Justicia gendarussa*, *Pongamia pinnata* and *Piper longum* at 0.225 g/ml could be a considered for the management of *S.oryzae* infesting stored commodities..

Key words: Mortality, *Acalypha indica*, *Murraya koenigii*, *Justicia gendarussa*, *Pongamia pinnata*, *Piper longum*, Methanol leaf extract, Aqueous leaf extract and *Sitophilus oryzae*

DEVELOPMENT OF A SIMPLE AND EFFICIENT *IN PLANTA* TRANSFORMATION METHOD FOR TOMATO

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ABSTRACTS

An efficient, fast and tissue culture independent method was developed for *Agrobacterium*-mediated genetic transformation of tomato (*Solanum lycopersicum* cv Thilina). Initially, tomato seeds were sterilized and soaked in water for 3-10 days. Thereafter embryo regions of seeds were wounded 1-3 times with G18 1 ½” hypodermic needles and incubated for 30 minutes in two separate *Agrobacterium* cultures harboring different constructs. Culture 01 harbors a plasmid containing *GUS* reporter gene to analyze infected plants by transient *GUS* expression. Culture 02 harbors the plasmid pART27 cloned with *16D10* gene of root-knot nematodes, and infected plants can be analyzed by DNA based PCR technique. Tomato seeds which were wounded but uninfected with *Agrobacterium* were used as the control. All culture bottles were incubated under fluorescence light. Germination rate of infected seeds (60%) were considerably lower compared to the control (75%). About 80% of seeds and germinated cotyledons of tomatoes, infected with culture 01 were positive for histochemical GUS assay. Tomato seedlings germinated from the seeds infected with culture 02 were washed with cefotaxime and transferred to pots. Genomic DNA was extracted from leaves of these plants using phyto-spin D™ plant DNA extraction kit (Ceygen Biotech, Ltd., Sri Lanka) and used in PCR with primers specific to transgene *16D10*. PCR products of size 171 bp were obtained for 10 infected plants confirming the successful integration of *16D10* gene into tomato genome. Therefore, results of both GUS assay and PCR indicated that this novel *in planta* transformation method is an effective tool for production of transgenic tomato.

Keywords: *Agrobacterium*-mediated, root knot nematodes, GUS assay, PCR, transgene

OVIPOSITION DETERRENT POTENTIAL OF *Ruta graveolens* ESSENTIAL OIL AND ITS AROMATIC LONG CHAIN ALIPHATIC 2-METHYL KETONE CONSTITUENTS IN STORED MAIZE PROTECTION AGAINST THE RICE MOTH, *Corcyra cephalonica* (Stainton) (Lepidoptera: Pyralidae)

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ABSTRACT

Essential oils, a part of the plant immune system, created by its evolutionary intelligence are comprised of aromatic constituents furnishing the oils with their characteristic fragrances, primarily for the protection of plants from insect pests through the impairment of their behavioral patterns. Hence, immunological power of essential oils and their constituents could be exploited in the sustainable control of unsystematic use of conventional insecticides, intimately linking the ethno-botanical understanding to post-harvest insect pest management programs. In this sense, present work was undertaken in the light of exploring potential of major aromatic constituents of *Ruta graveolens* essential oil that contribute to its strongly marked fragrance, on the oviposition deterrence of *Corcyra cephalonica* in stored maize under laboratory conditions ($29 \pm 2^{\circ}\text{C}$ and $84 \pm 2\%$ R.H). Standardized essential oil authentically predominated by long chain aliphatic 2-methyl ketones of C8-C13 (44.643 %) where, 2-octanone (0.447 %), 2-nonanone (22.684 %), 2-decanone (2.230 %), 2-undecanone (17.760 %), 2-dodecanone (0.727 %) and 2-tridecanone (0.786 %) spiked following linear relationships with significant ($p > 0.001$) correlation coefficients ($r > 0.960$). Essential oil demonstrated significantly greater oviposition deterrence followed by shorter-chained congeners (C8-C10) wherein the longer-chained congeners (C11-C13) had negligible effect on oviposition. Ovaries of females emerged from the eggs treated with essential oils and shorter-chained alkanones exhibited empty spaces, shrinkages, disorderly arranged ova and coalesced lumpy masses within ovarioles. This study underlines the importance of utilizing *R. graveolens* essential oil and its alkanone constituents in the effective control of *C. cephalonica* in insect pest management approaches.

Keywords: *Ruta graveolens*, *Corcyra cephalonica*, Essential Oil, Oviposition Deterrence, Long Chain Aliphatic 2-Methyl Ketones

LONG TERM CHANGES IN CHILLING REQUIREMENT IN SOME SELECTED CLIMATES OF IRAN

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ABSTRACT

Deciduous fruit trees require cold winter events to fulfill chilling requirements, allowing production of normal harvests. Trends in chill accumulation over the last five decades were investigated at a number of main horticultural climate locations in Iran. In this research, chilling accumulation was detected using three chill models: The 0–7.2°C Model (CH), Utah Model (UM) and Dynamic Models (DM). The aim of this study was to evaluate long term changes in chill accumulation at some selected sites in Iran. Geographical differences were found in different sites with notable recent declines at one location and increase in another site. Other locations have remained stable with no consensus increase in chill across all models. Trends in chill accumulation were shown to differ between models with results indicating that the 0–7.2 °C model frequently behaved differently to the other chill models. These results highlight the need for multi-modal analysis of chill trends, especially in a climate change context and climate type contrasts, to avoid maladaptation

Keywords: Dormancy, Trend, Climate Change, Chill Accumulation, Winter

EFFECT OF INCORPORATING TOBACCO IN RICE BASED CROP ROTATION ON SOIL FERTILITY IN LOW-COUNTRY INTERMEDIATE ZONE

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ABSTRACT

A study was conducted in Galewela region in Low country Intermediate Zone of Sri Lanka to determine the effect of incorporating tobacco (*Nicotiana tabacum L.*), a high value cash crop, in rice based crop rotation on soil fertility. Soil samples were collected from four fields each from three crop rotations as tobacco-paddy-tobacco (TPT), tobacco-paddy-other (TPO) and other-paddy-other (OPO) (where 'other' denotes vegetable, fallow or other field crops) at the beginning and end of *Yala-2016*. Soil was collected in triplicate from each field at 0 – 30 cm depth and analyzed for nutrients, organic C, CEC, EC, pH, potentially mineralizable nitrogen (PMN), active carbon (AC) and texture. Undisturbed soil samples were collected from 0 – 15 cm and 15 – 30 cm depth classes for aggregate stability and bulk density measurements. Results indicate that soil physical fertility parameters were not significantly affected by type of crop rotation. Wet aggregate stability was greater than 50% in all fields. Incorporating tobacco in crop rotation did not cause instability in soil structure in studied soils. Soil chemical fertility parameters were significantly affected by cropping system. Cultivating tobacco increased OC, CEC, and some available nutrients (P, Ca, Zn and Cu). The PMN and AC contents in all studied soils were low and should be improved. Biological and chemical fertility of soils in the studied rice based cropping systems in the region were generally poor irrespective of the crop rotation type. Incorporating tobacco in rice based crop rotation in flat terrains of Galewela region did not cause soil fertility degradation.

Keywords: Tobacco, Soil Fertility, Rice Based Cropping Systems, Flat Terrains

**RESPONSES OF INUNDATION STRESS ON THE PERFORMANCE OF SOYBEAN
(*Glycine max* L. Merrill) PROPORTION TO ADVENTITIOUS ROOTS AND
PEROXIDASE ACTIVITY CAUSED BY GA₃ TREATMENT**

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ABSTRACT

In Indonesia, soybean is generally cultivated in paddy fields after rice, and water saturated condition is a major problem in that areas. The availability of soybean-tolerant varieties can be one of the efforts to increase soybean production. The objective of the research were to determine the effect of inundation stress on the growth of several varieties of soybean plants (Anjasmoro, Detam-1, Gepak Kuning, Grobogan, and Willis) on GA₃ treatment. The soybean were planted in outdoor greenhouse. Inundation soil treatment ongoing the day plants reached V₃ and continued for four consecutive days. The control received normal irrigation. The design of this study was used Randomized Block Design (RAK) at 95% confidence level for growth observation, covering plant height, yellowing leaf percentage, total chlorophyll, fresh weight, and number of adventitious roots. The results showed that inundation stress affects plant growth. indicated by a decrease in some growth parameters compared to control. The most significant decrease occurred in the treatment of stagnant inundation with the high puddle 5 cm above soil level, whereas total chlorophyll and the adventitious roots were increased under inundation stress and provided GA₃. The adventitious roots has increased along with the stress duration and the high water level above. Inundation stress also led to a significant increase in Peroxidase (POD) enzyme activity for Detam-1 and Willis varieties. No interaction occurred for the variety, high water level, and concentration GA₃ between treatments.

Keywords: Soybean, Varieties, Inundation, GA₃, Adventitious Roots, Peroxidase

**EVALUATION OF APPLICABILITY OF HEDGE BAMBOO (*Bambusa multiplex*) TO
IRRIGATION CANAL REVETMENT MATERIAL FOR ENVIRONMENTAL
CONSIDERATION**

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ABSTRACT

The objective of this study is to evaluate applicability of hedge bamboo (*Bambusa multiplex*) to irrigation canal revetment material aimed to conserve water quality and ecological system. The absorptive abilities of nitrogen and phosphorus by hedge bamboo were quantified by logistic model described as a function of cumulative temperature. Water tank experiments with various initial concentrations of T-N and T-P were performed to optimize the parameters of logistic model. The experimental results indicated that the absorptive abilities of nitrogen and phosphorus by hedge bamboo changed with time and initial concentration. Using the experimental data, the parameters of logistic model were identified. The changes of absorbed nitrogen and phosphorus could be predicted using this model. Hedge bamboos were trial-introduced as the afforestation and protection materials for irrigation canal slopes. The effects of revetment using hedge bamboos on the water quality and ecological system in the irrigation canal were evaluated by field observation. The results of the field observation indicated that the water quality and biodiversity of the irrigation canal with hedge bamboos were improved compared with the irrigation canal with the artificial revetment.

Keywords: Eco-Friendly Irrigation Facility, Water Quality, Biodiversity, Multi-Function of Agriculture, Environmental Consideration

ENVIRONMENT MANAGEMENT SYSTEM (EMS) IN AGRICULTURE- A SUSTAINABLE APPROACH

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ABSTRACT

An Environmental Management System (EMS) is a management tool that a business or organization can use to manage its impacts on the environment on a systematic and continuous basis. An EMS can provide a management the framework within which best management practices can be integrated and codes of practice upheld. An EMS may be certified to the international ISO14001 standard. An agricultural business may voluntarily adopt an EMS because it provides improved financial returns and can help achieve environmental management objectives and provide intangible benefits to the business and community. Government involvement in facilitating the adoption of EMSs in agriculture needs to be carefully examined and assessed because of the potential costs of government action and uncertainty about the outcome. An Environmental Management System or EMS is a voluntary, flexible business management system that helps farmers and managers to develop their own strategies for integrating environmental considerations into the daily operations of a farm for a sustainable agriculture. It works on farms harnessing new technologies and renewing the best practices of the past and it relies on one's own knowledge and sense of how to best manage an operation. The EMS starts with what is already in place and helps organize multiple management approaches. An EMS provides an umbrella for continually improving management of all the plans and practices currently in place on farms. An EMS builds on the environmental stewardship already in place by providing a systematic means to assess, review and improve environmental performance.

Keywords: Sustainable, EMS, ISO14001, Agriculture, Stewardship

ACCLIMATIZATION OF *Zizyphus jujube* UNDER WATER STRESS: EVIDENCES FROM PLANT MORPHOLOGY AND PHYSIOLOGY

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ABSTRACT

Pakistan is an arid to semiarid country. Under climate change predicting erratic precipitation patterns longer drought spells are expected to be frequent putting survival and growth capacity of *Zizyphus jujube*, an important tree species, to decrease sharply. Pot experiment was carried out to evidence the effect of water stress on growth and physiological adjustment in six months old *Z jujube* seedlings. Experiment was conducted in a greenhouse and individuals under control were watered daily to field capacity and individuals in medium and high water stress were watered to 70% and 40% of the field capacity. During the experiment various parameter related to growth, biomass production and allocation were measured along with physiological parameter like CO₂ assimilation, stomatal conductance and water use efficiency using leaf gas exchange system. The results showed that the growth parameters (plant height, stem diameter, chlorophyll contents, and biomass production/allocation to leaves, stem and roots) decreased significantly with increase in water stress; however, root length and root biomass production and allocation increased under medium water stress and decreased significantly under high water stress. Furthermore, stomatal conductance and CO₂ assimilation rate was insignificantly different under control and medium water stress individuals, but decrease significantly under high water stress treatment. Water use efficiency was also significantly higher under medium water stress and lower under high water stress treatment. Thus, it can be concluded that *Z jujube* can tolerate medium water stress through morphological adjustments, increasing root biomass, and maintaining photosynthetic activity at early growth stages.²

Keywords: Water Stress, Biomass Production And Allocation, CO₂ Assimilation Rate, Stomatal Conductance, Water Use Efficiency

LINEAR PROGRAMMING ON YIELD OPTIMIZATION OF STRING BEAN FOR DIFFERENT LEVELS OF SPACING AND FERTILIZER

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ABSTRACT

Optimization of yield in agriculture crops is vital to safeguard the farmer and the scope of agriculture is the utilization of resources in the most efficient manner. Hence, the study was aimed on yield optimization of agricultural crops in alliance with linear programming of operation research. The study was carried out on the crop string bean, is to optimize the yield of string bean with three levels of spacing such as S1 (90 cm×30 cm-control), S2 (100 cm×35 cm) and S3 (110 cm×40 cm) and four levels of fertilizer such as F1 (no fertilizer-control), F2 (450 g/6m²), F3 (1,200 g/6m²) and F4 (1,800 g/6m²). Yield was optimized with application of input cost such as weeding, land preparation, irrigation, planting materials and other management practices of the crop to find out the optimized yield over recommended yield through linear programming. Field plot was assigned in randomized complete block design. Result of the optimization model was revealed that the recommended yield of string bean was 17.3 ton/ha which optimized into 14 ton/ha through the modal application. About average yield of 13 ton/ha was obtained from the real field of agriculture and there were no significant yield observed between optimized yield and real yield in the field, this result revealed that farmer can get the optimal yield by this field application of the model. Significant result of optimized yield showed that spacing was not significantly optimize the yield. But, fourth level of fertilizer (F4) was highly optimize the yield and pod number of the string bean.

Keywords: ANOVA, Fertilizer, Linear Programming, Spacing, String Bean, Yield

“CROP DIVERSIFICATION IN UTTARAKHAND, INDIA: AN ECONOMIC ANALYSIS”

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ABSTRACT

Crop diversification is an important strategy for overall agriculture development in the country. The present study was conducted in Uttarakhand, with the objectives to estimate growth rates of different crops, to examine the socio-economic status, to analyze the nature and extent and to identify the factors affecting crop diversification. The present study utilizes both secondary and primary data, secondary data was collected for the period of 11 years (2000-01 to 2010-11). For primary data, multistage stratified random sampling technique was followed to select 45 farmers from hill region and 30 farmers from plain region. Exponential growth function was used to estimate the growth rate of different crops, to examine socio economic, simple statistical tools were used, Simpson diversification index had been used to analyze the nature and extent of crop diversification. Multiple linear regression was used to examine the factor affecting crop diversification.

The diversification indices constructed for all the crops groups at districts, divisions and state level showed that the diversification has been found more in hill districts as compared to plain districts. State as a whole registered a significant rise in all the crop groups. Pulses also show the significant high level of diversification, while oilseed show the moderate level of diversification. At farm household level, about 62 per cent farmers comes in the category of very high level of diversification in hill region while in plains same per cent belongs to high level of diversification. Hill region show the higher level of diversification in all the crop groups and also in the varieties, as compared to plain region. The major factors responsible for the change in crop diversification were fertilizer consumption, gross irrigated area, road length, mechanization and certified seeds, at districts, divisions and state level. In case of farm households age of household head, size of farm households, distance to market, off-farm/non-farm income and fertilizer which effects the crop diversification. The creation of basic infrastructural facilities is an essential prerequisite for crop diversification and fostering the process of agricultural development.

A REGIONAL ASSESSMENT OF GREEN MANURE/COVER CROPS APPROPRIATE FOR SOUTHEAST ASIAN CLIMATES

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ABSTRACT

While maintaining adequate levels of soil fertility can be a challenge on any farm, maintaining those levels on the resource-limited smallholder farms of the tropics requires some creative solutions. This research endeavor was designed to compare the adaptability and potential of 4 legume species promoted as Green Manure/Cover Crops (GMCC's) in Southeast Asia. Cowpea (*Vigna unguiculata*), Jackbean (*Canavalia ensiformis*), Lablab (*Lablab purpureus*), and Ricebean (*Vigna umbellata*) were planted in field trials in 5 countries across Southeast Asia in 2016, including Cambodia, Myanmar, Thailand, Bangladesh, and the Philippines. Data was collected to assess the production of above-ground biomass, percent ground cover, and timing of growth cycles at each site. Although results varied from country to country, based on soil-type, climatic conditions, and growing degree days, Jackbean consistently outperformed other GMCC species in terms of biomass production, yielding up to 12 t ha⁻¹ on a dry-weight basis in Bangladesh and the Philippines. Of the 4 crops compared, cowpea consistently delivered the shortest growth cycle, reaching the pod formation stage in the fewest number of days across all 5 sites. These results provide informative answers regarding the growth habits and life cycles of these 4 crops, and serve to enhance the capability of producers in Southeast Asia to select appropriate species needed for soil improvement purposes in a wide-ranging set of cropping systems.

Keywords: Cover Crop, Green Manure, Southeast Asia, Ground Cover, Soil Organic Matter

STATUS, IMPORTANCE AND FUTURE PERSPECTIVE OF NA TREE (*Mesua Ferrea* L.) IN THE NAGANCHOLAI AREA OF DRY ZONE OF MULLAITIVU DISTRICT IN SRI LANKA

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ABSTRACT

The study was carried out at reserve forest of Nagancholai in the Mullaitivu district to assess the status, importance and future perspective of a forest species namely *Mesua ferrea* L., which is the national tree of Sri Lanka belongs to Clusiaceae family and commonly called as iron wood or Na tree. The species distribution area comes under Mulliyawali beat of the district and approximately covers the extent of 40 ha. World database on protected areas (WDPA ID) and IUCN category of the area is 27,431 and wilderness area (Lb), respectively. About 30 sampling plots were randomly laid at a size of 20 m × 20 m. A total of 447 trees, 2,890 seedlings, 2,221 saplings were recorded for the species in the study areas. Mean number of seedlings, saplings and trees per plot of the species were 96.3±14.23, 74.0±10.94 and 15.0±0.97, respectively, revealed that number of seedlings was greater than saplings followed by trees, indicates that the species had a good regeneration capacity in the study areas. Mean tree height and diameter of the species were 11.8±0.24 (25.9-3.7) m and 20.4±0.58 (66.6-2.8) cm, respectively. Mean number of coppice from the main stem of the species was 1.2±0.07 (6-0). Sociocultural survey in the study area revealed that the population is directly or indirectly responsible for the deforestation and degradation of the species and the timber of the species illegally logged. Hence, regeneration assessment is an important part of evaluation of the forest status and finally, the study focus for monitoring and managing tree species diversity, forests, and carbon stocks on a regional, national and global level, which aims to assess the conservation status of the species and forest management and development programme in the district.

Keywords: Conservation, Dry zone, *Mesua ferrea* L., Nagancholai, Regeneration, Sri Lanka

**EFFECT OF OIL CAKES AND GARLIC AQUEOUS BASED FORMULATIONS OF
Trichoderma viride ON MANAGEMENT OF *Meloidogyne incognita* IN CHILLI**

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ABSTRACT

Root-knot nematode, *Meloidogyne incognita* is a threat to the chilli cultivation, by forming root galls and subsequent wilting. These nematodes are reported surviving in other Solanaceae family crops and in some weeds as well. Bio control of root-knot nematode with antagonistic fungi is an eco-friendly management and best fit to tackle the problem towards toxin free nation. Considering the urgency and collective need, an attempt was made to evaluate the effect of *Trichoderma viride* and its formulations on root-knot nematode, *M. incognita* management. Oil cakes such as neem (*Azadiracta indica*), gingelly (*Sesamum indicum*), mahua (*Madhuca longifolia*) and garlic (*Alium sativu*) extracts were used to evaluate the potential growth and sporulation of *T. viride*. Among the four preparations, neem oil cake readily supported to harvest high spore yield of 1.75×10^7 spores/ml. Similarly gingelly and garlic were supported with the spore yield of 1.57×10^7 spores/ml and 1.368×10^7 spores/ml respectively. Comparatively Mahua obtained low spore yield of 7.87×10^6 spores/ml. MI-2 chilli variety was tested to investigate the potential of *M. incognita* and its management by using *T. viride* formulations. Plant growth was significant ($P < 0.05$) in the application of neem oil cake formulation (30.42cm). Extent of galling was significantly low in garlic (9.00) and neem (9.25). The results confirmed that the formulations of neem oil cake, gingelly oil cake extract and garlic aqueous extract stimulated the chilli plant growth, productivity and reduce the nematode infestations. Above all, neem and garlic are the best formulations that can be used to manage the *M. incognita*.

Keywords: Chilli, Root-knot nematode, *Meloidogyne incognita*, Gall, *Trichoderma viride*, Bio-control

ANALYSIS OF FARMERS' ADOPTION OF CLIMATE SMART AGRICULTURAL PRACTICES IN NORTHERN NIGERIA

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ABSTRACT

Climate change is becoming a threat to sustainable agricultural production and food security in Africa. Climate Smart Agricultural practices could help farmers to be more resilient to climate change. The objective of this study was to determine the extent of farmers' adoption of selected Climate Smart Agricultural practices in the North Western geopolitical zone of Nigeria. A multistage sampling procedure was used to select sample of 577 farmers who cultivate rice and maize as major crops across three distinct vegetation strata. Data were collected through interview schedule with the aid of questionnaire. Data were analyzed using descriptive statistics. The results showed that adoption of the selected agricultural practices was generally low. Agronomic components were the mostly adopted practice. Practices such as Integrated Pest/Weed Management, agro-forestry, efficient soil fertilization and water management were just becoming popular. Bush burning remained a major setback towards effort of building resilience to climate change in the study area. Sensitization of farmers on reality of climate change and the need to adopt climate smart practices towards reduction of adverse effect of climate change should continue. Policy and support programme that would enhance dissemination of Climate-Smart Agricultural practices to a larger proportion of farmers is recommended.

Keywords: Climate Change, Climate Smart Practices, Adoption, Nigeria

ADOPTABILITY OF THE IMPROVED HOLLOW CONE NOZZLE ON BEANS AND TOMATO UNDER FARMER FIELD CONDITIONS

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ABSTRACT

An earlier investigation has revealed that relatively very high volumes of pesticides are being used in vegetable cultivations in Sri Lanka mainly due to the use of errant nozzles under low pressure. The same study has further indicated that the use of an improved hollow cone nozzle under standard pressure managed to reduce around one third of the pesticide volume used in cabbage cultivation. Further evaluation of this improved hollow cone nozzle on other types of foliages under farmers' cultivation conditions is required in recommending this new nozzle replacing the conventional nozzle in foliar applications of insecticides on vegetables. The present study was carried out to confirm the effectiveness of this improved hollow cone nozzle on vegetables with other type of foliage under farmers' cultivation conditions. The pest control efficacy of the improved hollow cone nozzle was compared with the conventional nozzle on tomato and bean in famers' field at Bandarapola, Matale. Spraying of insecticides using both types of nozzles reduced the number of pests and increased marketable yield and there was no significant difference of the efficiency between them. However the Improved nozzle consumed only 20% to 29% lower spray volume when compared with the conventional nozzle. Therefore, improved hollow cone nozzle can be used to replace the conventional nozzle effectively reducing the use of pesticide volume in vegetable cultivation which will in turn be an environmentally friendly and health wise beneficial for human being.

Keywords: Pests, Crop Yield, Foliar Insecticides, Improved Hollow Cone Nozzle

EFFECTS OF SALT STRESS IN *Terminalia arjuna* SEEDLINGS: MODERATE STRESS HAS LITTLE IMPACT ON BIOMASS PRODUCTION, PARTITIONING AND PLANT PHYSIOLOGY

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ABSTRACT

In Pakistan, salinity is regarded as a serious abiotic stress for plant growth and development. Out of 20 million hectares of agriculture land, 6.67 million hectares are saline ranging from moderate to high salinity. Previous studies has demonstrated that mature *Terminalia arjuna* can tolerate salt stress, however salt tolerance in young *Terminalia arjuna* seedlings, especially in terms of germination ability and plant physiology remains poorly documented. Therefore, present study was conducted to evaluate germination percentage, growth potential and physiological adjustment in young *Terminalia arjuna* seedlings under various saline condition. Experimental was carried out at Forestry research area, University of Agriculture, Faisalabad. Various parameters were measured during the experiment related to seed germination, plant growth and physiology (leaf gas exchange system) under three salinity levels: control, medium and high saline (2, 8 and 16 dS m⁻¹). Results showed that seed germination percentage, growth biomass production and physiological parameters (CO₂ assimilation rate, stomatal conductance and transpiration rate) significantly decreased under high salt stress treatments. However, individuals under medium salinity remained insignificantly different as compared to control treatment. Therefore, it can be concluded that young *Terminalia arjuna* seedlings can tolerate moderate salt stress which can be attributed to sustained CO₂ assimilation rate.

Keywords: Salt Stress, Biomass Production And Allocation, CO₂ Assimilation Rate, Stomatal Conductance

EFFECT OF SALINE WATER ON CROP YIELD OF BITTER-GOURD UNDER DRIP IRRIGATION SYSTEM IN PAKISTAN

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ABSTRACT

The water scarcity has been increased for the last couple of decades; it is incumbent on agriculture to maximize the use of water of all qualities. Drip irrigation system practice has shown vast increase in profit and research interest in the last two decades. However, the application of this system is still limited. The research study was conducted at Malir, Karachi, the semi-arid region Pakistan. The aim was to evaluate the effects of three different qualities of ground-water on water use efficiency. To this end, bitter-gourd was grown under drip irrigation system during the year, 2016. The uniformity co-efficient (UC) ranged from 93 to 96% was achieved. Three qualities of ground water having EC_{iw} 2.70dS.m⁻¹ (IT1 (Control)), EC_{iw} 3.32dS.m⁻¹ (IT2) and EC_{iw} 3.65dS.m⁻¹ (IT3) were used through drip irrigation system to bitter-gourd crop. The total amounts of water of 12941m³.ha⁻¹ were applied in each treatment. The results showed a significantly higher average weight (54.14gm), average length (13.89 cm) and average diameter (3.46cm) of fruit was observed under E.C 2.70dS.m⁻¹ (IT1). The study concluded that bitter-gourd crop can be grown successfully on sandy loam using brackish quality ground-water under drip irrigation system.

Keywords: Uniformity Co-Efficient, Water Use Efficiency, Drip Irrigation, Ground-Water

**SITE SPECIFIC NUTRIENT MANAGEMENT IN HIGH QUALITY PROTEIN MAIZE
(HQPM) IN INDO-GANGETIC PLAINS OF INDIA**

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ABSTRACT

Field experiment was conducted during *Kharif* season of 2009 and 2010 at Norman E Borlaug Crop Research Centre, Govind Ballabh Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) to study the Effect of site specific nutrient management on productivity and economics of HQPM in Indo-Gangetic plains of India. The experimental site was sandy loam in texture having soil pH 7.2, organic carbon 0.85%, available nitrogen, phosphorus and potassium 224, 19.5 and 268 kg/ha, respectively. The treatments consisted of 7 treatments i.e. T₁: control (no fertilizers), T₂: state recommendation of nutrient (120:60:40::N:P₂O₅:K₂O kg/ha), T₃:Improved nutrient recommendation (150:60:40:25:: N:P₂O₅:K₂O:ZnSO₄ kg/ha), T₄: site specific nutrient management (SSNM) (148:48:97:25:: :P₂O₅:K₂O:ZnSO₄ kg/ha), T₅:SSNM-Nitrogen (SSNM-N), T₆:SSNM-Phosphorus (SSNM-P) and T₇: SSNM-Potash (SSNM-K) were planted under completely randomized block design with three replications. The growth and yield attributes, grain yield, economics and B:C ratio of HQPM were differed significantly with nutriment management practices. The grain yield of HQPM was recorded significantly highest under SSNM with application of 148:48:97:25::N:P₂O₅:K₂O:ZnSO₄ kg/ha that also had 19.4 and 35.7% greater grain yield than improved nutrient recommendation i.e.150:60:40:25::N:P₂O₅:K₂O:ZnSO₄ and state recommendation of nutrient i.e. 120:60:40::N:P₂O₅:K₂O kg/ha, respectively. It was also noticed that application of N was very crucial for crop growth and development as evidenced under SSNM-N where maximum reduction in grain yield i.e. 77.5% took place compared to SSNM treatment. Similarly the 41.7 and 42.6% grain yield reduction were observed under SSNM-P and SSNM-K, respectively. Besides, the days required for 50% tasseling and silking stages were increased in absence of nitrogen. SSNM also had significantly highest net returns and B:C ratio indicating that HQPM may be fertilized with 148:48:97:25:: N:P₂O₅:K₂O:ZnSO₄ kg/ha for realizing maximum potential of HQPM in Indo-Gangetic plains of India.

Keywords: Cob Yield, HQPM, B:C Ratio, Silking, SSNM, Tasseling

**MARKET PARTICIPATION AND MARKETING CHANNEL PREFERENCES BY
SMALLHOLDER SORGHUM FARMERS IN SEMI-ARID ZIMBABWE**

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ABSTRACT

A fundamental concern of agricultural development is the efficient marketing of goods and services. Household and market related characteristics play a critical role in understanding the inclination for choosing specific market segments and their growth potential. The main aim of this paper is to examine the specific attributes which determine marketing channel choice by sorghum farmers. A case comprising 380 households from five Wards in the mid Zambezi Valley of Zimbabwe was used. The study adopted a cocktail of tools including a questionnaire, observations and discussions for data collection. Secondary data were used to triangulate and validate responses from farmers. A multinomial logit regression model was adopted and applied to the marketing channel choice decision making processes. Four marketing channels were isolated and the local option used as the referent category. This shows that marketing channel options are limited in the smallholder sector of Southern Africa. The dominant channel used by sorghum farmers is the local marketing channel due to its convenience and lower transaction costs. Household and market specific factors influence marketing channel choice. These are age, education, dependency ratio, gender, extension, time and transport costs. Price, buyers and distance to the market are the most robust determinants of marketing channel selection. Strengthening cooperative based marketing can reduce the risks associated with relating to external traders who usually exploit farmers for price and standard requirements. Extension modes also need to be accommodative of the competitive realities which have recently characterized agricultural markets if sorghum is to penetrate the consumers' evoked sets.

Keywords: Sorghum, Multinomial Regression, Marketing Channel, Zimbabwe

ESSENTIAL OIL OF *Pimenta dioica* (ALLSPICE) LEAVES AS A POTENTIAL GREEN CANDIDATE FOR THE MANAGEMENT OF THE POST-HARVEST INSECT PEST, *Callosobruchus maculatus* (F.) (COLEOPTERA: BRUCHIDAE)

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ABSTRACT

The essential oil of *Pimenta dioica* (Allspice) leaves was isolated using hydro-distillation and potential insecticidal properties were evaluated with the aim of suppressing the populations of the most devastating post-harvest insect pest, *Callosobruchus maculatus* in storage legumes and pulses. Four concentrations of leaf oil (0.50, 0.60, 0.80 and 1.00 v/v%) were tested individually to evaluate contact and fumigation repellency as well as insecticidal activities against one day old adult insects using a modified single choice cup bio assay. Volatile organic compounds of leaf essential oil was analyzed by headspace solid-phase micro extraction coupled with gas chromatography and mass spectrometry (HS-SPME/GC-MS) using polar and medium polar fibers. All concentrations of the leaf oil elicited significantly higher repellent effects on insects after 2 hour exposure when compared with those of the control (0.00%) whereas the highest concentration produced 98.00% and 92.00% contact and fumigation repellency effects. Observations on contact and fumigation toxicity tests exhibited 100% mortality for the highest concentration after 6 and 12 hour exposure respectively giving low LC₅₀ values of 0.34 and 0.39. Volatile oil analysis (VOI) indicated that leaf essential oil comprised of a very high amount of Eugenol (89.80%) as well as Methyl eugenol (2.39%) and caryophyllene (4.14%) for the polar fiber. Eugenol (42.61%), Caryophyllene (27.91%), Humulene (6.87%) and Linalool (8.18%) were obtained for the medium polar fiber. Overall results of the present study strongly indicate that leaf essential oil of *P.dioica* would be a safe, eco-friendly alternative botanical insecticide in managing *C.maculatus* during storage.

Keywords: Essential Oil, *Pimenta dioica*, *Callosobruchus maculatus*, Repellency, Toxicity

**HORMONAL REGULATION OF FLOWER QUALITY ACCORDING TO THE
METHOD OF APPLICATION IN *Dendrobium* ‘JAQ HAWAII’ X *Dendrobium*
‘SINGAPORE WHITE’**

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ABSTRACT

This study was conducted to evaluate the effect of plant growth regulators on enhancing the flower size of *D.* ‘Jaq Hawaii’ x *D.* ‘Singapore White’ at Mid Country Wet Zone, Sri Lanka. The experiment design was RCBD and each treatment combination contained five replicates with four plants per each. Sole and combination effects of Gibberellin A3 (GA3) and 6-Benzylaminopurine (6BA) were tested according to drench and spray modes of application. Data on average sepal, petal and labellum lengths and widths as well as area of flower were collected on the fourth day after full blooming. Both sole application of 125 mg/L GA3 and combination of 125 mg/L GA3 + 200 mg/L 6BA were able to reduce days taken for blooming. The ratio between length and width of petal, sepal and labellum were minimum at 200 mg/L 6BA while giving a better visual appearance. Sole application of 125 mg/L GA3 increased petal, sepal and labellum lengths, whereas 200 mg/L 6BA increased the petal, sepal and labellum widths and area of the flower. Between the modes of applications, spraying was found to be the best. Study results conclude that spraying 125 mg/L GA3 or 125 mg/L GA3 + 200 mg/L 6BA can be used to achieve economic advantage by early blooming. The area of the flower, petal, sepal and labellum sizes can be manipulated according to the flower characters and market demand.

Keywords: *Dendrobium*, Drench, Flower Quality, Plant Growth Regulators, Spray

**HIGHER EDUCATION IN AGRICULTURAL SCIENCES: ANALYZING GENDER
DIVIDE AND WOMEN DISINCLINATION TOWARDS HIGHER STUDIES IN
PAKISTAN**

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ABSTRACT

There is lack of women agricultural scientists, academician and extension workers in many developing countries but the issue is more prominent in Pakistan. Gender divide in higher education in agriculture and allied subjects and pretty wide despite of the fact that country's economy based on agriculture and women contribute equally (if not more) in farm related activities along with men. There is very few women in agricultural extension department as well as in agricultural research institutes. Many scholarship opportunities are available but the ratio of women in higher education in agriculture is very low and a gender gap in leadership is expected to be even wider in the coming years. In this context this study was conducted to investigate the factors that hinder women decision for higher studies and availing foreign scholarships in agriculture related subjects. The paper specifically addressed the questions related to the perceptions and aspirations of female agricultural students about higher studies and the factors (socio-cultural and financial) that hinder their decision regarding studying in a foreign country on scholarship. The paper also gives some suggestions to improve female access in higher studies in agricultural subjects.

A proportionate sample of 250 girl students from University of Agriculture, Faisalabad (UAF) was taken from different institutes and departments of the university. UAF was selected purposely because it is the largest and top-ranked university of Pakistan. Both qualitative and quantitative methods were used for data collection. Regression model was applied to understand the factor affecting the decision of female students regarding higher education in agriculture. Results indicated that the majority of the respondents were highly motivated for higher studies but they perceive that religion and society would not accept their decision of going abroad alone for higher education. Education of mother, family type, socio-cultural norms, religious misconceptions and feeling about the attitude of society towards girls were some of the factors that were affecting women disinclination towards higher education in agriculture.

Keywords: Gender divide, Higher education, Agriculture, Pakistan

EFFECT OF BIOFILM FORMULATIONS ON SOLUBILIZATION OF ROCK PHOSPHATES

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ABSTRACT

Rock Phosphate (RP) is a cheap, phosphate-rich source, but application is limited due to low solubility. National Institute of Fundamental Studies (NIFS) has developed biofilm formulations with potential biosolubilization of P in Rock Phosphate (RP) which direct to overcome its low solubility and trim down conversion cost to a chemical phosphorous(P) fertilizer by the combined application of RP with biofilms. Hence this study was focused to evaluate the performance of certain biofilm formulations on solubilization of rock phosphate in cultural broths. Series of laboratory experiments were conducted with six treatments developed from four biofilms cultures in liquid low cost medium (LCM) with rock phosphate particles denoted as BF1, BF2, BF3 and BF4 and two controls as positive and negative arranged in complete randomized design(CRD) by maintaining three replicates for each. Available P, water soluble P, organic P, microbial biomass carbon and P, pH and other microbial observations are taken after 15 days incubation. Biofilm -3 (BF3) was dominated with releasing significantly highest amount of available P, biomass P, organic P and water soluble P rather than other biofilm treatments. Significantly highest organic acid production denoted by lowest pH of the cultural broth was observed in BF2. If though its high assimilatory activity leads to immobilize a large portion of solubilized P inside the microbial cells. Consenting overall performances, it can be concluded that BF3 as the most outstanding biofilm formulation on solubilization of rock phosphate which consists heaviest microbial biomass (23.77mg/g) . Thus, further studies are needed to evaluate the P solubilization performance of biofilms in field condition for the concrete verdict.

Keywords: Biofilms, Organic Acids, Phosphorous Solubilization, Rock Phosphate

**NITROGEN, PHOSPHOR, AND POTASSIUM NUTRIENT INTERACTION ON
SEEDLING QUALITY OF THREE PALM OIL VARIETIES IN VARIOUS PLANTING
MEDIA COMPOSITIONS**

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ABSTRACT

Nitrogen, phosphor, and potassium are the macro nutrients needed for oil palm seedling for their growth and development. The interaction of nutrient content will determine the quality performance of the oil palm seedling. The objective of these research was to study four levels of macro nutrients in plants and their contribution to the three characteristics of seedling quality, namely the number of leaves, plant height, and stem diameter. Magnesium as a macro nutrient is also observed to see its effect on the amount of leaf chlorophyll. Three varieties of oil palm are: D x P 239; D x P Simalungun; And D x P Avros. The composition of planting medium were: Top Soil; Top Soil + Palm Oil Fibers, Top Soil + Oil palm empty bunches (OPEB); Top Soil + Solid decanter; And Top Soil + Palm Fibers + OPEB + Solid decanter. The results showed that nitrogen and phosphor levels in plants will contribute root and shoot growth. Combination treatment of Dxp239 variety with planting media composition top soil: solid decanter (1:1) gives the highest on stem diameter and seedling height, but does not effect on the number of leaves.

KeywordS: Oil Palm Seedling, Macro Nutrient, D x P 239, D x P Simalungun, D x P Avros

INVESTIGATING DISTRIBUTIONAL CHANGES IN EXTREME RAINFALL OVER SRI LANKA

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ABSTRACT

Nowadays occurrence of natural disasters due to extreme rainfall events are frequent in Sri Lanka and it is crucial to analyze the probability distribution for extreme rainfall. Therefore, this study is focused on understanding distributional changes in annual daily maximum rainfall (ADMRs) over time in Sri Lanka using a quantile regression. A simplified nine-category distributional-change scheme by comparing empirical probability density function of two years (i.e. the first year and the last year), was used to determine the distributional changes in the ADMRs. Daily rainfall series of 13 stations over Sri Lanka were analyzed for the period of 1960-2015. Four distributional categories were identified based on the posterior distributions associated with different quantiles (i.e. quantiles from 0.05 to 0.95 with an increment of 0.01 for the ADMRs). Five stations showed an upward trend in the quantiles which could lead to high probability of extreme rainfall (i.e. flooding). Rest of the stations showed a downward trend in the quantiles which could give high probability of lower rainfall. This study confirmed that the proposed Bayesian non-crossing quantile regression could give comprehensive information on non-stationarity in hydrological extremes. Further, results showed considerable spatial diversity in distributional changes of ADMRs over Sri Lanka.

Keywords: Hydrological Extreme, Quantile Regression, Sri Lanka

**WATER LOGGING DURATION AT FLOWERING STAGE OF MUNGBEAN ON
PHYSIOLOGICAL ASPECT AND YIELD**

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ABSTRACT

Cultivation of mungbean as third season crop is very popular cultivation system in Sri Lanka. Due to climate change, unexpected heavy rains could be occurring and water logging could affect on the crop. Therefore, it is important to study the impact of water logging durations on mungbean growth and yield. Therefore, the field experiment was conducted to assess plant survival ability, yield response and physiological changes of mungbean accessions for water logging stress at late vegetative period. The split plot design was adapted with four replicates. Three water logging durations, whereas 0, 5 and 10 days were applied as a main factor. Selected 16 Mung bean accessions screened on water logging durations were sub factors. At 35 days after planting water logging treatments were imposed. Plant survival %, chlorophyll content, leaf area after stress and per plant seed yield were recorded. More than 5 days water logging was highly affected on mung bean accessions with genotypic variations. Increased water logging duration decreased the plant survival %, chlorophyll content, leaf area and seed yield of mungbean. MIMB911 is the best performing accession for the water logging risk environments and MIMB911 and MIMB936 could be contain water logging tolerant characteristics.

Keywords: Mungbean, Plant-Survival, Water Logging Duration, Yield

INCIDENCE OF POTENTIALLY HIGHLY HEAT-RESISTANT SPORES IN SRI LANKAN ULTRA HIGH TEMPERATURE MILK

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ABSTRACT

The objective of the study was to evaluate the contamination level of raw ingredients and different unit operations of Ultra High Temperature (UHT) milk manufacturing for aerobic and thermo resistant spore forming bacteria. In order to achieve this, the occurrence of the spore-forming bacteria in different segments of production lines of UHT milk of a commercial plant and its transfer to the final product was studied. The samples were collected from raw ingredients (raw milk, skim milk, whey powder, cocoa powder), pasteurized milk, UHT milk (before storage) and UHT milk stored at 35 °C for 3,7 and 14 days, in 42 days with six weeks intervals (2 samples /week) from a commercial dairy processing plant in Sri Lanka. The total colony count of aerobic spore forming bacteria and thermo resistant spore forming bacteria were enumerated using Nutrient Agar. The highest mean count of aerobic spores was detected in raw milk (3.56 Log CFU/mL). The mean count of aerobic spores decreased ($p < 0.05$) in UHT milk by 88.10% and increased considerably in UHT milk stored at 35 °C for 3 days by 41.7%. The average levels of aerobic spore-forming bacteria were considerably lower in the UHT milk than in other segments. The study revealed that raw ingredients are the primary factors influencing the number of aerobic spores and thermo resistant spores in final products. Aerobic spores are reduced to the acceptable level during UHT manufacturing process. The proportion of aerobic spore-forming bacteria in the final product depends on storage periods.

Keywords: Aerobic, Spore-Forming Bacteria, UHT, Raw Milk

**SUSTAINABILITY OF FOOD LAND PRODUCTIVE THROUGH POLICY AND
COMMUNITY EMPOWERMENT STRATEGIES**

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ABSTRACT

The conversion of agricultural land to non-farm is about 2% per year, his condition leads to a decrease in food production. This research is a descriptive qualitative research that is used as a problem-solving procedure related to the conversion of agricultural upland to non-agricultural land in North Sumatra Batubara District. The cause of the farmers will divert the function of paddy field to plantation land is caused by: higher income of palm farming, lower harvest failure and relatively stable price. The consequences or impacts of land conversion are increased food prices, land degradation, and unpredictable drought and flood stress. To reduce the rate of land conversion, the effort is to formulate eight policies and six community empowerment.

Keywords: Conversion of Upland, Policy, Community Empowerment

**MARKET DRIVEN IN-SITU CONSERVATION OF MUSHKBUDGI: WAY TOWARDS
SOCIO-ECONOMIC DEVELOPMENT OF FARMERS**

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ABSTRACT

Landraces evolved over millennia under natural and human selection pressures are known to be the reservoirs of useful allelic resources. These not only sustain the present crop improvement programmes but are required to meet the aspirations of the future generations under changing circumstances. Landraces are highly adapted to the specific agro-climatic regions, have special uses and varying levels of resistance to biotic and abiotic stresses. Rice being the most important staple food in South and South East Asia, the conservation of the bio-diversity and its utilization for breeding new rice varieties is directly related to the food security of ever increasing population of the world. In past few decades, increase in share of high yielding varieties and shrinkage in the area of local varieties have been reported in India. Kashmir valley is a home to number of landraces belonging to *japonica* sub-species which are known for their unique quality features particularly for aroma with desirable taste and texture of the cooked rice, besides, being early maturing and highly cold tolerant. These genotypes evolved under specific ecological niches and carry combined adaptive traits suitable to the temperate climatic conditions of Kashmir valley. In spite of the introduction of many high-yielding modern rice varieties, few land races such as *Mushk Budji*, *Kamad*, *Larbouel*, *Mughal*, *Begum* and Red rices (*Gulzag*, *Baber*, *Tilzag*, *Gulbara*, *Mushkandi*) are still being cultivated by few households in fragmented pockets due to their unique qualities as niche crops.

Keywords: Local Biodiversity, Scented Rice, Conservation

**ISOLATION AND CHARACTERIZATION OF TWO *Serratia* STRAINS FROM THE
RHIZOSPHERE OF POTATO AS POTENTIAL BIOCONTROL AGENTS TO
CONTROL *Meloidogyne* spp.**

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ABSTRACT

Root knot nematode (*Meloidogyne* spp.) is one of the important pathogens in North Sumatra, Indonesia, that causes big impact on potato crop yields. One of the control strategies for controlling this nematode is by using biocontrol agent. This research was conducted to evaluate the possibility of using antagonistic bacteria isolated from potato rhizosphere as biocontrol agents to control *Meloidogyne* spp. Out of 6 isolates, 2 isolates JG1 and JG2 which maximum antagonistic activity during *in vitro* bio assay against the motile juvenile stage 2 of root knot nematode. Inactivation and mortality were recorded after 1, 2, 3, and 4 hours of exposure to bacteria. JG1 maximum nematode mortality (98.2%) after 4 hours, and JG2 maximum nematode mortality (93.2%) after 4 hours. The isolates were identified as *Serratia* sp. (JG1) and *S. marcesens* (JG2) based physiological and and biochemical characters, and analysis of the 16S rRNA gene sequence. The result showed that *Serratia* sp. and *S. marcesens* can be used as bicontrol agent to control *Meloidogyne* spp.

Keywords : Biocontrol, Bacteria, Potato, *Serratia*

**IMPLEMENTATION OF FOOD SAFETY MANAGEMENT SYSTEM: THE CASE
STUDY IN MANDARIN ORANGE FARMERS BY JAPAN'S AGRICULTURAL
COOPERATIVES**

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ABSTRACT

A number of high outbreaks have raised questions regarding food quality and safety assurance.

Agriculture cooperatives as food business operators have a central role, challenged to maintain standards demanded by customers, government, and international code which are incorporated into their operations activity. The objective of this study was to investigate the role of cooperatives in implementing food safety management at production (farmers) and consumer (exporters, retailers or wholesale) levels. The research employed case studies in prefecture-level cooperatives in Japan. Data were collected with a diagnostic tool for evaluation of food safety management systems (FSMS) on farms and traders and semistructured interviews with safety assurance managers of the cooperatives. Thirty mandarin orange farms, two traders, one processing company and one exporter association were evaluated. The findings indicate that cooperatives have the double responsibility in managing quality and safety in the food chain. They are responsible for operational decisions taken by farmers during cultivation period. At the same time, they make the tactical decision concerning of quality and safety requirements between customers, and farmers, including selling the products. Hierarchical relationships farmers with cooperatives and customers with cooperatives show the good level in operation of control activities (score 2). Therefore, this study useful for assist quality assurance system into the food industry and agriculture sector in Japan.

Keywords: Agricultural, Cooperatives, Food safety management systems

Keywords: Agricultural, Cooperatives, Food Safety Management Systems

FOOD SECURITY AND AGRICULTURAL POLLUTION IN SOUTH ASIA EMERGING NEEDS FOR RESEARCH, POLICY, AND TRAINING

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ABSTRACT

South Asia is blessed with fertile soil, plenty of water resources, and excellent weather to grow food to feed the growing population. At the same time, a large percentage of children under the age of five suffer from some form of chronic malnutrition in South Asia. Worldwide, today, more than one billion people out of a total population of about 7 billion lack access to safe drinking water. More than 2.5 billion people in the world do not have access to good sanitation systems to avoid water borne diseases. Several thousand children die every day from water born diseases. The major question for the scientific and academic community is what needs to be done to reverse these trends, bring food and water security to all the living things on the planet including humans, animals, plants, and rest of fauna and flora in larger ecosystems? What are the emerging research, training, policy, and economic needs for food and water security?

In South Asia, despite many challenges, the surface and groundwater resources are adequate to meet growing irrigation development needs through the year 2050 if farmers adopt and implement innovative water management practices. Agriculture is far the largest consumer of water resources (about 71%) whereas about 20% is used by the industry and the remaining 9% is consumed for domestic and municipal uses. The intensification of agriculture has led to increased use of water for irrigation and agricultural chemicals to produce more food on the same land. Environmental impacts of irrigation and the use of pesticides and fertilizers on soil and water pollution and human health have become a source of major concern for the society. Much of the untreated municipal and industrial wastewater is also flowing directly into rivers and groundwater systems in many of the countries in South Asia. Poor environmental practices and lack of desire to implement local environmental regulations are the main causes for this dilemma. Water quality problems from agriculture and industry, especially linked to water borne diseases and human/animal health, should be the focus of major research and capacity building efforts in the 21st century. If we did not increase research and training efforts in this area, society is likely to face many unknown water borne diseases affecting human health, especially the pathways of migration from water or food to humans. At the same time there is a serious need to revise our current educational curricula at MS and PhD levels to include advanced topics on environmental quality/chemistry, environmental regulations, water policy and marketing, and international water conflicts. This will require international collaborations and partnerships between leading global institutions to solve complex environmental quality issues by developing joint research projects. Therefore, objective of this paper is to share results of studies conducted on effects of agriculture on water quality and present emerging research priorities and curriculum needs on soil and water pollution problems from intensification of agriculture and assuring food security for the growing population in South Asia.

DIVERSIFICATION OF AGRICULTURE FOR FOOD, NUTRITION AND ENVIRONMENTAL SECURITY

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ABSTRACT

Agricultural diversification can be described in terms of the shift from the regional dominance of one crop towards the production of a large number of crops to meet the increasing demand of those crops. It can also be described as the economic development of non agricultural activities (Start, 2001). The process of diversification can be classified into horizontal, vertical, temporal and spatial diversification. *Horizontal diversification* can be referred to as that form of diversification wherein farmers diversify their agricultural activities in order to either stabilize or increase their income or both. It can either take the form of shift from subsistence farming to commercial farming or the shift from low value food crops to high value crops. *Vertical Diversification* refers to the farmers' access to non-farm income, i.e. the income from non agricultural sources (Haque, 1996). The crop diversification has emerged an important alternative to attain the objectives of output growth, employment generation and natural resources sustainability in the developing countries. The recent experience in Asia, particularly southeast Asia, Middle East and North Africa indicates that policy makers and planners are increasingly focusing on crop diversification to promote agricultural development. Green revolution led to crop specialization with heavy use of inputs including fertilizers, pesticides and water with more emphasis on more production and benefits but contrary deteriorates our natural resources, soil fertility, biodiversity and enhances pollution with increased global warming . This necessitates crop diversification just to reverse the adverse impacts of green revolution. Recent agro-technologies like new crop varieties, precision nutrient, water and pest management are available that help enormously to take up intensive cropping with high level of crop diversification. The diversification of agriculture will help to Food and nutritional security and poverty alleviation, Natural resource management for sustainable agricultural development, and agricultural Planning: an Area Approach. The number of indicators like , productivity of the system, production efficiency of the system, land use efficiency, energy use and energy production, water use productivity, nutrient use productivity, Profitability, economic efficiency, B: C ratio, stability/sustainability, employment generation, soil fertility trend, and natural weed and pest management.

Rice-wheat system is the most important food production system of India particularly of Indo-Gangetic plains of India but over exploitation of land and water resources as well as its mono-cropping has declined its factor productivity. Further, increasing trend of annual income and awareness the dietary habit has changed and more multi nutritious food, fruits, vegetables etc have increased in the food. This trend forced to farmers cum scientist to look for more diversified agriculture that may fulfill the need of masses. Therefore the number of more profitable and high energy cropping systems has emerged and may

replace to prevalent rice-wheat system. Similarly the many new more profitable cropping systems are now available for different agro climatic zones of India. Maize-potato-sunflower, rice-wheat-moong, rice-wheat-maize, rice-maize-cowpea, rice-potato-onion, maize-potato-onion, groundnut-potato-bajra (Fodder) are some of the important cropping systems that may replace to rice –wheat system in whole Indo-Gangetic plains of India to support food and nutritional security of the nation. Besides, these diversified cropping systems will not only sustain the soil and water resources but also make green environment for safe and secure human life. However the crop diversification requires proper site specific evaluation before adoption of substitute crops, resources, enterprises etc. over existing ones. Over all it's proven that crop diversification is a need of hour for not only for food and nutritional security but also for sustainable development of the countries

Keywords: Cropping Systems, Diversification, Nutrition, Profitability, Security and Sustainability

**EFFECT OF THIDIAZURON AND GIBBERELLIN ON PINEAPPLE APICAL BUD
INDUCTION (*Ananas comosus* L. Merr.) EX-VITRO**

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ABSTRACT

Pineapple is one of Indonesia's flagship commodities and mainstay of Indonesian fruit exports. . Hence needs serious handling on the provision of seeds. The aim of this research is to know the combination of Thidiazuron and Gibberellin on shoot induction on pineapple seed (*Ananas comosus* L. Merr.). Randomized Complete Block Design Factorial with 2 factors and 3 replications were applied. The first factor was the Thidiazuron concentration consisting dari T0 (0 mg/l), T1 (1 mg/l), T2 (2 mg/l), dan T3 (3 mg/l), the second was Gibberellin concentrations consisting G0 (0 mg/l), G1 (1 mg/l), G2 (2 mg/l) and G3 (3 mg/l). ZPT application is done by sprinkling on apical buds 5 ml per plant and 3 times [8, 13 and 16 weeks after planting]. The results showed that the combination of Thidiazuron and Gibberellin can induce the appearance of shoots emerged symptoms was only 9 out of 16. T1G3 [1 mg/l Thidiazuron - 3 mg/l Gibberellin] , T2G0 [2 mg/l Thidiazuron - 0 mg/l Gibberellin] and T3G0 [3 mg/l Thidiazuron - 0 mg/l Gibberellin] are faster to induce the emerge of shoots than other treatments. T1G3 [1 mg/l Thidiazuron - 3 mg/l Gibberellin] and T2G0 [2 mg/l Thidiazuron - 0 mg/l Gibberellin] afford of 40-50% apical shoots with 1-3 shoots per plant and takes 38-80 days after the first application.

Keywords: Pineapple, Apical Shoot Induction, Ex-vitro, Thidiazuron, Gibberellin

**YIELD AND YIELD COMPONENTS OF SESAME (*Sesamum Indcum L.*) AS
INFLUENCED BY SOWING DATE AND INTRA-ROW SPACING IN YOLA, NORTH-
EASTERN NIGERIA**

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ABSTRACT

Sesame (*Sesamum indicum L.*) is an important oilseed crop grown in many tropical areas of the world including Nigeria. However, average yield as obtained by local farmers in Nigeria has been low, due mainly to lack of adequate information on the appropriate sowing date and optimum plant population available to farmers. Field experiments were conducted in Yola north- eastern Nigeria to evaluate the effects of sowing dates and intra- row spacing on yield and yield components of sesame. The treatments consisted of five sowing dates as main plot treatment and six intra-row spacing as sub- plot treatments in a split plot design. Data were collected on number of branches per plant, number of capsules per plant, seed yield per plant, 1000 seed weight and total yield per hectare. The data were subjected to Analysis of Variance (ANOVA) and significant means were separated using Duncan's Multiple Range Test (DMRT). The results showed that sesame sown on 31st July performed better in all the parameters considered while delaying sowing to 11th September in Yola resulted in significant yield lost and sesame sown at 10cm intra-row spacing giving a population density of 666,666 plants/ha resulted in the highest seed yield. The interaction between July 31st sowing and 10cm intra-row spacing gave the highest yield of 1429.58kg/ha and least yield was from 11th September at 35cm intra- row spacing (39.63kg/ha). It is there for recommended that sesame farmers in Yola should sow their crop around 31st July at a spacing of 10cm intra-row for maximum yield.

Keywords: Intra-Row, Population, Sesame, Sowing Date, Yola

ISOLATION AND CHARACTERIZATION OF YEASTS FROM LOCALLY FERMENTED FOODS

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ABSTRACT

This study was focused on isolation of different strains of yeasts which are prospective to be utilized in various industries from locally fermented foods. Altogether 24 yeast isolates were obtained from fermented fruits and vegetables (banana, cabbage, grapes, lime and mango), pudding, bee honey, toddy and fermented fish samples. Characterization of the yeasts using several biochemical tests (urease, catalase, liquid carbon and nitrogen assimilation and sugar fermentation tests) revealed that this pool was composed with yeast strains belong to genera of *Saccharomyces*, *Kluyveromyces*, *Candida*, *Pseudozyma*, *Cryptococcus*, *Rhodotorula* and *Debaryomyces*. Molecular biological studies authenticated that Y071 to be *Starmerella bombicola* which is industrially beneficial as a bio-surfactant. The other beneficial yeasts forecast in this study are expected to be screened using molecular biological methods to utilize them in industrial applications. The most effective lactose fermenters (33% of the pool) were identified as the viable candidates for bioethanol production and for manufacturing fermented dairy products for lactose intolerant people. Yeasts with highest biomass production were suggested as the best viable candidates for industrial SCP production using whey, the major byproduct of dairy industry. The five thermo-tolerant yeasts (Y55, Y57, Y58, Y59 and Y70) and Y069 which was optimally active under 100C were recognized as suitable for industrial applications. The 23 isolates tolerant for high osmotic pressure conditions were identified as potential strains to be used in highly concentrated food products. Sugarcane juice was recognized as a possible media for the cultivation of these yeasts under industrial settings.

Keywords: Yeasts, Isolation, Characterization, Fermented Foods, SCP

EXTRACTION OF GELATIN FROM REX RABBIT SKIN AND THE APPLICATION IN YOGHURT

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ABSTRACT

The purposes of this study were to understand the interaction and influence of acetic acid concentration and soaking time to obtain the best treatment in production of gelatin and determine the effectiveness of Rex rabbit skin gelatin in yoghurt.

Randomized Block Design (RAK) factorial was used. First step was the extraction Rex rabbit skin gelatin by using two factors. A acetic acid concentration (0%, 1%, 3%, 5%) and soaking time (24 hours and 48 hours). The parameters observed were yield, moisture content, ash content, protein content, pH, viscosity, gel strength test and Scanning Electron Microstructure (SEM). The best treatment of Rex rabbit skin gelatin by De Garmo test is T1A3 (3% of acetic acid for 24 hours) at yield of 8.26%, water content of 6.62%, ash content of 1.5%, protein content of 70.3%, pH of 4.88, viscosity of 11,17cP and gel strength of 187 Bloom grams.

Second step was application of the best treatment of Rex rabbit skin gelatin compared commercial gelatin in yoghurt. The parameters observed protein content, pH, viscosity and gel strength test. The result showed that protein content, pH, viscosity and gel strength test of yoghurt with the addition of gelatin rabbit skin Rex the same as commercial gelatin

Keywords: Gelatin, Rex Rabbit skin, Acetic acid, Soaking time, Yoghurt

BIOCHEMICAL CHARACTERS, KINETIC REACTION, AND PURIFICATION OF CHITINASE ENZYME OF 3 SPECIES OF *Vibrio* SP. BACTERIA

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ABSTRACT

Despite the significance of *Vibrio* sp. to prawn diseases, it has been reported that chitinolytic enzymes may be isolated from this group of bacteria (*Vibrio alginolyticus*, *V. fluvialis* and *V. harveyii*). However, the information about this enzyme's characteristics remains limited. This research aimed: i) to characterize chitinases isolated from the three *Vibrio* sp. species; ii) to partially purify the enzymes by subsequent treatments with saturated ammonium sulphate precipitation and separation process using Sephadex G-75 column chromatography by means of electrophoresis and immunoblotting techniques.

This research was conducted within two experiments. The first experiment assessed chitinase enzyme activities of the above-mentioned bacteria: a) at various levels of pH (6; 6.5; 7; 7.5; 8; and 8.5); b) of various incubation temperatures (30°C; 35°C; 40°C; 45°C; and 50°C); c) in the incubation period of 30; 60; 90; 120; 150; and 180 minutes; and d) to determine Michaelis-Menten (K_M) and V_{maks} . The second experiment evaluated the enzyme specification, employing dot blot and western blot techniques using a monoclonal antibody chitinase.

The results revealed that the maximum level of chitinolytic activity varied across different species. *Vibrio alginolyticus* showed a maximum activity at pH of 7.5, at 35°C, and in 90 minutes. The values of *V. fluvialis* were pH of 7.0, 45°C, and 120 minutes. As for *V. harveyii*, the values were pH of 7.0, 40°C, and 90 minutes. Michaelis-Menten (K_M) was 7,6216 $\mu\text{mol/mL}$ and V_{maks} was 0,0657 $\mu\text{mol/minutes}$. Immunoblotting assessment has shown chitinases with the molecular weights of 62.5 kDa and 58 kDa.

Keywords: Biochemistry Characters, Kinetic Reaction, Purification, Chitinase Enzyme, *Vibrio* Sp. Bacteria

THE EFFECT OF ONION (*Allium cepa*) ON LIPID OXIDATION OF COOKED PORK SAUSAGES

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ABSTRACT

The objective of this work was to suppress the lipid oxidation of meat products using antioxidant effect of onion (*Allium cepa*). Total phenolic content (TPC) of onion water extraction (OWE), onion ethanol extraction (OEE) and commercial onion powder (OP) were analyzed using ISO garlic standards. Different concentrations of OWE (0.1%, 0.2%, 0.3%, 0.4%), OEE (0.07%, 0.13%, 0.2%, 0.28% and 0.34%), OP (0.05%, 0.1%, 0.15%, 0.2% and 0.25%) and butylated hydroxyl toluene (BHT, 0.01%) were incorporated in meat model systems and oxidation was measured using 2-thiobarbituric acid-reactive substances (TBARS) throughout the 5 days(d) of storage under refrigeration. Oxidation of three treatments of OP (0.25%, T1), BHT (0.01%, T2) and control (T3) were measured by TBARS. OP exhibited the highest TPC ($P < 0.05$). Meat model system containing OP (0.25%) showed the lowest TBARS value ($P < 0.05$) and the highest taste, texture and overall acceptance exceptionally the color attribute. OP, as a natural antioxidant was highly effective over synthetic antioxidant, suppressing the lipid oxidation in cooked pork sausages.

Keywords: Onion, Extraction, Lipid Oxidation, Antioxidant

**SHORT RUN AND LONG RUN SUPPLY ELASTICITY OF SHALLOT
AT NORTH SUMATERA PROVINCE**

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ABSTRACT

Shallot is a food commodity which has high nutritional value and useful as natural food flavoring. Production of shallot in North Sumatera cannot fulfill the demand for it, this leads to increase in price of shallot. From its producer's point of view, higher price has motivated its farmers to increase the production and optimize the use of production factors. The objective of the research was to analyze some factors which influenced the supply of shallot and the elasticity of supply the price of shallot in North Sumatera. The data were secondary data with time series (monthly data in 5 years: 2010-2014) and analyzed by using Nerlove partial adjustment model and multiple linear regression equation with the estimation technique of Ordinary Least Square (OLS). The result of the analysis showed that the area of shallot harvesting, the area of shallot planting, the price of garlic, and the price of TSP fertilizer had positive influence on the supply of shallot, while the price of shallot and the supply of shallot in the previous period had negative influence on the price of shallot in North Sumatera. The supply of shallot on its price in North Sumatera was elastic, either in the short term or in the long one.

Keywords: Shallot, Price, Short Run Elasticity, Long Run Elasticity

**VALUE ADDITION OPTIONS FOR NON-TIMBER BASED FOREST PRODUCTS
TOWARDS LIVELIHOOD IMPROVEMENT IN TRIBALS: AN INDIAN
PROSPECTIVE**

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ABSTRACT

Non-timber forest products (NTFPs) generally refer to all biological resources extracted from forest for human use other than timbers. Now a days, demand of forest based products is getting accelerated momentum in the international scenario. Several NTFPs such as Mahua, Chironji, Tamarind, Sal leaves and seeds, Neem seeds, Amla, Bahada, Tendu, Honey, Jamun, etc., are the most economical valued items available in the tribal areas of Chhattisgarh, Madhya Pradesh, Bihar, Jharkhand, Odisha and some other states in India. These forest products are associated with numerous health promoting benefits as they have potential medicinal and nutritional properties such as antioxidant, anti-microbial, anti-HIV, neuro-protective, cardio-protective and so on. These NTFPs are basics to sustenance and livelihood for tribals. Therefore lack of sustainable livelihood opportunities for tribal community is one of the principal causes of their backwardness as compared with other social groups in the various states in India. There is need of livelihood generating activities based on locally available resources or raw materials in a cost effective manner so that gainful employment opportunities could be created at the door-steps of tribal community. This paper review critically the livelihood generating options through value addition of non- timber forest resources to various health food products and dissemination of such suitable technology in tribal area for their social and economic improvement.

Keywords: NTFPs, Livelihood, Value addition, Forest Use, Health food

KANNELIYA FOREST-A BIODIVERSITY HOT SPOT

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ABSTRACT

Kanneliya forest is situated 35 kilometers North-West of Galle district. This is a wet zone forest which has a surprisingly high biodiversity. It is well visited by tourists and it is said to be a haven for people who are interested in ecotourism. This forest is called as KDN reserve as it covers Kanneliya, Dediyaigala and Nakiyadeniya. This reserve was designated a biosphere reserve by UNESCO in 2004. The whole forest covers 25000 acres and is becoming a very fascinating tourist hot spot. It is a catchment area for several rivers. The previous reports say that according to UNESCO a total of 319 woody plant species representing 194 genera have been identified. They have found that among the identified genera, 22% are endangered, 27% are vulnerable and 45% are rare. In fact the Kanneliya forest is a forest that has recovered from logging. The logging was done for the hard wood timber manufacture at a place known as Gintota. Thus Kanneliya forest is considered to be a secondary forest as it is reforested after several loggings of timber trees. A similar forest is found in Dambulla where trees have been rescued from human impact and seedlings of trees have been replanted. This is known as Popham arboretum which is situated in the dry zone. It is amazing that the Kanneliya forest, a wet zone forest is found in the dry zone. In fact it is well maintained and well-visited forest by tourists and members of the ecotourism foundation. Some trees which are said to be critically endangered by the International Union for the Conservation of Natural resources are found in this forest. The Kanneliya forest is not only a place of high biodiversity or tourism but also a naturally maintained treasure for people who are interested in ecotourism. People who enjoy water sport can certainly have a marvelous experience in this forest.

Keywords: Kanneliya, Ecotourism, Forest

EFFECT OF DESICCANTS AND PACKAGING MATERIAL ON SEED VIGOUR AND VIABILITY DURING STORAGE OF SOYBEAN (*Glycine Max L.*) MERRILL. UNDER COASTAL ENVIRONMENT

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ABSTRACT

Seeds are characterized by rapid deterioration during storage under hot and humid coastal environment. Physiological changes that occur in seeds during storage are manifested as reduction in seedling vigour and percentage germination. This study aimed at prolonging the seed longevity of soybean, world's most important seed legume also known as a 'miracle crop' with over 40% protein and 20% oil through packaging materials with or without desiccants. Each 10 kilograms of soybean seeds treated with Vitavax 200 (2g/kg of seed) were stored with or without desiccants viz., Calcium Chloride @ 10 g / kg of seeds, Silica gel @ 10 g / kg of seeds and 'Zeolites' drying beads @ 35 g / kg of seeds, packed in two different containers viz., Cloth bag and Super grain bag and kept under ambient conditions of coastal environment of Karaikal district, South India. Seed samples were drawn from storage at interval of three months and tested for seed viability and seedling vigour upto nine months. At nine months of storage, seeds stored in Super grain bags registered 80 per cent germination as against 43 per cent in cloth bags, with or without desiccants. In addition, the loss in seed vigour due to ageing was only 12 per cent in Super grain bags as compared to 83 per cent in cloth bags indicated that Super grain bag has the potential to effectively contain the influence of environment on seeds stored. Hence, it is suggested that the vigour and viability of soybean seeds could be very well prolonged by storing in Super grain bag instead of cloth bags under coastal environment.

Keywords: Soybean, Seed Storage, Desiccants, Containers, Vigour, Viability

**EFFECT OF ELEVATED TEMPERATURE ON WEED SEED GERMINATION IN
SOIL SEED BANK OF PADDY FIELDS**

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ABSTRACT

Temperature is a one factor that governs seed germination. Scientists believe that with increasing temperatures weed problems are increasing. A pot experiment was conducted employing Complete Randomized Design to study how weed seeds are germinated in paddy soil seed bank in 2015/16 Maha season. Pots were filled with top soils up to 12cm and kept at 04 different temperatures namely 27°C, 30°C, 35°C and 40°C in a controlled growth chamber. Relative humidity of the growth chamber was maintained at 80%. Seedling counts were recorded at 10 days intervals up to one month. Results revealed that Counts of Seedling Germinated (CSG) of all types of weeds (Grasses, Sedges and Broadleaves) showed a significant increment at elevated temperature of 35°C. The CSG of sedges was not significantly increased at 35°C. But the CSG of grasses and broadleaves types of weeds showed a significant increment at elevated temperature of 35°C. Beyond 35°C CSG showed a significant decline in all 03 types of weeds. Elevated temperature up to 35°C causes significant increment in count of seedling germinated and beyond 35°C it causes significant decline in count of seedling germinated in tested paddy soils under 80% RH level. There is a potential of increasing populations of weed species like *Echinochloa crus-galli*, *Leptochloa chinensi*, *Lindernia rotundifolia* and *Monochoria vaginalis* in rice growing fields under elevated temperatures.

Keywords: Elevated Temperature, Germination, Soil Seed-Bank

**STUDY ON THE LEVEL OF SOIL CONTAMINATION DUE TO SALINE WATER
INTRUSION AND SUITABLE LAND RECLAMATION PROCESS IN SELECTED
AREAS IN KILINOCCHI DISTRICT, SRI LANKA**

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ABSTRACT

A bund was reconstructed to avoid the salt-water intrusion during the high tide period in three villages namely Kariyalainagapaduvan, Pallavarayankaddu, and Kiranchi in killinochchi during 2015 to 2016 in order to avoid costal salinity by UNDP. A series of soil survey was conducted to study the level of soil contamination due to saline water intrusion to analysis the degree of soil contamination and propose potential measures for land reclamation process in the affected area. Soil samples were collected twice form 150 farmers' fields in four different depths prior and after completion of bund construction. Electrical Conductivity and pH of the samples were analyzed. The degree of contamination was calibrated and the affected areas were categorized and mapped. The Electrical Conductivity had varied trend across the depth. The pH value of the soil samples showed considerable variation toward the acidic condition. Number of measures recommended to reclaim the affected soil into productive are introducing tolerant varieties, crop rotation, addition of organic matters, addition of liming and establishing of drainage channel to keep the soil without the water logging condition .A filed demonstration was also carried out with saline tolerant rice verity (BG 369) and thus produced seed were distributed to the farmers of the affected areas for lateral spread.

Keywords: Costal Salinity, Salt Water Intrusion, Land Reclamation

**DIVERSITY OF MACROFUNGAL IN MOIST TEMPERATE FOREST OF LORE
LINDU NATIONAL PARK CENTRAL SULAWESI INDONESIA**

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ABSTRACT

Lore Lindu National Park is one of the most important protected area in Central Sulawesi, Indonesia. The plant biodiversity of this region has been studied earlier by several researchers, but for the fungus diversity. Macrofungi are a group of fungi which have a macroscopic fruiting body size. Further, the main objective of this study was to know diversity of macrofungi along elevation gradients in Lore Lindu National Park, Central Sulawesi, Indonesia. The present study was carried out in different moist temperate forests of Lore Lindu National Park, Central Sulawesi, Indonesia. We collected fruiting bodies in the park along an elevation gradient; <1000 m above sea level (asl), 1000 – 2000 m asl and >2000 m asl. As a result of an extensive field survey and microscopic study in laboratory, a total number of 232 species of macrofungi were identified from all study sites. *Marasmius* spp. was found to be abundant in their occurrence. The species richness increased with increasing altitude.

Keywords: Biodiversity, Macrofungi, Moist Temperate Forest, Lore Lindu National Park, Altitude

**POSTER
PRESENTATIONS**

HANDLING AND DISPOSAL OF AGRICULTURAL CHEMICALS ON A2 FARMS IN CHIRUMHANZU DISTRICT

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ABSTRACT

In 2000 the Government of Zimbabwe undertook a massive land redistribution programme under its black economic empowerment policy where white-owned farms were seized and sub-dividing into smaller A1 and A2 models and redistributed to landless black majority. However, most of the land beneficiaries were ill-resourced and ill-trained to use the land in an ecologically friendly manner. This paper investigated how newly resettled farmers handled and disposed agricultural chemicals on the acquired A2 farms. In-depth interviews and observation were the main data collection instruments. The study involved farm employees on A2 farms that use agro-chemicals to enhance farm productivity. A total of 150 respondents participated in the study. The findings of this study indicated that despite the availability of statutory provisions on handling and disposal of agricultural chemicals, there is rampant mismanagement of environmentally unfriendly chemicals on the farms. Although most of the employees on the farms are literate, they find it difficult to understand the technical jargon used on these chemical labels. The study also established that agricultural chemicals are vital in sustaining Zimbabwe's agricultural sector in terms of food security, foreign exchange generation, employment and provision of raw material for the manufacturing sector. On the other hand mismanagement of these chemicals can have adverse effects on human beings and the environment. It is therefore, important for farmers and their employees to be trained on personal, public health and environmental implications of poor management of agricultural chemicals. The paper recommends that the Zimbabwean Government should adopt a multi-sectoral campaigns strategy against mismanagement of agricultural chemicals. Use of electronic and print media of communication through the local languages is also recommended.

Keywords: A2 Farmers, Agricultural Chemicals, Environment, Management, Chirumhanzu District

TOLERANCE OF PHYSIC NUT (*Jatropha curcas* L.) GENOTYPES BASED ON THE DROUGHT STRESS

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ABSTRACT

Jatropha is one of potential plant that has to become an alternative energy source. This study aims to determine the F1 *Jatropha* genotypes tolerance to drought stress based on morphology and first harvest. This research use six *Jatropha* genotypes, that are 5-1-14 (SP8 x SP-16), 6-2-10 (SP8 x SP-38), 7-2-8 (SP-33 x HS-49), 18-1 -14 (SM-35 X-SP-38), IP-3 A, and IP-3 P. Plants were treated on the soil water content of 100%, 70%, and 40% of field capacity. The results showed that drought stress by up to 40% soil moisture content can inhibit the vegetative growth and influence to generative growth. Based on the sensitivity index (IS) test 7.2.8, 18.1.14, IP-3A and IP-3P genotypes grouped on less tolerance, while 5.1.14 and 6.2.10 genotypes grouped on moderate category.

Keywords: Drought Stress, *Jatropha curcas* L., Sensitivity Index, Tolerance

**GENETIC RELATIONSHIPS OF MILK MILK B –HYDROXYBUTYRATE, ACETONE,
FAT TO PROTEIN RATIO AND ENERGY BALANCE IN KOREAN HOLSTEIN
CATTLE**

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ABSTRACT

The objective of this study was to estimate the genetic parameters for milk β -hydroxybutyrate (BHBA), acetone (Ac), fat protein ratio (FPR) and energy balance (EB) and investigate the effect of early lactation FPR and EB predicted using test day records in milk for elevated levels of milk ketone body concentrations. Total 262,940 test-day records collected from Korea Animal Improvement Association (KAIA) during the period of 2012 to 2016 were used in this study. Milk BHBA and Ac concentrations were measured by Fourier transform infrared spectroscopy (FTIR). FPR values were obtained using test day records of fat and protein percentage. EB was calculated based on parity, lactation week, and milk composition data. Elevated milk BHBA and Ac concentrations were observed during the early lactation under the negative energy balance. Milk FPR tends to decrease with the decreasing ketone body concentrations. So FPR and EB can be suggested as potential predictors for risk of hyperketonemia. Genetic parameters, for each parity were estimated by restricted maximum likelihood (REML) procedure based on repeatability model using Wombat program. Heritability estimates for milk BHBA, Ac, EB and FPR were ranged from 0.09 to 0.14, 0.23 to 0.31, 0.19 to 0.52 and 0.16 to 0.42 respectively at 1-4 parities. The overall heritability for BHBA, Ac, EB and FPR were 0.19, 0.28, 0.50 and 0.46 respectively. The heritability estimates of above analyzed traits indicate that the selective breeding may contribute to maintain the milk ketone bodies at optimum level during early lactation.

Keywords: Energy balance, Fat protein ratio, Heritability, Repeatability model, Genetic parameters

GWAS FOR SNP MARKERS OF KETOSIS IN HOLSTEIN COWS

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ABSTRACT

The purpose of this study is to conduct genomic analyses of ketosis indicators. Samples for BHBA in both blood(**BBHBA**), milk(**MBHBA**) and acetone from 92 healthy and 30 subclinical ketotic female cows between 5 and 20 days in milk. Blood samples were tested with the Precision Xtra meter to obtain BBHBA concentrations. Milk samples were analyzed by FTIR spectroscopy using a CombiFoss™ FT+ system with previously developed calibration equation. Genotyped data was collected using Illumina BovineSNP50K BeadChip panel from 112 cows with 5 to 20 days in milk were analyzed. The number of effective SNPs were 43,552 after quality control tests in total 107 cows. After pruning, Linkage disequilibrium(LD) analysis was estimated up to 1,000 kb apart across the genome, r^2 is 0.11 around 100 kb. The effective population size from SNP data was conducted, the N_e was estimated 313.8 when 55 generations ago. A total of 80 SNPs were identified for ketosis indicator(p -value < 0.5), among of them the number of 17 SNPs were identified in BHBA with highly significance(p -value < 0.1). Therefore, this study suggests that in order to accurate Ketosis screening, BHBA in GWAS combine with treatments in early lactation can be used. A SNP named rs110923951 located on BTA13 was observed in acetone and BBHBA which related with Somatic cell counts in cow. This study indicates that the ketosis in Holstein might be influenced by certain genomic regions and a selection on these traits using them could reduce the ketosis incidence in early lactation stage. The SNPs obtained in this study will provide a basic resource for identification of candidate gene and QTL about Ketosis and also application in Holstein cow breeding program.

Keywords: Dairy cattle, Holstein, Ketosis, GWAS, SNP Markers

GENETIC IMPROVEMENT TREND FOR GGP BREED

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ABSTRACT

This study was carried out to investigate the genetic improvement trend using genetic parameters of the productive and reproductive traits in the ongoing GGP group. The production records of 10,502 pigs and the reproduction records of 4,200 litter from Duroc, Landrace and Yorkshire collected from 2014 to 2017 were used. The production traits included days to 90 kg, average daily gain and back fat thickness measured with ultrasound device (piglog 105), and reproductive traits were total litter size and number of born alive. The model for reproductive traits included breed and farrowing-year-month and random additive genetic effects and the model for production traits included breed, birth-year-month, sex and maternal parity and random additive genetic effect of animal. The coefficient of inbreeding was increase until the third quarter of 2015. Prior to the third quarter of 2015, planned mating could not proceed and it was considered that the inbreeding coefficient decreased due to planned interbreeding considering the relatives. Reproductive traits showed a tendency to decrease before the third quarter of 2015, but increased through planned crossbreeding starting in the third quarter of the year. Genetic improvement was achieved through planned crosses starting from the third quarter of 2015. In the second quarter of 2016, daily gain of body weight and day of reaching 90kg were not improved, due to decrease in individuals born in the second quarter of 2016. Prior to the third quarter of 2015, the backfat thickness remained unchanged, but it was maintained through planed inbreeding. Therefore, genetic ability can be improved through planned inbreeding through strong selection.

Keywords: Genetic Improvement Trend, GGP, Productive Traits, Reproductive Traits , Coefficient of Inbreeding

**A WHOLE GENOME ASSOCIATION ANALYSIS FOR 305MILK IN KOREAN
HOLSTEIN COW**

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ABSTRACT

Genome-wide association studies (GWAS) based on SNP genotyping technologies open a broad pathway for exploring genes associated with milk production traits in dairy cattle. GWAS based on the premise that the diversity of traits is responsible for gene differences in individuals, and when genetic differences exist between measured traits and individuals, they are most significantly involved in transgene expression among different individuals. The purpose of this study was to identify single nucleotide polymorphisms (SNP) associated with milk production traits and find the significance using SNPs in Korean Holstein cattle. Milk samples were collected from 627 cows with 305 days in milk (DIM). Those samples were genotyped using the Illumina BovineSNP50K BeadChip. Association analysis was done using PLINK 1.07 software package. The quality control was analyzed with 43754 SNPs and 592 cows through missing per-individual, missing per-marker, minor allele frequency and threshold Hardy-Weinberg equilibrium. A total 8 SNPs were significant at $P < 0.05$ level. It suggests that, those 8 SNPs effect the milk production. According to that, this analysis concluded, SNPs and quantitative trait loci affecting milk yield can be used to estimate the capacity of milk production in dairy Holstein cows without waiting for pregnancy. So, selective breeding programs can be performed to identify high producing dairy cows using GWAS.

Keywords: Genome-Wide Association Studies, SNP, Milk Yield, PLINK, Korean Holstein Cattle

**ADAPTABILITY TESTING OF SHORT DURATION CLUSTER ONION (*Allium Cepa*
L.) CULTIVARS IN SRI LANKA**

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ABSTRACT

Onion is the most important condiment all over the world. Cluster onion plays a major role in national onion production in Sri Lanka. World climate changes open a way for development of short duration crops to face future challenges of production. Availability of short duration onion varieties and cultivars are limited in Sri Lanka. This study aims at testing adaptability of short duration cluster onion cultivars to future releasing for major onion growing areas of Sri Lanka. Four accessions named ACA 13, ACA 26, ACA 56 and ACA 57 with two cultivars named Jaffna Local, Thelulla Selection and Thinnavelly Red were evaluated in four seasons from 2014/15 *maha* to 2016 *yala* at Kalpitiya, Thirunelveli, Kilinochchi and Aralaganwila Research Stations. Treatments were arranged in Randomized Complete Block Design with three replications. Total bulb yield was evaluated for adaptability and stability parameters. Results revealed that adaptability changed with seasonal wise and ACA 13 was the most adaptable accessions. ACA 56 got comparatively higher average yield than the variety Thinnavelly Red and farmer cultivars. All the accessions got maturity before 75 days after planting and ACA 13 mature before 40 days after planting at Killinochchi.

Keywords: Adaptability, Onion, Short Duration

**THE GROWTH OF APPLE SEEDS WITH IN VITRO BY THE ADDITION OF
Thidiazuron AND *Naphthalene* ACETIC ACID**

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ABSTRACT

Apple is not originally from Indonesia but can adapt and grow primarily in Malang and Batu. East Java is very suitable area for the growth of apple plants based on climate and land area of 72,890.42 hectares (Irawan, 2007). This development would require seedlings in large quantities and types of variety in order to adapt to different conditions. These requirements can be achieved using in vitro techniques. The first stage for application of in vitro techniques is shoot and callus induction. The aim of the research is to study the embryo growth of some apple cultivars with the addition of TDZ and NAA medium. The design used was Factorial Random Block Design with 2 factors and repeated three times. Factor 1 was 6 apple cultivars and factor 2 was 4 combination of TDZ and NAA. Eksplan used was the seed of a ripe apple. The result shows that the emergence of radikula in Rome Beauty and Manalagi cultivar are longer than 4 other cultivars. The addition of TDZ and NAA can accelerate the emergence of radikula in Rome Beauty and Manalagi cultivars while at 4 other cultivars are no different. Therefore, the addition of TDZ and NAA increases the number of buds from 1.03 to 3.31, but decreases plant height, root number and root length.

Keywords: In Vitro, Apple, TDZ, NAA

**THE GROWING STOCK AND SUSTAINABLE UTILIZATION OF WHITE BAMBOO
(*Bambusa membranacea*) AND COMMUNITY FOREST MANAGEMENT IN THE
NATURAL MIXED DECIDUOUS FOREST WITH TEAK IN THAILAND: A CASE
STUDY OF HUAY MAE HIN COMMUNITY FOREST, NGAO DISTRICT, LAMPANG
PROVINCE**

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ABSTRACT

The Growing Stock and Sustainable Utilization of White Bamboo (*Bambusa membranacea*) and Community Forest Management were studied at Huay Mae Hin Community Forest, locating in the natural Mixed Deciduous Forest with Teak of Mae Nam Ngao Watershed. It was used a Stratified Sampling Method of 308 hectares in order to find the growing stock. There were questionnaires of 126 households and there were in-depth interviews with key informants for discovering the bamboo utilization and community forest management. The study showed that the growing stocks consisting of 107,492 clumps and 760,760 culms. The majority 334,796 culms (44.01%) were bamboo at the age over 3-year-old class, followed by the class of the age at 3 years old (163,240 culms, 21.46%), at the age of 2 years old (143,528 culms, 18.87%) and bamboo aged at 1 year old (119,196 culms, 15.67%) respectively. Approximately 43,696 culms were harvested or 5.74 % of the growing stock was utilized. The relationship between the bamboo utilization and the growing stock in the community forest was found significantly correlated. The community had the strength in community forest organization, effective rules and regulations, forest activities and people's participation. The opportunities were supported from external organization and joint network. However, there were also the weaknesses in the community forest management plan, the limited opportunities of people's participation in decision-marking, the lack of youth participation and the violation of people in the community. The violation of people outside of the community was also the threat of community forest management.

Keywords: Growing Stock, Utilization, *Bambusa membranacea*, Community Forest Management, Huay Mae Hin Community Forest

**ETHEPHON EVALUATION FOR EARLY SPROUTING OF YAM (*Dioscorea alata* L.)
TUBERS**

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ABSTRACT

This study was conducted to determine the effect of ethephon on the sprouting behavior of VU-2 yam tubers and to establish the most effective concentration and time of application of ethephon for early sprouting of yam tubers. Ethephon concentration of 500 mg/L was more effective when applied at one month after harvest (OMAH) in promoting early and high percentage and long sprouts while delayed application (i.e. two months after harvest) resulted to delayed sprouting, low sprouting incidence and production of short sprouts. Also, tubers applied with 500 mg/L ethephon immediately after harvest (IAH) reached 50% sprouting the earliest. The degree of sprouting, shriveling, and decay incidence were not significantly affected by the different concentration and time of application of ethephon.

Keywords: Ethephon Concentration, Sprouting, VU-2, Shriveling

**EVALUATION OF APPLICABILITY OF HEDGE BAMBOO (*Bambusa multiplex*) TO
IRRIGATION CANAL REVETMENT MATERIAL FOR ENVIRONMENTAL
CONSIDERATION**

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ABSTRACT

The objective of this study is to evaluate applicability of hedge bamboo (*Bambusa multiplex*) to irrigation canal revetment material aimed to conserve water quality and ecological system. The absorptive abilities of nitrogen and phosphorus by hedge bamboo were quantified by logistic model described as a function of cumulative temperature. Water tank experiments with various initial concentrations of T-N and T-P were performed to optimize the parameters of logistic model. The experimental results indicated that the absorptive abilities of nitrogen and phosphorus by hedge bamboo changed with time and initial concentration. Using the experimental data, the parameters of logistic model were identified. The changes of absorbed nitrogen and phosphorus could be predicted using this model. Hedge bamboos were trial-introduced as the afforestation and protection materials for irrigation canal slopes. The effects of revetment using hedge bamboos on the water quality and ecological system in the irrigation canal were evaluated by field observation. The results of the field observation indicated that the water quality and biodiversity of the irrigation canal with hedge bamboos were improved compared with the irrigation canal with the artificial revetment.

Keywords: Eco-Friendly Irrigation Facility, Water Quality, Biodiversity, Multi-Function Of Agriculture, Environmental Consideration

**STUDY ON PHYSIOLOGICAL CHARACTERISTICS OF PLANT GERMINATION
DIFFERING IN PHYTATE CONTENT**

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ABSTRACT

Phytate is storage of phosphorus and mineral which is considered that important for seed germination. However, initial studies indicated that some low phytate cultivar has little effect on seed germination. To understand the role of phytate for seed germination, this study will investigate the relationship between phytate and germination in different seed, and reveal the germination physiology in low phytate soybean. The 141 species of plant seeds and spore were collected from the area of Hiroshima prefecture, Japan. Fern spore was grown in the prepared medium and obtained the gametophyte. Gametophytes, spores and seeds were used to analyze the total phosphorus (TP), inorganic phosphorus (IP) and minerals. The soybean seeds (high and low phytate genotype soybean) were planted in vermiculite respectively for the experiment. Phytate content is very different among plant species but cannot be detected phytate in gametophytes and spores. Some species of the same family have shown similar characteristics. The peak of phytase activity in high phytate soybean was 1.7-fold higher than low phytate soybean cultivar. No significant difference of growth state was observed both two genotypes during germination. Phytate exists in various seed types make seed very different, and confirmed that during germination. These results suggested that phytate have the effect on seed formation and improving environmental adaptation, also confirmed that phytate can influence phytase activity during germination.

Keywords: Phosphorus, Phytate, Germination, Phytase, Low-Phytate Cultivar

**DYNAMICS OF AGRICULTURE SYSTEM BASED ON LAND RESOURCES
CONSERVATIONS AROUND LORE LINDU NATIONAL PARK, CENTRAL
SULAWESI, INDONESIA**

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ABSTRACT

The scarcity of land resources due to massive transfers of non-agricultural functions is a major obstacle to the agricultural sector in the fulfillment of people's food. While, the remaining agricultural land has largely decreased its carrying capacity due to the use of high concentrations and doses of chemical fertilizers over a long period continuously. The aim of the study was to determine the dynamics of the agricultural system by the local community of Nokilalaki Sub District which is directly related to Lore Lindu National Park. Two methods were used in this study, consisting of observation on the farming practices, garden forms and interviews on the agriculture system. The number of case informants in this study was 36 people. The results showed that in the early stage of the land clearing process, people in this area generally planted seasonal crops like corn, sweet potatoes, taro, nuts, vegetables and fruit to meet daily consumption and commercial needs. Once people have started to solve their consumption problems, some people start planting annual crops with the main commodities of cocoa and gambel as shade crops that are planted among the annual crops. Furthermore, the community is slowly trying to replace the non-valuable shade crops into commercial crops like hazelnut, avocado and durian, so that the form of mixed garden and simple and complex agroforestry. The changes of agricultural systems that were applied by the community were done based on the increasing of production, the economic value of the commodity, the improvement of the soil fertility and the effectiveness of land resources.

Keywords : Agricultural System, Polyculture, Agroforestry, Land Conservation

**MAPPING AND ANALYZING VALUE CHAIN OF RICE CROP IN AYEYARWADDY
REGION, MYANMAR**

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ABSTRACT

In this paper, we study the mapping and analysis of the value chain of rice crop in Ayeyarwaddy Region, Myanmar. In this region, the issues with respect to the rice value chain are complex and multifaceted. In this perspective, we structure the rice value chain map and describe the socio-demographic characteristics of the value chain actors. Moreover, we determine marketing costs and marketing margins of the various actors and identify the constraints of the actors in the rice value chain. These different characteristics are identified by purposive and simple random sampling methods. We use the descriptive statistics, cost and return analysis, and marketing cost and marketing margin analysis in this study. We find two structures of rice value chain: *farmer, primary collector, miller, wholesaler and retailer*, and *farmer, primary collector, miller, wholesaler and exporter*. More male actors involve in the rice value chain. *Farmers* are the oldest and have the highest working experience, and *exporters* are the most educated among actors in the rice value chain. *Millers* receive highest profit and *farmers* have highest marketing margin in all rice value chains. The constraints mainly faced by the actors are: uneven raining during the production period, labor scarcity and flooding for *farmers*; poor road access and poor paddy quality for *primary collectors*; High transportation costs, low rice quality and limited access to working capital for *millers*; high transportation costs for *wholesalers*; high taxation for *retailers*; and exchange rate fluctuation and product price fluctuation for *exporters*.

Keywords: Mapping, Analyzing, Value Chain, Rice

VIRTUAL PRESENTATIONS

BREWING OF COMPOST TEA WITH LOCALLY AVAILABLE MICROBIAL ENHANCERS: ITS PROPERTIES AND EFFECT ON RED ONION (*Allium cepa*)

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ABSTRACT

Massive utilization of synthetic agrochemicals causes serious health and environmental issues. Increasing public objection on the use of such toxic chemicals creates an interest towards organic farming. Compost tea is a valuable brewed product to manage the nutrients and the pests. This study was carried out to screen out suitable microbial enhancers, an effect of aeration for the production of compost tea and its effect on red onion. Locally available substrates; black gram soaked water, coconut water, rice mill effluent, 1% palmyrah jaggery solution and 1% palmyrah fruit pulp extract were investigated. Aeration has an effect on pH, total soluble solid content, electrical conductivity, culturable bacterial and fungal colony forming units (CFU) of the compost tea. High total culturable bacterial CFU was observed in aerated compost teas with Black gram soaked water (85×10^{10} CFU/ml), jaggery (77.33×10^{10} CFU/ml), palmyrh fruit pulp extract (72.00×10^{10} CFU/ml) compared to non-aerated teas. However compost teas with coconut water (94.00×10^{10} CFU/ml), rice mill effluent (85.00×10^{10} CFU/ml), contained high bacterial CFU than aerated teas. Field study revealed that palmyrah fruit juice (48012.5 kg/ha), black gram soaked water 39762.5 kg/ha, coconut water (39487.5 kg/ha) did not significantly differ in growth and yield of red onion compared to synthetic fertilizer, urea (40375.5 kg/ha) as a control treatment. Therefore compost teas with locally available microbial enhancers are potential alternatives or complements to synthetic fertilizers for enhancement of crop production

Keywords: Compost Extract, Locally Available Substrates, Aeration, Red Onion, Black Gram

BIOLOGICAL CONTROL OF SOUTHERN ROOT KNOT NEMATODE, *Meloidogyne incognita*, ON CUCUMBER

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ABSTRACT

Culture filtrates of fungal bio-control agents viz., *Aspergillus flavus*, *Penicillium chrysogenum* and *Pochonia chlamydospora* have demonstrated nematocidal properties and these fungi could be used as potential bio-control agents against *Meloidogyne incognita* on cucumber. In the present research we examined the use of culture filtrates of three fungal bio-agents alone and in several different combinations *in vitro* and *in planta* green house and field studies using cucumber cultivar “Beith alpha”. *In vitro* study conducted on *M. incognita*, cumulative percent hatch inhibition and J2s mortality reached to 100% over 72 h of incubation in spring, 2012 and 2013 by fungal bio-agent combination viz., *P. chrysogenum* + *P. chlamydospora*. All the fungal bio-control agents significantly suppressed *M. incognita* on cucumber in green house and field trials. The fungal bio-control agent combination viz., *P. chrysogenum* + *P. chlamydospora* had the greatest effects on nematode galling indices, egg masses and adult females per 10 g of cucumber roots and substantially reduced the reproductive factors in both year green house experiments. Field trials conducted under natural field infestation at Dargai, filtrates of the fungal bio-agent combination *P. chrysogenum* + *P. chlamydosporium* reduced the nematode parameters and enhanced the plant growth parameters of cucumber in the spring, 2012 and 2013 years trials with attendant yield increase. These data suggest that filtrates of fungal bio-agents viz., *A. flavus*, *P. chrysogenum* and *P. chlamydospora* could be used alone or in different combinations in an integrated pest management as an effective strategy for *M. incognita*.

Keywords: *Meloidogyne incognita*, Culture Filtrates, *Aspergillus flavus*, *Penicillium*, *Chrysogenum*, *Pochonia chlamydospria*, Cucumber

**GREEN EXTRACTION AND STABILITY STUDY OF ANTIOXIDANT COMPOUNDS
FROM SPICE *Zingiber officinale* RHIZOME: A CONTRIBUTION TO SUSTAINABLE
FOOD SYSTEMS**

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ABSTRACT

Among all the agro-horticultural sectors, spice is one of the booming sector in the Indian agriculture trade which includes production and export of 52 spice types. India has wide production of spices as compared to the post-harvest processing facility. From the ancient times peoples are using spices in their foods as flavouring and colouring material. Indian ayurvedic system gives detailed about health promoting activities of spices which is due to the presence of specific biologically active compounds in it. Extraction and value addition of these bio-actives in a food product enhances its value towards producing sustainable food system. In the present study an attempt has been made to separate antioxidant rich extracts from ginger by using green supercritical fluid extraction (SFE) technology over conventional extraction techniques. Antioxidant rich extract has been used to preserve edible oils which is more prone towards oxidation. Stability study of this ginger extract has been compared with synthetic antioxidants like BHA, BHT and TBHQ. Result of present study revealed that SFE technology has a potential to extract target oriented compounds by differing pressure and temperature above its critical limit. Small scale food and pharmaceutical industries can easily adopt this extraction technique due to its speciality to extract target oriented compounds from the spice materials. Stability study of ginger extracts proves its potential to preserve edible oils which is the base of all lipid based food materials. Excluding TBHQ, ginger extracts gives comparative results with BHA and BHT.

Keywords: *Zingiber officinale*, Antioxidants, Supercritical Fluid Extraction, Edible Oils, Stability Study

**VALUE ADDITION OPTIONS FOR NON-TIMBER BASED FOREST PRODUCTS
TOWARDS LIVELIHOOD IMPROVEMENT IN TRIBALS: AN INDIAN
PROSPECTIVE**

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ABSTRACT

Non-timber forest products (NTFPs) generally refer to all biological resources extracted from forest for human use other than timbers. Now a days, demand of forest based products is getting accelerated momentum in the international scenario. Several NTFPs such as Mahua, Chironji, Tamarind, Sal leaves and seeds, Neem seeds, Amla, Bahada, Tendu, Honey, Jamun, etc., are the most economical valued items available in the tribal areas of Chhattisgarh, Madhya Pradesh, Bihar, Jharkhand, Odisha and some other states in India. These forest products are associated with numerous health promoting benefits as they have potential medicinal and nutritional properties such as antioxidant, anti-microbial, anti-HIV, neuro-protective, cardio-protective and so on. These NTFPs are basics to sustenance and livelihood for tribals. Therefore lack of sustainable livelihood opportunities for tribal community is one of the principal causes of their backwardness as compared with other social groups in the various states in India. There is need of livelihood generating activities based on locally available resources or raw materials in a cost effective manner so that gainful employment opportunities could be created at the door-steps of tribal community. This paper review critically the livelihood generating options through value addition of non- timber forest resources to various health food products and dissemination of such suitable technology in tribal area for their social and economic improvement.

Keywords: NTFPs, Livelihood, Value Addition, Forest Use, Health Food

CHALLENGES IN IMPLEMENTING EMISSION MITIGATION TECHNOLOGIES IN INDONESIA

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ABSTRACT

Emission reduction in agricultural sectors holds the main role in reducing non-CO₂ emission. In Indonesia, agricultural sector becomes the third largest GHG emitters, far behind Land Use Change and Forestry (LUCF) and energy sector. However, this sector becomes the biggest contributor of non-CO₂ emission and also become the most vulnerable sector suffered by climate change. Indonesian government committed to reduce total emission by 26% from BAU level in 2030 under Nationally Determined Contribution (NDC) and to realize this commitment Indonesia government need to reduce emission from each sector including the agricultural sector. There are several mitigation technologies recommended by UNFCCC which can be implemented such as replacing urea with ammonium sulfate fertilizer, replacing nitrogen fertilizer with multi-content fertilizer, water irrigation management, replacing roughage with concentrate as livestock feed, and building biogas digester. From our Computer General Equilibrium (CGE) simulation, the full implementation of those mitigation technologies will reduce the carbon prices by only 1.5 USD/tCO₂eq in 2030 compared to without any emission mitigation technology implementation which can make the carbon price reach 2.4 USD/tCO₂eq. However, a deeper examination of those mitigation technologies shown that it is a challenging works to fully implement mitigation technologies in the agricultural sector, especially in Indonesia. For example, replacing urea with ammonium sulfate, in fact, double the use of chemical fertilizer and although it can reduce methane emission in paddy rice, this technology also increases the N₂O emission. In this research, we examine each technology and check its compatibility with Indonesia condition and make policy recommendations regarding which policy that can be implemented by Indonesia government.

Keywords: Indonesia, GHG Mitigation, Mitigation Technologies, Non CO₂ Emission

DOES THE REGULAR PHOSPHATE FERTILIZATION AFFECT THE SOIL PHOSPHATE BANK?

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ABSTRACT

Regular application of phosphate (P) fertilizer is known to accumulate in soil creating a soil P bank. Eppawala rock phosphate (ERP) is the major mineral phosphate fertilizer resource in Sri Lanka, which is recommended for perennials such as cinnamon. This study was aimed to investigate the soil P level in fertilized and non-fertilized cinnamon plantations which will allow possible reduction of ERP application and there by utilize this non-renewable phosphate resource in a sustainable manner. Total P (P_{Tot}) and plant available P ($P_{Available}$) were quantified in rhizosphere soil and bulk soil in ten fertilized and ten non-fertilized cinnamon plantations using Murphy and Riley method, 1962. Both P_{Tot} and $P_{Available}$ present in rhizosphere soil of fertilized lands were significantly higher ($p \leq 0.05$) to those of bulk soil which could be due to long term fertilization associated with root zone area. Mean P_{Tot} in rhizosphere and bulk soil in fertilized lands were 649.32 ± 113.24 mg P/ kg soil and 286.29 ± 29.56 mg P/ kg soil, respectively. Mean $P_{Available}$ in rhizosphere and bulk soil in fertilized lands were 12.21 ± 1.29 mg P/ kg soil and 7.83 ± 1.62 mg P/ kg soil, respectively. In non-fertilized lands, only the $P_{Available}$ of the bulk soil (Mean $P_{Available}$ - 6.04 ± 0.74 mg P/ kg soil) were significantly higher ($p \leq 0.05$) than that of the rhizosphere soil (Mean $P_{Available}$ - 3.80 ± 0.65 mg P/ kg soil) as the limited amount of P in rhizosphere is being depleted by the plant uptake. However, P_{Tot} levels among rhizosphere soil (Mean P_{Tot} of 265.26 ± 40.36 mg P/ kg soil) and bulk soil (Mean P_{Tot} of 223.36 ± 26.60 mg P/ kg soil) did not differ significantly. These results lead to the conclusion that a high P content is fixed in rhizosphere soil in most of the fertilized plantations due to the regular fertilization over a long period of time. However, plants can uptake only available P in soil although the total P content is high. Therefore, development of strategies to utilize this valuable resource for improved plant P nutrition can lead to a reduction in the cost of production and sustainable utilization of Eppawala rock phosphate reservoir.

Keywords: Eppawala Rock Phosphate (ERP), Soil P Bank, Available P, Total P

**COMPARISONS OF COMMERCIAL FEEDS FOR CAGE CULTURE OF THE NILE
TILAPIA (*Oreochromis niloticus*) IN THE VOLTA LAKE, GHANA**

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ABSTRACT

Cage fish farming is relatively new but is fast growing in Ghana. However, as elsewhere ensuring the sustainability of the practice depended heavily on a viable feed input. This had become central to the development of cage culture in the country in recent years. Seven commercial fish feeds labelled A, B, C, D, E, F and G were fed to juvenile Nile Tilapia *Oreochromis niloticus* in cages to determine which were the most cost-effective. The performance of each feed was compared using survival, daily growth and final weight gain among others as indicators. After 5 months of culture, an average yield of 46.7kg/m³ was obtained. Survival of stocked fish were not predisposed to any of the feeds ($p < 0.05$) but growth performance was subjective of the quality. Fish harvested compared positively with the protein content and the food conversion ratios. The feed types consistently exhibited superiority in the order: $G > F > D > B$ with no clear distinction between E and A ($p < 0.05$). The unit costs of the feeds were prohibitive within the range GH¢/kg 1.35(US\$0.93) to GH¢/kg 1.8(US\$1.24) relative to 0.78US\$/kg in other jurisdictions. At these prices minimal profits were made by farmers. The results provided evidence for targeting interventions designed to resolve the constraint of high feed cost. The potential of local ingredients - trash fish and offal as materials for feed manufacture in the country needed assessments.

Keywords: Growth Performance Protein/Energy Ratio, F₅-generation, Akosombo

CHALLENGES IN IMPLEMENTING EMISSION MITIGATION TECHNOLOGIES IN INDONESIA

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ABSTRACT

Emission reduction in agricultural sectors holds the main role in reducing non-CO₂ emission. In Indonesia, agricultural sector becomes the third largest GHG emitters, far behind Land Use Change and Forestry (LUCF) and energy sector. However, this sector becomes the biggest contributor of non-CO₂ emission and also become the most vulnerable sector suffered by climate change. Indonesian government committed to reduce total emission by 26% from BAU level in 2030 under Nationally Determined Contribution (NDC) and to realize this commitment Indonesia government need to reduce emission from each sector including the agricultural sector. There are several mitigation technologies recommended by UNFCCC which can be implemented such as replacing urea with ammonium sulfate fertilizer, replacing nitrogen fertilizer with multi-content fertilizer, water irrigation management, replacing roughage with concentrate as livestock feed, and building biogas digester. From our Computer General Equilibrium (CGE) simulation, the full implementation of those mitigation technologies will reduce the carbon prices by only 1.5 USD/tCO₂eq in 2030 compared to without any emission mitigation technology implementation which can make the carbon price reach 2.4 USD/tCO₂eq. However, a deeper examination of those mitigation technologies shown that it is a challenging works to fully implement mitigation technologies in the agricultural sector, especially in Indonesia. For example, replacing urea with ammonium sulfate, in fact, double the use of chemical fertilizer and although it can reduce methane emission in paddy rice, this technology also increases the N₂O emission. In this research, we examine each technology and check its compatibility with Indonesia condition and make policy recommendations regarding which policy that can be implemented by Indonesia government.

Keywords: Indonesia, GHG Mitigation, Mitigation Technologies, Non CO₂ Emission

HONDURAS INDIGENOUS AGRICULTURAL PRACTICES FOR SUSTAINABLE AGROFORESTRY AND SHADE-GROWN COFFEE

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ABSTRACT

As the very identity of indigenous communities is inextricably linked with their lands through collective knowledge of their sky and surroundings, they offer valuable insights that provide a crucial foundation for the development of sustainable agricultural practices. Several Central American indigenous agroforestry systems have been documented, however, among them; the Quesungual System is still a poorly documented system from Western Honduras used by Lenca smallholder farmers, which offers a promising opportunity for the establishment of sustainable agroforestry in Honduras. Due to the system distinctive features, it not only becomes a strategy to address the environmental issues such as soil erosion, depletion of resources and deforestation generated by the slash and burn intensive agriculture; but provides also an alternative to expand the production of environmentally friendly coffee, one that has been diminished by the rise of the sun-grown coffee industry causing a negative effect on the environment, communities and individual farmers. This research, through an overlay analysis of the Honduras Landscape Systems, examines the viability of the Quesungual Lenca traditional agriculture as a sustainable agroforestry system and its potential for the shade-grown coffee sustainable system.

Keywords: Slash and Mulch, Natural Regeneration, Smallholder Agriculture, Sustainable Coffee, Traditional Agroforestry

**IN-VITRO STUDY ON COLONY GROWTH PATTERN OF BANANA PSEUDOSTEM
ROT FUNGI, *Marasmiellus* spp WITH *A.vera* LEAF POWDER EXTRACTS**

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ABSTRACT

Desert Lilly, *Aloe vera* L. plant has been known and used for centuries for its health, beauty, medicinal, food and skin care properties. The name *Aloe vera* derives from the Arabic word “Alloeh” meaning “shining bitter substance,” while “vera” in Latin means “true.” On the other hand, *Aloe vera* is important in industrial perspective as well as agricultural usage. *Marasmiellus* spp is a Basidiomycetes fungus (Agaricales: Tricholomataceae), It causes pseudostem rot on banana (*Musa* sp.) This study aims, the colony growth pattern of banana pseudostem rot fungi, *Marasmiellus* spp was assessed against *A.vera* leaf powder extracts. Leaf powder with acetone and ethanol extracts of 20, 200, 400, 1000 and 2000 µl were administered to assess the colony growth pattern of *Marasmiellus* spp. The experiment was conducted using completely randomized design and data were analyzed using SAS statistical package. By using *A.vera* acetone extract, in first day after inoculation, the colony diameter was higher (1.700±0.2cm) in control and the lowest diameter (0.433±0.38cm) was obtained in 2000 µl of extract. All treatments were significantly differed each other. The same highest and lowest colony diameter was obtained in second, third and fourth day after inoculation also. In *A.vera* ethanol extract, first day after inoculation the highest colony diameter (1.333±0.06cm) was observed in control and 1000 µl and 2000 µl concentration of extract fully inhibit the growth of colony. The same highest and lowest colony diameter was obtained in second and third day after inoculation. These findings are useful to prepare the extracts of *A.vera* leaf powder for the management of *Marasmiellus* spp.

Keywords: *Aloe vera*, *Marasmiellus* spp., Antifungal Activity, Colony Inhibition, Banana Pseudostem Rot

PRODUCTION AND ECONOMIC CHARACTERISTICS OF GOAT MANAGEMENT SYSTEMS IN VAVUNIYA DISTRICT, SRI LANKA

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ABSTRACT

A study was conducted to compare feeding and management strategies used in different goat management systems in Vavuniya district, Sri Lanka. A survey was carried out using 186 farmers (4 Veterinary divisions) from three different management systems, namely intensive, semi-intensive and extensive management systems over a period of 4 months using a well-structured questionnaire. Data were analyzed using the Statistical Package for the Social Sciences (SPSS). The results of the survey indicated that majority (71.51%) of farmers in the area considered goat farming as a part time business and 59.14% of women were involved in goat farming. Sixty one % of goat farmers had primary education and 27 % had studied up to GCE (O/L) while the rest had completed GCE (A/L). Educational background did not significantly influence on the profit of farmers. Hindu, Muslim and Christian communities were involved in goat farming where 64.52% of Hindus contributed to mutton industry. Between the three management systems, birth weight, slaughter weight and growth rate under intensive management and semi-intensive system were greater ($p < 0.05$) compared to extensive system. Since the costs of feeding and labour involvement in intensive system were higher, the average monthly profit was lower ($p < 0.05$) under intensive management system compared to extensive and semi-intensive management systems. Poor production of animal, lack of grazing land, high feed and labour cost and lack of loan facilities were identified as the major constraints in goat production in the area. Comparing all production and economic parameters, it can be concluded that goat farming under semi-intensive management system was more profitable compared to intensive and extensive management system in Vavuniya district.

Keywords: Goat Management Systems, Production and Economic Parameters of Goats

DYNAMICS OF SOIL MICROBIAL ABUNDANCE IN LOWLAND AND UPLAND CROPS WITH THE APPLICATION OF BIOFILMED BIOFERTILIZERS

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ABSTRACT

Decline in soil microbial diversity and abundance is supposed to be one of key factors for yield decrease in long-term continuous monocropping systems. The application of synthetic chemicals to increase the growth rate of crops will result in environmental issues and reduced sustainability of conventional agroecosystems. Recent studies have introduced microbial biofilms as biofertilizers, now known as Biofilmed biofertilizers (BFBFs), to reinstate sustainability of degraded agro-ecosystems. Present study was conducted to evaluate temporal changes of soil microbes under lowland and upland conditions using rice and onion as test plants in a pot experiment. Treatments were 50% chemical fertilizers (CF), 100% CF, BFBF, 50% CF + BFBF and control with no amendments. The experiment was arranged in a Completely Randomized Design with three replicates. Soil microbial counts were enumerated for 12 weeks. Initial and final soil pH, nitrogen, phosphorus and carbon were also measured. Compared to the other treatments, 50% CF + BFBF and BFBF alone showed significantly increased soil microbial counts ($p < 0.05$), and biofilm induction that contribute to healthy plant growth. Further, 50% CF + BFBF showed the significantly highest fungal-bacterial ratio in the soils, reflecting restoration. The soil parameters resulted from 50% CF + BFBF showed favorable levels, by adjusting pH range to 5.5-6.5. Since this field of research is still in early stages, further studies are needed to identify its effects and potentials.

Keywords: Agroecosystems, Biofilm Biofertilizer, Fungal-Bacterial Ratio, Soil Microbes, Sustainability

**THE USE OF WILD HERBS IN ITALY: ETHNOBOTANICAL RESEARCH BY MEANS
OF SOCIAL NETWORKS AND CROWDSOURCING**

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ABSTRACT

Indigenous populations have always appreciated spontaneous herbs for various uses, such as food and medicine. While in the past those uses were of daily occurrence, in recent years they have slowed down. However, nowadays there is a new interest in wild herb applications and local populations are the depositors of this historic and ecological culture. The present study intends to apply the principles of ethnobotanical research in order to map local skills on the use of spontaneous herbs by the members of an Italian Facebook group ("*Erbacce e Dintorni*"), which aims to promote the preservation of biodiversity and local traditions related to spontaneous herbs. A qualitative research will be carried out using a Google form that will allow to collect, analyze and, above all, preserve the immense heritage of traditional ecological knowledge existing within the group for future generations. In addition, relying on the principles of crowdsourcing, the group's members will be asked to act as innovators and to propose, for each of the herbs and the uses indicated, possible innovations that in their opinion create the right balance among the safeguard of traditions, the conservation of local biodiversity and the application of new skills deriving from the advancement of studies in different fields of research (food, medicine, phytotherapy, cosmetology and so on).

Keywords: Ethnobotany, Biodiversity, Crowdsourcing, Social Network, Traditional Ecological Knowledge (TEK), Innovation

ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS THROUGH INTEGRATED MICROALGAE-LIVESTOCK SYSTEM: A REVIEW

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ABSTRACT

By reviewing the literatures on the interrelationships between livestock and sustainable development in developing countries, this paper aimed at investigating where and how livestock could contribute to the United Nations (UN) Sustainable Development Goals (SDGs). Specific objectives were to perform an in-depth analysis of relevant interdisciplinary literature using Strengths, weaknesses, opportunities and threats (SWOT) analysis to identify knowledge gaps, and isolate areas of weaknesses and threads that could shed light into areas that require further research. This was followed by a quid pro quo synthetization of areas of linkage between livestock and microalgae culture using the SDGs as a unifying platform. The review identifies where integrated microalgae-livestock systems inclusion may have direct impact on achieving the SDGs targets such as poverty, hunger, global warming, and health. It also lays out evidences for the paths in which innovative livestock systems inclusion has indirect role in achieving other SDGs targets such as gender equality, education, and sanitation. Moreover, from the perspective of the SDGs, this paper highlights that, livestock inclusion is about alleviating poverty and empowering the poor. Furthermore, despite inconsistent trends of microalgae's usefulness as a livestock feed, a comparative examination of the literatures on microalgae-based feedstock's with conventional feeds suggest that, overall performance issues in livestock due to low nutrition can be improved through microalgae source feeds.

Keywords: Livestock, Sustainable Development, Microalgae, Feeds

