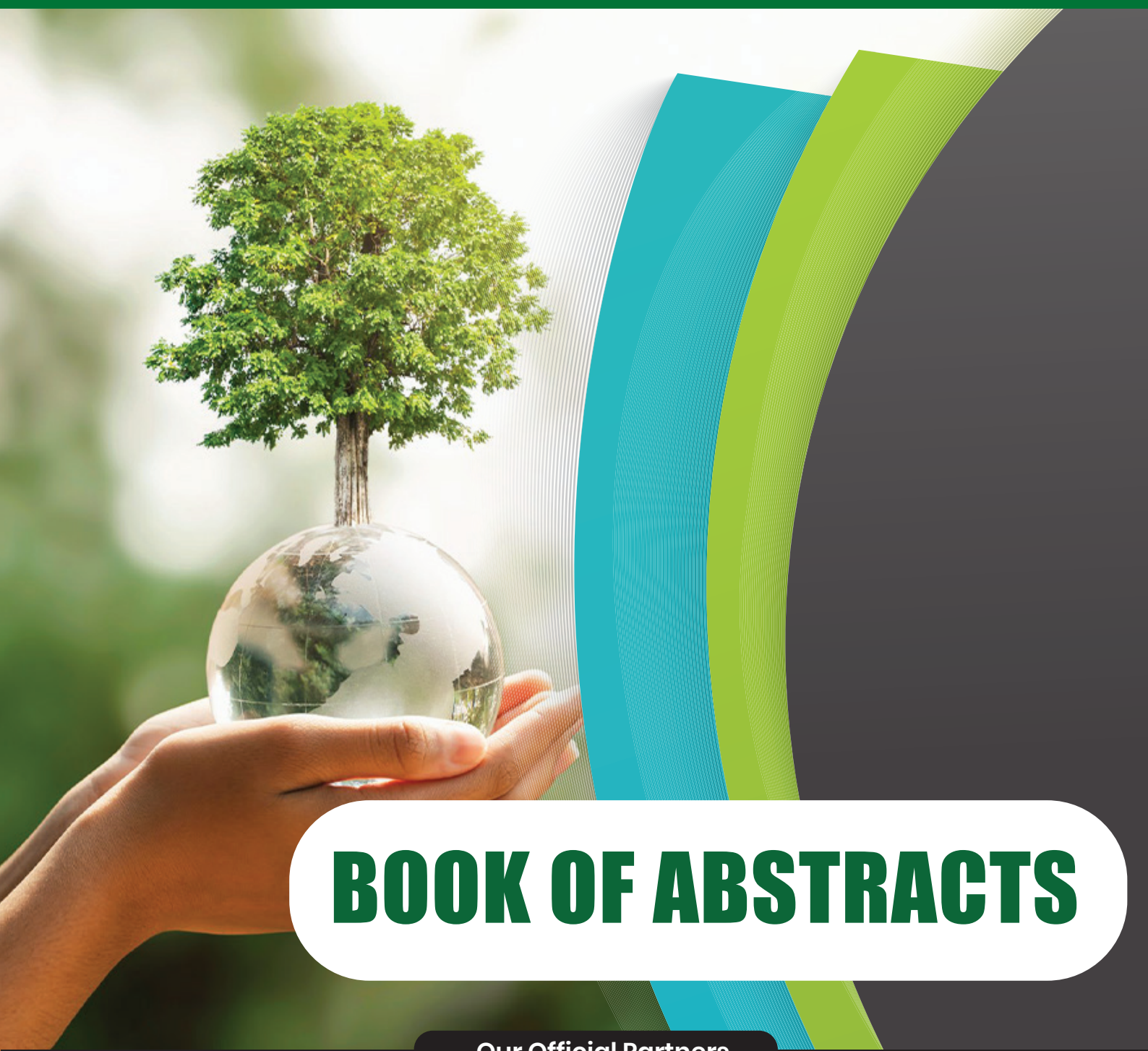


# THE 9<sup>TH</sup> INTERNATIONAL CONFERENCE ON **AGRICULTURE 2022**

11<sup>th</sup> – 12<sup>th</sup> August 2022 | Virtual Conference

**“Sustainable utilization of resources in agriculture: way of food security and safety”**



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(AGRICO 2022)

11<sup>th</sup> – 12<sup>th</sup> August 2022

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The International Institute of Knowledge Management (TIKM)

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## MESSAGE FROM THE CONFERENCE CO-CHAIR

Excellences, Colleagues, Ladies and gentlemen,

Thank you all for joining AGRICO 2022. I'm delighted to extend my personal welcome to the 9th International Conference on Agriculture 2022 (AGRICO 2022) which will take place from 11th – 12th August 2022 in Virtual Platform again this year due to the COVID-19 pandemic. This year's conference theme is Sustainable utilization of resources in agriculture: way of food security and safety. We hope AGRICO 2022 will give us the time to be filled with material, deferent interesting and significant studies outcomes that is needed for the onward progress of agriculture and global food security.

The International Institute of Knowledge Management (TIKM) and their esteemed partners offer this innovative and informative International Conference reflecting the world need for supporting sustainable development goals (SDGs) and the challenges and opportunities of food security and safety, as well. Our world grows more complicated; agricultural sustainable innovation provides the tools to solutions to issues that continue to threaten our planet peaceful coexistence. And if we are not adequately equipped with the knowledge and skills to meet contemporary challenges, people as a whole cannot move forward to a better future. Although, we are meeting in a virtual format, I invite you to engage with the speakers as you are able in the conference sessions and to form collaborative partnerships that will be of mutual benefit. I encourage each of you to get benefit from the publishing opportunities as well as, to consider how you will contribute to the future of food security and safety.

I wish to express my deep appreciation to the wonderful staff at The International Institute of Knowledge Management (TIKM) for organizing this conference. Thanks are due to all the members of organizing, scientific, and technical committees. Acknowledgements are due to the logistics and secretary of the conference for their support and continuous follow up, that makes it a success case.

Again, we are glad to have you join us for this important virtual gathering.

Thank you.



Professor Samih Abubaker  
Chair- AGRICO 2022  
Former Dean of the Faculty of Agricultural Technology  
Al-Balqa Applied University  
Jordan

## MESSAGE FROM THE CONFERENCE CO-CHAIR

I wish to extend my welcome to all delegates of the 9<sup>th</sup> International Conference on Agriculture (AGRICO) 2022, held virtually again this year due to the COVID-19 pandemic. The coverage and scope of this conference is designed to contribute significantly toward the continuing progress of agriculture around the globe, with particular emphasis on Food Security and Food Safety.

The global food system is central to some of the biggest challenges facing humanity. While food production is only one aspect of the food system, the agro-food sector also provides a livelihood for millions of people. Globally, most of the people living in extreme poverty are in rural areas where food production is often the most important economic activity. Based on current estimates, there are almost 570 million farms worldwide today, and millions of people work in food-related jobs. The global food system is heavily burdened by a large environmental footprint. It is well established that agriculture occupies nearly 40% of the earth's surface, far more than any other human activity. In addition, irrigation of agricultural crops takes up 65-75% of global water use, and agriculture directly contributes to 10-15% of Global Greenhouse Gas (GHG) emissions.

This year's conference theme is Sustainable Utilization of Resources in Agriculture: Way of Food Security and Safety. Given that climate change is impacting agricultural productivity across the globe, we must find ways to deal with shrinking arable land, rising costs of production, and interestingly increasing computing power. Holistic technologies such as precision agriculture and biotechnology are steadily moving forward with advanced capability to improve resource utilization. The industrial revolution 4.0 technologies such as Internet of Things (IoT), Artificial Intelligence (AI), Drones, Sensors, Robotics, Blockchain, 3-D Printing, Virtual Reality (VR) and Augmented Reality (AR) are bringing new energy and hope into the way we carry out agriculture. The emergence of smart agriculture as a direct consequence of digital agriculture and precision agriculture is indeed a game changer. This scenario will provide us with the necessary tool sets to produce 'more with less.'

Although we are meeting via a virtual platform, I invite you to engage as much as you can with the experts across all sessions to form collaborative partnerships that will be of mutual benefit. Most of all, I encourage each of you to consider how you could play a meaningful role in steering the future of agriculture during these challenging times.

I wish to express my appreciation to the International Institute of Knowledge Management (TIKM) for organizing this conference.

Have a great conference!



Dr. Siva K Balasundram, PhD  
Associate Professor (Precision Agriculture) and Head  
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|                           |
|---------------------------|
| <b>ORAL PRESENTATIONS</b> |
|---------------------------|

|                                       |
|---------------------------------------|
| <b>SOCIAL DEVELOPMENT ECONOMY (A)</b> |
|---------------------------------------|

|    |    |                                                                                                                                                                  |    |
|----|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| A1 | 1. | Community-Based Participatory Research and Extension Continuum in Urban Agriculture in an Urban Barangay of Northern Philippines                                 | 02 |
|    |    | <i>Daculog MN, Suaco TP and Parado RD</i>                                                                                                                        |    |
| A2 | 2. | Assessment of Social Determinants of Health in Women Residing in Mountainous Region of India                                                                     | 03 |
|    |    | <i>Anjali J and Rekha V</i>                                                                                                                                      |    |
| A3 | 3. | Appraisal of Energy Demand in the Banana Supply Chain to Effectively Introduce Sustainable Energy to Support Small Producers in Ecuador                          | 04 |
|    |    | <i>Salvatierra-Rojas A, Lohr K, Acosta Barbosa J, Maranon Berrazueta J, Romero Romero M, Willms B and Torres-Toledo V</i>                                        |    |
| A4 | 4. | Effect of Financial Management Practices on Performance of Agri-Smes in Tanzania: Managers' Perception on the Implementation. Practices (Conceptual Perspective) | 05 |
|    |    | <i>Mang'ana K</i>                                                                                                                                                |    |

|                                                                                       |
|---------------------------------------------------------------------------------------|
| <b>FOOD SCIENCE, TECHNOLOGY SECURITY AND SAFETY, CHALLENGES AND OPPORTUNITIES (B)</b> |
|---------------------------------------------------------------------------------------|

|    |    |                                                                                                                                                                    |    |
|----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| B1 | 5. | Quantification of Selected Antioxidant Compounds in Sweet Basil ( <i>Ocimum basilicum L.</i> ), through the Optimization of Temperature and Solvent Concentrations | 06 |
|    |    | <i>Zubair QA, Juju NJ, Rani SU and Maget WPE</i>                                                                                                                   |    |
| B2 | 6. | A Review of Agricultural Policies and Beef Production in South Africa                                                                                              | 07 |
|    |    | <i>Thabani D and Ogujiuba K</i>                                                                                                                                    |    |

|    |    |                                                                                                                                                        |    |
|----|----|--------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| B3 | 7. | Smallholder Farmers Envisioned Opportunities and Challenges of Fourth Industrial Revolution: Evidence from Msukaligwa Local Municipality, South Africa | 08 |
|    |    | <i>Agholor AI and Nkosi M</i>                                                                                                                          |    |
| B4 | 8. | Determinants of Market Choice of Fresh Produce in South Africa: Evidence from Smallholder Farmers in Nkomazi Municipality, Mpumalanga                  | 09 |
|    |    | <i>Nomcebo L and Ogujiuba K</i>                                                                                                                        |    |

### AGRICULTURAL BIOLOGY (C)

|    |     |                                                                                                                                                       |    |
|----|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| C1 | 9.  | Estimation GCA and SCA, Hybrid Potency, Protein Gene Action and Grain Yield for Two Generations of Bread Wheat Grains ( <i>Triticum aestivum</i> . L) | 10 |
|    |     | <i>Al-timimi OAA, Aziz aljubory JM and Al-Mfarji BAM</i>                                                                                              |    |
| C2 | 10. | Quantitative Analysis of Genetic Components and Screening for Elite Genotypes in EMS Mutagenized Rice Population                                      | 11 |
|    |     | <i>Mamun AA, Islam MM, Adhikary SK and Sultana MS</i>                                                                                                 |    |
| C3 | 11. | Distribution of Collected and Conserved Sorghum ( <i>Sorghum Bicolor</i> (L.) Moench) Landraces in the South African Gene Bank                        | 12 |
|    |     | <i>Matelele LA</i>                                                                                                                                    |    |
| C4 | 12. | Production of Xylanase by a Wild Strain of Schizophyllum Commune in Submerged Fermentation using Wildly Growing Non-Food Plant Biomass as Substrate   | 13 |
|    |     | <i>Sridevi B</i>                                                                                                                                      |    |

### AGRICULTURAL BIODIVERSITY (D)

|    |     |                                                                                                |    |
|----|-----|------------------------------------------------------------------------------------------------|----|
| D1 | 13. | Heterosis in Early Maturing Yellow Seeded Maize                                                | 14 |
|    |     | <i>Dadheech A and Munwal R</i>                                                                 |    |
| D2 | 14. | Identification of Gene Loci Conferring Tolerance to <i>Fusarium virguliforme</i> in Glycin Max | 15 |
|    |     | <i>Hemlata S, Lightfoot DA and Amit D</i>                                                      |    |

|    |     |                                                                                                                                       |    |
|----|-----|---------------------------------------------------------------------------------------------------------------------------------------|----|
| D3 | 15. | Sweet Abulug Pomelo (SAP): The Lucky Fruit of Cagayan Valley, Philippines<br><i>Agaid MB</i>                                          | 16 |
| D4 | 16. | Genetic Diversity Studies for Yield and Maturity Traits in Bread Wheat ( <i>Triticum Aestivum L</i> )<br><i>Hemlata S, and Amit D</i> | 17 |

### AGRICULTURE ENGINEERING (E)

|    |     |                                                                                                                                               |    |
|----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------|----|
| E1 | 17. | Location-Based Identification of Transboundary Plant Pests & Diseases Using UAVs & Deep Learning<br><i>Makati T, Mokgosi K and Kgosiame T</i> | 18 |
| E2 | 18. | Microsoft Dynamics Business Central- for Seed Industry<br><i>Chauhan M</i>                                                                    | 19 |
| E3 | 19. | Design and Realization of Spatial Database of Darongshan Agricultural Production Base Based on ARCSDE<br><i>Hussin N and Li W</i>             | 20 |
| E4 | 20. | Land Cover Mapping Using Object-Based Analysis in Forested and Plantation Areas<br><i>Sheriza MR And Zaiton S</i>                             | 21 |

### PLANT NUTRITION, FERTILIZATION, SOIL MANAGEMENT, HORTICULTURE PRACTICES (F)

|    |     |                                                                                                                                                                                             |    |
|----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| F1 | 21. | Efficacy of Plant Extracts in Controlling Wheat Smut Caused by <i>Ustilago tritici</i><br><i>Badar R, Ahmed A, Waheed H, Din MS and Rasool GM</i>                                           | 22 |
| F2 | 22. | Can Additional Amounts of NPK and Urea Fertilizers at Heading Stage Improve Yield of Irrigated Rice in Burkina FASO?<br><i>Yameogo PL, Serme I, Ouedraogo B, Serpantie G and Sauret ESG</i> | 23 |

|    |     |                                                                                                  |    |
|----|-----|--------------------------------------------------------------------------------------------------|----|
| F3 | 23. | Changes in Bean Plant Grown in Lead-Contaminated Soil                                            | 24 |
|    |     | <i>Ekinici M, Yüce M, Turan M, Örs S and Yildirim E</i>                                          |    |
| F4 | 24. | Optimizing Phosphorus and Potassium Management for Sustainable Potato Seed Tuber Production      | 25 |
|    |     | <i>Amare DA, Yohannes DB and Desta TA</i>                                                        |    |
| F5 | 25. | The Impact of COVID-19 on Vegetable Farmers: A Review                                            | 26 |
|    |     | <i>Rathnayake S, Gray D, Reid J and Ramilan T</i>                                                |    |
| F6 | 26. | Effect of Tea Waste Biochar on pH Buffering Capacity in Tea Growing Ultisols of Sri Lanka        | 27 |
|    |     | <i>Herath WSKK, Dissanayake DMMR, Dharmakeerthi RS, Gunaratne GP and Wijayatunga WMS</i>         |    |
| F7 | 27. | Drought and Bio stimulant Treatments Affected Organic Acid Content of Tomato Seedlings           | 28 |
|    |     | <i>Yildirim E, Ekinici M, Turan M, Örs S and Yüce M</i>                                          |    |
| F8 | 28. | Maize Performance as Influenced by Manure and Fertilizer in Titanium Mined Soils                 | 29 |
|    |     | <i>Muindi EM, Wamukota AW, Mulinge JM, Okello N, Wekesa G and Ahmed H</i>                        |    |
| F9 | 29. | Effects of Bio Stimulant Treatments on Amino Acid Content of Tomato Seedling Under Water Deficit | 30 |
|    |     | <i>Ekinici M, Turan M, Örs S, Yüce M and Yildirim E</i>                                          |    |

## ENVIRONMENTAL MANAGEMENT (G)

|    |     |                                                                                                                                              |    |
|----|-----|----------------------------------------------------------------------------------------------------------------------------------------------|----|
| G1 | 30. | Resource Use Planning for Sustainable Agriculture in the Thar Desert Region of Rajasthan                                                     | 31 |
|    |     | <i>Latika S, Meena G L and Sharma S K</i>                                                                                                    |    |
| G2 | 31. | The Effects of Climate Change on Agricultural Productivity: A Conceptual Framework                                                           | 32 |
|    |     | <i>Sithole MZ and Agholor AI</i>                                                                                                             |    |
| G3 | 32. | Comparative Analysis of Ground Cover of Selected Crops on Runoff Generated from Three Moderately Sloppy Experimental Plots in Northern Ghana | 33 |
|    |     | <i>Dogbey RK, Abagale FK and Adongo TA</i>                                                                                                   |    |

|     |     |                                                                                                                                                                                                           |    |
|-----|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| G4  | 33. | The Potentials of Crop Diversification for Increased Farm Profitability and Climate Change Adaptation: A Review                                                                                           | 34 |
|     |     | <i>Sithole MZ and Agholor AI</i>                                                                                                                                                                          |    |
| G5  | 34. | Assessment of Fuel saving and CO <sub>2</sub> Mitigation of Improved Cook Stoves in Tribal Household Kitchens                                                                                             | 35 |
|     |     | <i>Arya P, Rathore H and Panwar NL</i>                                                                                                                                                                    |    |
| G6  | 35. | Effect of Biochar and Compost on Carbon Mineralization of a Corn Growing Alfisol in Dry Zone of Sri Lanka                                                                                                 | 36 |
|     |     | <i>Logarasa L, Dharmakeerthi RS and Munasinghe ST</i>                                                                                                                                                     |    |
| G7  | 36. | Fertilizer Induced Changes in Phosphorus Fractions and Availability in Paddy Growing Alfisols of Sri Lanka                                                                                                | 37 |
|     |     | <i>Kalpana DPDN and Dharmakeerthi RS</i>                                                                                                                                                                  |    |
| G8  | 37. | Variation in pH and Electrical Conductivity in Soil Samples Collected from Paddy Lands in Sri Lanka                                                                                                       | 38 |
|     |     | <i>Delgoda KHBH, Neththasinghe NASA, Chandrasekara EDCT, Dissanayaka DMSB, Ariyaratna M, Rathnayake WMUK, Sirisena DN and Suriyagoda LDB</i>                                                              |    |
| G9  | 38. | Economic Burden in Paddy Cultivation: Determine the Nitrogen and Phosphorus Leaching Losses from Intensively Managed Paddy Field under Controlled Run-Off Condition through Grey Water Footprint Approach | 39 |
|     |     | <i>Palliyaguru MPGNM, Navaratne CM, Wickramasinghe DD and Nanayakkara CM</i>                                                                                                                              |    |
| G10 | 39. | Development of a Tool to Calculate Greenhouse Gas Reduction According to REDII in the Biomethane Fuel Sector in Germany                                                                                   | 40 |
|     |     | <i>Karatassios H</i>                                                                                                                                                                                      |    |
| G11 | 40. | Application of Chemical Fertilizer in Paddy Cultivation and Water Pollution due to Leachate                                                                                                               | 41 |
|     |     | <i>Palliyaguru MPGNM, Navaratne CM, Wickramasinghe DD and Nanayakkara CM</i>                                                                                                                              |    |
| G12 | 41. | Soil Physical Properties in Two Intensive Vegetable Cultivating Systems in the Central Highland of Sri Lanka                                                                                              | 42 |
|     |     | <i>Upekshani HAN, Dharmakeerthi RS and Weerasinghe P</i>                                                                                                                                                  |    |

## AGROECOLOGY AND SUSTAINABLE AGRICULTURE (H)

|    |     |                                                                                                                                                    |    |
|----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------|----|
| H1 | 42. | Impact of Establishing a Farmer Corporation to Reach the Welfare of Farmers (Case Study: Demak Regency, Central Java Province)                     | 43 |
|    |     | <i>Ikhsan M, Rukmana D, Fahmid IM and Tenriawaru AN</i>                                                                                            |    |
| H2 | 43. | Growth and Yield Performance for Rice ( <i>Oryza sativa</i> var. NSIC Rc222) at Varying Levels of Nitrogen Fertilizer under Carcar City Conditions | 44 |
|    |     | <i>Tangpos MD</i>                                                                                                                                  |    |
| H3 | 44. | Performance of Soybean Seed Production and Emerging Trends under Central European Conditions                                                       | 45 |
|    |     | <i>Bozóki B, Kovács GP and Gyuricza C</i>                                                                                                          |    |
| H4 | 45. | Land-Use Pattern of Rice-Based Cropping Systems in Batticaloa District in Sri Lanka; An Empirical Study                                            | 46 |
|    |     | <i>Neththasinghe NASA, Chandrasekara EDCT, Delgoda KHBH, Rathnayake WMUK, Sirisena DN, Dissanayaka DMSB, Ariyaratna M and Suriyagoda LDB</i>       |    |
| H5 | 46. | Analysis of the Sustainable Development Goals and Its Relation to Psychological Stress                                                             | 47 |
|    |     | <i>Vyas R and Juyal A</i>                                                                                                                          |    |
| H6 | 47. | Natural Farming in Modern Time: Changing Context and Need of Hour                                                                                  | 48 |
|    |     | <i>Sharma SK, Choudhary R, Jat G, Yadav SK and Jain RK</i>                                                                                         |    |
| H7 | 48. | Awareness of Consumers towards Sustainable Consumption                                                                                             | 49 |
|    |     | <i>Vyas R and Saksh M</i>                                                                                                                          |    |
| H8 | 49. | Response of Prom and Biodynamic Manure on Productivity of Organic Blackgram                                                                        | 50 |
|    |     | <i>Choudhary R, Sharma SK, Ranjan M, Jat G, Yadav SK and Jain RK</i>                                                                               |    |
| H9 | 50. | A Review of Plant Leaf Disease Detection and Classification by Deep Learning Approaches                                                            | 51 |
|    |     | <i>Dasari SR and Kathula S</i>                                                                                                                     |    |

|     |     |                                                                        |    |
|-----|-----|------------------------------------------------------------------------|----|
| H10 | 51. | Utilization of Phytoecdysteroids in Improving Sericulture Productivity | 52 |
|-----|-----|------------------------------------------------------------------------|----|

*Obra EP, Ancheta LA, Salazar CGE, Higoy JQ and Salazar RE*

## **SUSTAINABLE PLANT PRODUCTION (J)**

|    |     |                                                                      |    |
|----|-----|----------------------------------------------------------------------|----|
| J1 | 52. | Effect of Abiotic Elicitors on Phytochemical Accumulation in Cocoyam | 53 |
|----|-----|----------------------------------------------------------------------|----|

*Harbor CI, Uka WC, Irouka CG, Ukpong J and Ijeh II*

|    |     |                                                                                                                          |    |
|----|-----|--------------------------------------------------------------------------------------------------------------------------|----|
| J2 | 53. | Performance of Seed Hub in enhancing the Quality Seed Production of Pulses in Bundelkhand Region of Uttar Pradesh, India | 54 |
|----|-----|--------------------------------------------------------------------------------------------------------------------------|----|

*Singh NP, Bajpai NK, Singh RK and Vister J*

|    |     |                                                                                                      |    |
|----|-----|------------------------------------------------------------------------------------------------------|----|
| J3 | 54. | Effect of Plant Essential Oils on Phytotoxic Responses of Chilli ( <i>Capsicum annum</i> ) Seedlings | 55 |
|----|-----|------------------------------------------------------------------------------------------------------|----|

*Pramodi KHPS and Wijesekara WMAUKM*

|    |     |                                                                                                                                                   |    |
|----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------|----|
| J4 | 55. | Effect of Different Transplanting Dates and Shock Preventing Methods on the Performance Pearl Millet ( <i>Pennisetum typhoides L.</i> ) Varieties | 56 |
|----|-----|---------------------------------------------------------------------------------------------------------------------------------------------------|----|

*Yadav VL*

|    |     |                                                                                                   |    |
|----|-----|---------------------------------------------------------------------------------------------------|----|
| J5 | 56. | Rice Husk Biochar Affects Yield and Nutrient Uptake of Rice Plants in Dry Zone Soils of Sri Lanka | 57 |
|----|-----|---------------------------------------------------------------------------------------------------|----|

*Kulasinghe HPGTN and Dharmakeerthi RS*

|    |     |                                                                                                              |    |
|----|-----|--------------------------------------------------------------------------------------------------------------|----|
| J6 | 57. | Nutrient Profiling of Melon Varieties at Different Developmental Stages and Its Relation with Fruit Cracking | 58 |
|----|-----|--------------------------------------------------------------------------------------------------------------|----|

*Lija M, Suhara Beevi S and Byju G*

## **WATER MANAGEMENT, SUSTAINABILITY AND AGRICULTURAL ENTOMOLOGY AND PEST (K)**

|    |     |                                                                         |    |
|----|-----|-------------------------------------------------------------------------|----|
| K1 | 58. | Innovative Omics-Based Approaches for Reducing Post-Harvest Food Losses | 59 |
|----|-----|-------------------------------------------------------------------------|----|

*Sirangelo TM*

|    |     |                                                                                                                                                                |    |
|----|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----|
| K2 | 59. | Importance of Gram Pod Borer Management for the Sustainable Yield of Chickpea in Bundelkhand Region of Uttar Pradesh, India                                    | 60 |
|    |     | <i>Bajpai NK and Singh NP</i>                                                                                                                                  |    |
| K3 | 60. | Population Structure, Pathogenicity, and Fungicide Sensitivity of Colletotrichum Species Causing Strawberry Anthracnose in Eastern China                       | 61 |
|    |     | <i>Zhang L, Fang X, Li S and Zhang X</i>                                                                                                                       |    |
| K4 | 61. | Effects of Variety, Deficit Drip Irrigation and Rice Straw Mulch on Flowering, Fruiting and Yield of Tomato ( <i>Lycopersicon esculentus</i> L.)               | 62 |
|    |     | <i>Kah KN, Abubakari AH, Dzomeku IK, Abagale FK and Adombilla R</i>                                                                                            |    |
| K5 | 62. | Water Management Practices among Dry Season Irrigated Vegetable Farmers as It Reflects Their Socio-Economic Characteristics, in Jimeta, Adamawa State, Nigeria | 63 |
|    |     | <i>Timon F, Preuksa N and Khawmee K</i>                                                                                                                        |    |

#### ANIMAL HUSBANDRY AND ORGANIC FARMING (L)

|    |     |                                                                                                                                 |    |
|----|-----|---------------------------------------------------------------------------------------------------------------------------------|----|
| L1 | 63. | Harvesting Age, Yield and Nutritive Value of Hybrid Maize Varieties for Fodder Production in the Mid-Country, Intermediate-Zone | 64 |
|    |     | <i>Kumara Mahipala MBP, Weerasinghe WMPB, Karunadhipathi UL, Weerathunga MWDC and Fernando PRMK</i>                             |    |
| L2 | 64. | Effect of Pre and Post Emergence Herbicides on Weed Control Efficiency and Productivity of Blackgram ( <i>Vigna mungo</i> L.)   | 65 |
|    |     | <i>Verma A and Choudhary R</i>                                                                                                  |    |
| L3 | 65. | Case Study: Should the Non-Descriptive (Local) Buffalo Herds in Waligepola, Sri Lanka be Upgraded Using Murrah Semen?           | 66 |
|    |     | <i>Jeewanie EC, Kumara Mahipala MBP and Silva KFST</i>                                                                          |    |

## POSTER PRESENTATIONS (L)

- |    |     |                                                                                                                                        |    |
|----|-----|----------------------------------------------------------------------------------------------------------------------------------------|----|
| P1 | 66. | Evaluation of Different Poultry Breeds Under Organic Production System                                                                 | 68 |
|    |     | <i>Gupta L, Mishra S, Sharma SK and Kumar A</i>                                                                                        |    |
| P2 | 67. | Assessment of Genetic Variability and Character Association for Yield and Its Component Traits in Barley ( <i>Hordeum vulgare L.</i> ) | 69 |
|    |     | <i>Abhay D, Singh MB and Urmila</i>                                                                                                    |    |

# ORAL PRESENTATIONS

A1

[01]

**COMMUNITY-BASED PARTICIPATORY RESEARCH AND EXTENSION  
CONTINUUM IN URBAN AGRICULTURE IN AN URBAN BARANGAY OF  
NORTHERN PHILIPPINES**

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**ABSTRACT**

Soil fertility and nutrient balance are utmost the central anchor to sustain food production in a farming community considering altitudes, agronomic crops, and farming systems. Urban agriculture, on the other hand, provides an alternative agricultural system in response to food insecurity in a highly populated and densed community. Using community-based participatory research, the study aimed to bidirectionally analyze the soil nutrients, recommend soil fertility management, and policy recommendations to improve the urban agriculture in Barangay Lucnab, Baguio City, Cordillera Region, Philippines. Results show, from the quantitative soil test in three sampling sites, the soil is composed of 40:60 clay-sand ratio, strongly acidic (4.53 pH level), and low soil moisture (29.47%). However, the soil's macronutrients are high at the optimum level (113.88 ppm phosphorus and 206.67ppm potassium) while the soil has low organic matter (3.48%). Results further revealed high soil micronutrients (.78ppm copper; 2.24ppm zinc; 15.27ppm iron; and 13.34ppm manganese). These varying soil fertility nutrients and chemical imbalance affect the solubility of minerals, water holding capacity, and plant growth and development. Hence, to facilitate the agricultural extension education among the locals as a result of the quantitative soil tests, a participatory non-formal learning session and education was conducted to frame urban agriculture as a multifunctional green infrastructure to be managed by the community members. The training served as a corrective measure to propose various solutions to soil management. As a corrective measure, the extension program provided agricultural lime to correct the high soil acidity level and varying nitrogen-based fertilizers to suit the production of high value crops such as cabbage, sweet peas, tomatoes, raddish and cucumber. Policy advocacy and recommendation were also adopted by the local leaders as basis for potential urban agriculture expansion in the community. This community-based research-extension continuum provides more benefits among the locals while maximizing land use in a highly urbanized community.

Keywords: soil fertility, soil management, community-based participatory research, urban agriculture

A2

[02]

**ASSESSMENT OF SOCIAL DETERMINANTS OF HEALTH IN WOMEN  
RESIDING IN MOUNTAINOUS REGION OF INDIA**

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**ABSTRACT**

Rural women in India have always been viewed as a gender which is best suitable for household work and not as a conventional monetary contributor. The standing of rural women in India can be evaluated by classifying underlying themes that mark their socio-economic development. This research intends to investigate probable social, economic, physical and psychological catalysts appertaining to the health of rural women native to the mountainous region. Social determinants identify the motivating factors, problems and challenges faced by women that stimulate poverty reduction, subsidize national development and encourage autonomy among rural women. 150 women from Amsore village of Uttarakhand were enrolled for this study. All the participants were evaluated using a semi-structured questionnaire for demographic profile and Borg scale of perceived exertion for activities impact assessment. The majority of the women were unemployed (100%), had up to intermediate level education (72%) and were managing medium-sized (55.3%) joint families (63.33%) with a monthly household income of less than Rs. 5000 (53.33%). Fetching water (100%), fodder collection (71.33%) and firewood collection (80%) were reported as the most exertion inducing tasks causing physical and psychological stress to the women. Low income, unemployment, and poverty, as well as inadequate education, social marginalisation, poor sanitation, unsafe and hazardous working environments, and a lack of access to health care, have been identified as major contributors to health disparities. In order to increase socio-economic contribution and lower the frequency of health injuries among women, these findings urge for preventive efforts and safety guidelines.

Keywords: social determinants, woman health, stress, exertion

A3

[03]

**APPRAISAL OF ENERGY DEMAND IN THE BANANA SUPPLY CHAIN TO  
EFFECTIVELY INTRODUCE SUSTAINABLE ENERGY TO SUPPORT SMALL  
PRODUCERS IN ECUADOR**

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**ABSTRACT**

In Ecuador, energy access for small banana producers is getting expensive. This case is observed in rural areas, where standalone diesel engines for irrigation or gasoline engines for two-stroke grass trimmers used for de-weeding result in adverse environmental impacts such as air and soil pollution. Nowadays, green technology has advanced access to electricity worldwide and has proven its potential as a decentralized energy supply. These technologies are available and can be implemented in the agricultural sector. However, a successful replacement requires an accurate assessment of the energy demand, followed by an estimation of the potential energy supply with various alternatives, such as solar energy production and the sizing of the photovoltaic (PV) system. Thus, the framework of the present research was to investigate the energy demand of the different technologies across the banana supply chain with a focus on smallholder producers in Ecuador. 18 banana farms were purposefully sampled. Then qualitative field observations gave context and particular insights into supply chain processes and energy use. Mapping the energy throughout the supply chain was done through workshops based on GIZ's value-link approach. The information collected was used to model the potential renewable energy generation under different scenarios and a financial model. The expected outcomes of the model will be used to predict solar energy production, the dimensioning of the PV system, and estimate the payback period. Furthermore, the usage of this study may facilitate researchers, stakeholders, and policymakers to advise in the implementation of technologies driven by renewable energy along the supply chain while considering environmental mitigation to partially or totally replace diesel or gasoline power systems.

Keywords: renewable energy, greenhouse emissions, banana supply chain

A4

[04]

**EFFECT OF FINANCIAL MANAGEMENT PRACTICES ON PERFORMANCE OF  
AGRI-SMES IN TANZANIA: A STRUCTURAL EQUATION MODELING  
ANALYSIS**

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**ABSTRACT**

Agriculture Small and Medium-Sized Enterprises (Agri-SMEs) contribute significantly to economic change in developing countries by addressing a wide range of unemployment, nutrition, income poverty, and food security issues. Despite their critical role and contribution to economic growth, they have received a great deal of criticism for their poor performance. According to the literature, many of the challenges confronting these agro enterprises are the result of poor financial management practices (FMPs) among SMEs, which is why it is critical to examine whether Agri-SMEs properly observe and implement financial management practices within their business enterprises. The researcher hypothesizes that Tanzanian Agri-SMEs are failing to meet their respective business objectives due to ineffective financial management practices, which result in poor performance. To put the proposed theoretical model to the test, 303 SMEs in Tanzania's agricultural sector were polled. The developed hypotheses were evaluated using Structural Equation Modeling (SEM) with Smart PLS 4 to determine the effect of implementing Financial Management Practices on the organizational performance of Agri-SME. Several significant findings emerge from the empirical study. data analysis shows that implementing FMPs has a significant positive impact on both financial and organizational performance. The findings confirm a significant relationship between the implementation of best FMPs practices and Agri-SME organizational performance.

Keywords: financial management practices, Agri-SMEs performance

B1

[05]

**QUANTIFICATION OF SELECTED ANTIOXIDANT COMPOUNDS IN SWEET  
BASIL (*Ocimum basilicum* L.), THROUGH THE OPTIMIZATION OF  
TEMPERATURE AND SOLVENT CONCENTRATIONS**

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**ABSTRACT**

Sweet basil (*Ocimum basilicum* L.) is a valuable pharmaceutical herb that is rich in antioxidants. Despite this, the success in extracting those compounds lies on the technique used during the extraction processes. The current study was aimed to establish a suitable extraction technique through different levels of temperature and concentrations of ethanol. The dried leaves of sweet basil were treated with three different temperatures (40, 60 and 80°C) and combined with three concentrations of ethanol (60, 75 and 90%, v/v). The experiment was carried out in 3 X 3 factorial Complete Randomized Design with four replications and three samples per replicate. The analysis of variance (ANOVA) showed a significant interaction between the tested factors. Based on the findings, the highest extraction yield (11.56%) was obtained from the combination of 80°C + 90% ethanol. Meanwhile, the highest total phenolic content (67.02 mg of GAE/g DE), total phenolic yield (693.50 mg of GAE/100g DE), total flavonoid content (44.70 mg QUE/g DE), total flavonoid yield (462.52 mg QUE/100g DE) and antioxidant activity (66.80% in 100 µg/ml) were obtained from the combination of 80°C + 60% ethanol. Although the highest extraction yield was the highest from 80°C+90% ethanol, it is however, this study was focusing on the phenolic and flavonoid compounds. Hence, it is recommended to extract the sweet basil leaves under 80°C with 60% ethanol. Future research is needed to focus on identification of new phytochemicals under combination 80°C + 90% ethanol.

Keywords: sweet basil, extraction, phenolic, flavonoid, antioxidants

B2

[06]

## **A REVIEW OF AGRICULTURAL POLICIES AND BEEF PRODUCTION IN SOUTH AFRICA**

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### **ABSTRACT**

This paper studies the agricultural policies affecting beef production in South Africa namely The Marketing of Agricultural Products Act and the financing act. The paper makes an argument that the policies are equally distributed between white farmers and black farmers from South African backgrounds. In the review of literature, we also look at these policies in African countries and other countries around the world where we will try to understand how they have affected their beef production. The literature review further provides cases of other agricultural policies such as the meat safety act, water act and the conservation of agricultural resources act to also study how they affect the production of beef in South Africa. The findings of the study suggested that the policy reform by the government in South Africa resulted in equal distribution of policy regulations amongst all beef producers. The study further discussed that although there have been loopholes in these policies, there have been other constraints that have contributed largely to the industry including lack of market information, insufficient education, and production system to name a few. The study concluded that the role of the government should only be to facilitate these policies and prevent further involvement in the sector to prevent cases of monopolies.

Keywords: beef, government, market, production

B3

[07]

**SMALLHOLDER FARMERS ENVISIONED OPPORTUNITIES AND  
CHALLENGES OF FOURTH INDUSTRIAL REVOLUTION: EVIDENCE FROM  
MSUKALIGWA LOCAL MUNICIPALITY, SOUTH AFRICA**

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**ABSTRACT**

This study was carried out in Msukaligwa Local Municipality, South Africa. The main aim of the study was to examine the opportunities and challenges of the fourth industrial revolution for agricultural production among smallholder farmers. The specific objectives of the study were to determine the impact of the fourth industrial revolution on agricultural production, to examine the opportunities and constraints of the fourth industrial revolution for agricultural productivity, and to analyze the adoption behaviour of smallholder farmers in the use of technologies of the fourth industrial revolution. The unit of analysis was the individual smallholder farmers practicing agriculture. The study used both quantitative and qualitative research methods, which included questionnaires, semi-structured interviews and focus group discussions. The data collected was coded and analysed using Statistical Package for Social Sciences (SPSS) version 27. In the binary logistic regression model, fourteen variables were analysed. Eight variables out of the fourteen variables were found to be significant concerning the adoption behaviour in the use of technology in the fourth industrial revolution (age, education level, household size, monthly income, employment status, farm size, technology use readiness and extension service satisfaction level). Given the research findings, this study recommends that promoting technology adoption among smallholder farmers should be taken seriously, monitored, and evaluated. The government should capacitate and support extension agents with adequate means to enable them to disseminate new technological innovations relating to the fourth industrial revolution to smallholder farmers through workshops and training.

Keywords: smallholder farmers, fourth industrial revolution, innovation, technology, technology adoption

B4

[08]

**DETERMINANTS OF MARKET CHOICE OF FRESH PRODUCE IN SOUTH AFRICA: EVIDENCE FROM SMALLHOLDER FARMERS IN NKOMAZI MUNICIPALITY, MPUMALANGA**

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**ABSTRACT**

In South Africa and other developing countries, fresh produce smallholder farmers have restricted access to markets and credit facilities. Lack of market information, lack of transportation, inadequate storage facilities, unexpected prices, grade and standards, annual income, farmer's experience, lack of collateral and contractual agreement all influences the choice of market in which farmers take their produce. As a result, such constraints limit the farmer's ability to access formal markets and credit facilities. This study was conducted in Nkomazi Local Municipality based on a sample of 100 farmers who were selected using simple random technique. The study made use of a structured questionnaire to collect data through face-to-face interviews. Frequency and a multiple logistic regression model were used to identify factors influencing fresh produce market choices among the sampled farmers. The multinomial logistic regression model analysed these factors and the empirical results of the model discovered that market information, transportation, grades and standards, farm knowledge and experience, and storage facilities do not influence the choice of marketing channel for fresh produce farmers. In addition, the finding revealed that farmers do not have access to formal lending institutions, they rely on friends and families. Additionally, they also have no access to formal markets, they are dependent on the informal market. The outcomes suggest that policies aimed at linking farmers to lucrative markets should be revisited and lending institutions must re-evaluate their requirements in relation to collaterals.

Keywords: access, credit, choices, farmers, market, produce, smallholder

C1

[09]

**ESTIMATION GCA AND SCA, HYBRID POTENCY, PROTEIN GENE ACTION  
AND GRAIN YIELD FOR TWO GENERATIONS OF BREAD WHEAT GRAINS  
(*Triticum aestivum*. L)**

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**ABSTRACT**

The aim is to study the federative potential, the strength of the hybrid and the genetic action of some traits related to the quality and quality of the grains of genotypes of bread wheat genotype (*Triticum aestivum* L.) which are Adana, Cowes, July 2, Site Mall, Research 22, Rashid, Milan, Sham 6, Aba 99 and Abu Ghraib. Half crosses hybridization to obtain (45) hybrids, then these hybrids were planted with parents in three replications using RCBD design for the first generation 2018 and 2019 and the second generation 2019, traits (individual plant yield and protein ratio) were studied. Parents, hybrids, and parents against hybrids) the genotypes and fathers in addition to hybrids were significant at a probability level (1%) for all traits, while parents against hybrids were not significant for the individual plant yield trait for all generations and the second generation 2019 for the protein ratio and the first generation 2019 for the total protein ratio and the significant in For other generations of the protein ratio trait, and that the ratio between the components of the general to the special assessment was less than the correct one for the individual plant yield trait and for all generations and the first generation 2018 for the ratio of protein and the next generation The first and second 2019 for protein ratio and meta-analysis, and this indicates the importance of extra and non-additive effects on the studied traits. Parents 4, 7 and 9 outperformed with general general ability for most of the traits. The hybrids were (1 × 8), (6 × 9) and (7 × 10). And (8 × 10), (2 × 6) and (2 × 10) have a special general ability for most of the traits.

Keywords: GCA, SCA, hybrid, genes, wheat, protein, quality

C2

[10]

## QUANTITATIVE ANALYSIS OF GENETIC COMPONENTS AND SCREENING FOR ELITE GENOTYPES IN EMS MUTAGENIZED RICE POPULATION

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### ABSTRACT

Genetic improvement of rice needs to create new genetic variability and ethyl methane-sulfonate (EMS) has the capability to advance such plant breeding issues. The production of mutants followed by their characterization provides a powerful tool in selecting genotypes with desirable features. The goal of this work was to induce mutations in the background of a mega rice variety to create novel variants and to screen high performing mutants (M<sub>2</sub>) through multi-trait genotype-ideotype distance index (MGIDI). The augmented randomized complete block design was followed to execute the experiment maintaining three replications for each genotype. Descriptive statistics and analysis of variance reported a vast spectrum of heterogeneity among mutants. Projected heritability and genetic variance figured that almost all the traits were highly heritable and had complex inheritance pattern. The tillers hill-1, primary branches panicle-1, grains panicle-1, straw yield hill-1, and harvest index were shown to be highly linked with grain yield, implying that direct selection based on these traits may be sufficient for improving other attributes. Besides, a heat map was employed to assess the mutants' similarity matrix. The first two principal components explicated around 41.62% of the overall variation, and the biplot of genotype by trait identified superior genotypes with favorable trait combinations. The MGIDI analysis revealed that only ten mutants out of hundred performed much better. The strengths and weaknesses assessment of MGIDI indicted that genotypes having high tiller producing efficiency with luxury vegetative growth and harvest index should be prioritized in selecting novel mutants. These findings authenticated the efficacy of EMS in prompting variation in rice, and the selected mutants might have a great potential to be used in future improvement of this crop.

Keywords: rice mutants, heritability, genetic advance, principal components, genotype selection, multi-trait index

C3

[11]

**DISTRIBUTION OF COLLECTED AND CONSERVED SORGHUM (SORGHUM BICOLOR (L.) MOENCH) LANDRACES IN THE SOUTH AFRICAN GENE BANK**

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**ABSTRACT**

Plant genetic resources are a pool of possibly useful genetic material that exists both inter- and intra-specifically. For the protection of plant genetic resources for food and agriculture, a thorough understanding of their distribution is essential. Understanding the location of collected and conserved sorghum landraces in the South African gene bank's germplasm core collection is therefore critical. The aim of the study was to map and quantifying the geographic distribution of sorghum landraces in germplasm core collection of the South African gene bank from 1996 to 2008. Between 1996 and 2008, 312 sorghum landraces were collected and conserved in the South African gene bank. The geographical location of 152 villages in 57 municipalities, located in 23 District Municipalities of six (6) Provinces, was used to generate a spatial distribution of Sorghum accessions. The sorghum collections in the South Africa gene bank core collection revealed an important dispersion, covering different geographic areas, with the majority (40.1%) of collections made in Limpopo Province for a period of 12 years. It was observed that in 2003, the sorghum collection increased by more than three times the initial collection in 1996. In contrast, there was a decreasing trend of sorghum collection observed between 2003 and 2008. Crop diversity may be necessary for future climate adaptation, and its conservation is dependent on human activities and performance. The current analysis is also valuable in identifying collection priority locations, both explored and unexplored. Between 1996 and 2008, there were changes in the geographical distribution of sorghum germplasms in South Africa, which might be related to changes in climatic and agronomic conditions, the introduction of new varieties, and/or the development of new agricultural practices.

**Keywords:** plant genetic resources, genetic material, geographic distribution

C4

[12]

**PRODUCTION OF XYLANASE BY A WILD STRAIN OF SCHIZOPHYLLUM  
COMMUNE IN SUBMERGED FERMENTATION USING WILDLY GROWING  
NON-FOOD PLANT BIOMASS AS SUBSTRATE**

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**ABSTRACT**

Xylanases are glycosidases (O-glycoside hydrolases, EC.3.2.1.x) which catalyze the hydrolysis of 1, 4-β-D-xylosidic linkages of the complex plant cell wall polysaccharide xylan. In recent years, the biotechnological use of microbial xylanases has grown remarkably in the preparation of animal feed, and later expanded to food, textile and paper industries. The relatively high cost of enzyme production has hindered the industrial application of xylanases. In the present investigation the production extracellular xylanase by a newly isolated white-rot fungus *Schizophyllum commune* on the low-cost aquatic and terrestrial weed plant biomass hydrolysate was studied in submerged fermentation. Six wildly growing non-food plant biomass Benghal day flower (*Commelina benghalensis*), Bermuda grass (*Cynodon dactylon*), Water hyacinth (*Eichornia crassipes*), Congress grass (*Parthenium hysterophorus*), Water lettuce (*Pistia stratiotes*), and Green foxtail millet (*Setaria viridis*) were evaluated in SmF for xylanase production. In all the experiments, temperature and pH were kept constant at 25±2°C and 5.5 respectively and the fermentation was carried under static conditions for 7 to 14 days of incubation period. The best xylanase activity was obtained when pure xylan was used as the sole carbon source. The plant biomass of *Setaria viridis* was shown to be the best inducer for xylanase production followed by *Cynodon dactylon* and *Parthenium hysterophorus*. In aquatic plant biomass of *Eichornia crassipes* and *Pistia stratiotes*, this fungus showed moderate levels of xylanase activity. *Schizophyllum commune* produced very minimum quantities of xylanase when *Commelina benghalensis* biomass was used as carbon source.

Keywords: xylanase, white-rot fungus, plant biomass hydrolysate, inducer, submerged fermentation.

D1

[13]

## HETEROSIS IN EARLY MATURING YELLOW SEEDED MAIZE

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### **ABSTRACT**

An experiment consisted of 36 hybrids along with 12 parents and 4 checks viz., Vivek Hybrid-43, PHM-3, Pratap Makka-9, Haryana Maize-11, were evaluated during Kharif 2016 in randomized block design with three replications. The data were recorded on fifteen traits to study the magnitude of relative heterosis (RH), heterobeltiosis (HB), economic heterosis (EH). The analysis of variance revealed that the mean square due to genotypes, parents, crosses and parents v/s crosses were significant for all the traits except for parents v/s crosses days to 75 per cent brown husk, ear girth and no. of grains rows per ear. Among the parents inbred line L12 exhibited maximum mean values for grain yield per plant, No. of grains rows per ear and harvest index while Inbred line L12 exhibited minimum mean values for days to 50 per cent tasseling and days to 50 per cent silking. Among the hybrids, hybrid L12 x T3 showed maximum mean values for grain yield per plant and harvest index. Hybrids L12 x T3 also depicted positive significant economic heterosis for grain yield per plant over the best check Pratap Makka-9. While hybrid L2 X T1 exhibited maximum heterobeltiosis and relative heterosis for grain yield.

Keywords: maize, heterosis, heterobeltiosis, economic heterosis

D2

[14]

## IDENTIFICATION OF GENE LOCI CONFERRING TOLERANCE TO FUSARIUM VIRGULIFORME IN GLYCIN MAX

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### ABSTRACT

*Fusarium solani* f. sp. *glycines* (FSG; syn. *F. virguliforme* Akoi, O'Donnell, Homma & Lattanzi) is a soil-borne pathogen that infects soybean roots and scorches leaves causing sudden death syndrome (SDS). Root resistance is known to be due to antifungal fluorescent phytoalexins whereas tolerance to leaf scorch is more complex. The objective of this study was to identify loci conferring root resistance. The study was conducted under controlled conditions in a greenhouse. A culture of *F. virguliforme* virulent strain Mont-1 was used to induce fluorescence in roots of all 100 F5:14 RILs derived from the cross of Essex by Forrest. Essex was susceptible while Forrest was partially resistant to *F. virguliforme* root infection and tolerant to leaf scorch. One hundred RILs were transplanted to soil inoculated with *F. virguliforme* virulent strain Mont-1. The roots were harvested at 21 dai and the blue light induced green fluorescence measured. There was a significant correlation between root fluorescence and root resistance ( $r = 0.08$  and  $P = 0.005$ ). Non-infected roots showed major QTL on near Satt129 (D1a, 0.0032, 11%), near Sat\_001 (D2, 0.0072, 10%) near Satt303. (G, 0.0318, 7%), and near Satt 579 (D1b, 0.0582, 6%). The QTL on G appeared to segregate in NIL population 34. The QTL was distinct from the genes Fr1, Fr2 and Fr3 (blue fluorescence from UV light) and may be the previously detected but un-mapped Fr4, Fr5 or a new gene Fr6 (green fluorescence from blue light). Therefore, fluorescent root exudates, including phytoalexins, differ in Essex and Forrest and may underlie part of the resistance to root pathogens.

Keywords: fusarium, tolerance, QTL; roots, resistance

D3

[15]

**SWEET ABULUG POMELO (SAP): THE LUCKY FRUIT OF CAGAYAN VALLEY,  
PHILIPPINES**

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**ABSTRACT**

A sustainable food system in this time of new normal was a challenge to everyone due to many restrictions that hinder activities and immobility of businesses, leading to hunger and poverty. But in Cagayan Valley, Philippines, an opportunity to promote and showcase Siamese Abulug Pomelo (NSIC 2008 Pm 04) now popularly known as Sweet Abulug Pomelo (SAP), as source of Vitamin C and fiber in boosting immune system to fight COVID-19 and promising regional high value crop was launched. However, to address the low yield and fruit quality was imperative. Hence, research was conducted at Department of Agriculture (DA) - Northern Cagayan Experiment Station, Maquire, Lucban, Abulug, Cagayan from January – December 2021. The most critical pest infesting pomelo is the Citrus Rind Borer (CRB). Verification trials on pest management coupled with recommended cultural practices were conducted resulting to significantly improved fruit quality, obtaining higher yield and marketable price. Various cash crops were intercropped in between non-bearing SAP trees to determine the crop with the highest potential source of income. Field day was conducted last August 10, 2021 to popularize SAP and highlight the result of the study. It was attended by 114 farmers and partner agencies. The successful stories of pomelo growers inspired farmers to plant more as recorded in the increasing demand of planting materials and fruits. The promotional strategies of DA and other agencies increased farmer's income by marketing in bulk. Hence, through improved technology, farmers overcome crisis with a net income of Php.1,017,270.00 / ha / year.

Keywords: sweet abulug pomelo, citrus rind borer, intercropping

D4

[16]

**GENETIC DIVERSITY STUDIES FOR YIELD AND MATURITY TRAITS IN  
BREAD WHEAT (*Triticum aestivum* L.)**

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**ABSTRACT**

An experiment was carried out with 88 germplasm lines of bread wheat received under Elite International Germplasm Nursery from IIWBR, Karnal. These germplasm lines were evaluated against four checks viz., DBW88, K 1006, HI 1544 and UAS 304 during Rabi 2016-17 in augmented design for grain yield and maturity traits. Variability, genetic advance, correlation and diversity analysis were carried out. Analysis of variance showed considerable variation for all the traits under study. Grain yield per plant (GYP) exhibited high heritability coupled with high Genetic advance as percent of mean. Days to maturity (DM) exhibited significant positive association with Plant height while days to heading showed significant negative association with Plant height. 88 germplasm lines were subjected to diversity analysis and these were grouped into five clusters. Maximum contribution was exhibited by GYP followed by DM, Plant height (PH), days to heading (DH) and test weight (TW). Maximum genotypes were accommodated in cluster I and minimum in cluster V. High similarity coefficient was found between 48<sup>th</sup> IBWSN 1283 and 7<sup>th</sup> HLBSN 19 followed by 17<sup>th</sup> KBSN 14 and 36<sup>th</sup> ESWYT 110

Keywords: bread wheat, germplasm, variability, correlation and diversity

E1

[17]

## LOCATION-BASED IDENTIFICATION OF TRANSBOUNDARY PLANT PESTS & DISEASES USING UAVS & DEEP LEARNING

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### **ABSTRACT**

Farming, like all industries, is being disrupted by technologies in a push to increase productivity while being sustainable and contributing positively to climate change. Farmers are faced with a perennial problem of pests and diseases which negatively impacts the productivity and profitability of their enterprises. The most common of these being transboundary plant pests and diseases which affect food crops. To address this challenge, we propose Project Anton, a deep learning-based distributed solution that uses image data remotely sensed from satellites or any device with a camera to detect pests and diseases and give recommendations on the treatments and appropriate interventions to apply. We propose the above as we realized that physical field inspections delay productivity as farmers have to wait a long time for inspections and even more time to get inspection results. Lack of aggregated data makes it difficult to track pests and diseases including effects on yield, while lack of accurate land mapping data makes it difficult for agriculture researchers to provide resources/medicines to farmers especially those in remote areas. We use google earth engine to get satellite data used for land cover mapping, field mapping and location based field analysis. Currently the solution uses already existing platforms like Whatsapp and facebook messenger in combination with a deep learning model trained to identify pests and diseases based on image data. Furthermore, this data is visualized and analyzed on a web application to provide community feedback for farmers as well as a disease heatmap of a target area. For future work, we plan to integrate drones for collecting data and collaborating with the relevant stakeholders for testing and validation of the model.

Keywords: satellite images, UAVs, remote sensing, deep learning, mapping

E2

[18]

## MICROSOFT DYNAMICS BUSINESS CENTRAL- FOR SEED INDUSTRY

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### **ABSTRACT**

Pristine has designed and developed a Seed Industry module in Microsoft Dynamics Business Central which has all the modules for running the seed operations starting from Seed Production to Seed Dispatches. The seed production module covers a production mobile application for seed monitoring and seed planting with geo tagings of the farmers lands. The quality module is configurable module to creates samples, set parameters of quality declaration and validations to check any restricted movement of stock of quality failed lot. The stock movement is all mobile based. The warehousing module with an integrated mobile application facilitates paperless stock movement to ensure accurate and fast inventory movements within the warehouse. Distributor mobile apps and retailer mobile apps integrated with our dispatch and sales module gives the insights of distributor stock movement to retailer for entire visibility of liquidation of the stock in the targeted regions. The financial management is the core of the solution which ensures all controls systems and bring together data across accounting, sales, production, processing, and quality to gain a unified financial view. The product is successfully running in seed businesses across India. We came here to propose the same solution on this podium to offer the solution to other countries too.

Keywords: pristine business solutions, seed industry, mobile application, seed businesses, India

E3

[19]

**DESIGN AND REALIZATION OF SPATIAL DATABASE OF DARONGSHAN  
AGRICULTURAL PRODUCTION BASE BASED ON ARCSDE**

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**ABSTRACT**

With the development of agricultural modernization and the application of new technologies in agriculture, agricultural data presents a trend of huge amount of data, wide sources and various types. The method of managing and using agricultural data efficiently is a problem of modern agricultural management. By taking Darongshan Agricultural Production Base, China as the research area, this paper applies GIS and spatial database technology to realize agricultural data management, and puts forward new methods for the storage, management and spatial visualization of agricultural data. This agricultural spatial database takes ARCSDE as the spatial database platform and SQL SERVER as the relational database platform to establish Darongshan Agricultural Spatial Database. Object-oriented model is adopted to design the structure of Darongshan Agricultural Production Base. Based on the characteristics of data structure in research area, the hierarchical storage and management of spatial data and attribute data is adopted to realize the orderly storage and management of different data types, and the functions of agricultural spatial database are discussed. Through practice, the establishment of agricultural spatial database has realized the integration of agricultural spatial data and agricultural production data, which has positive significance for agricultural production and management.

Keywords: geographic information systems, spatial databases, agricultural management, data structure

E4

[20]

## LAND COVER MAPPING USING OBJECT-BASED ANALYSIS IN FORESTED AND PLANTATION AREAS

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### ABSTRACT

Land cover mapping provides overall information to land managers for resource management and planning. Based on satellite remote sensing image processing, land cover classification can map, and area is quantifiable. In Kuala Baram, East Malaysia, a Pleiades satellite image was used to map land cover for forested and Eucalyptus plantation areas using object-based analysis. Different segmentation scale techniques were used to classify forests, plantations (such as oil palms), and non-vegetated areas. For filtering soil features in all attributes, computational attribute manager filtering techniques were adapted based on the ratio of near infrared and red bands. The use of these two bands improved the accuracy with which the land cover was classified for the study. Land cover accuracy was 48.71%, with overall land cover accuracy being low. Prior to the implementation of the filtering techniques, some land cover had very poor accuracy. After the filtering techniques, overall accuracy improved, and all land cover showed higher accuracy ranging from 25.00% to 66.67%. This type of map can certainly assist with resource and human factor adaptation when dealing with plantation issues like pest and disease.

Keywords: mapping, tropical forest, remote sensing

F1

[21]

## EFFICACY OF PLANT EXTRACTS IN CONTROLLING WHEAT SMUT CAUSED BY *Ustilago tritici*

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### ABSTRACT

Wheat (*Triticum aestivum* L.) is grown all over the world and is the important food source for human around the globe the need and demand for the production of this crop is increasing day by day with the increase of human population growth. Cultivation of *T. aestivum* is becoming challenging and difficult due to the yield losses due to the attack of *Ustilago tritici* as the major fungal pathogen of this crop. While the other major challenge towards the better and economic production of wheat is the use of chemical based fungicides which are expensive and had hazardous health impact on human. The other possible solution towards the safety of food crop from these pathogens is the introduction of resistant varieties, but local farmer having small lands for cultivation are not aware of these modern varieties, due to which they are still cultivating susceptible varieties, which flourish the chances of losing resistance by the resistant varieties if grown continuously close to the susceptible varieties. Therefore, present experimental study was design to control these biotrophic parasites through plant extracts which is ecofriendly strategy towards safety of world's food due to having no side effects and is economic. An experimental study was performed using leaf extracts of (neem, tobacco, Jambolana and eucalyptus) to investigate the antifungal potential these plant extracts in vitro and in vivo. In vitro, all treatments showed no inhibited spore germination except neem extract which were recorded 93.99% inhibition of spore germination. Morocco as most vulnerable wheat variety was grown in greenhouse with all the suitable environmental conditions for fungal growth and germination in three plots as control (not treated), treated with neem extract and nativo as chemical spray). all the treatments were applied through foliar application after seven days after inoculation. results of the study clearly suggested that neem extracts showed positive results which were in accordance with the results of nativo compared with the untreated control crop. No infected plant was seen in both experimental plots while plants were seen infected with *U. tritici* in control plot. It had been concluded that plant extracts had a great potential for disease treatment and neem leaf extracts are recommended for use against biotrophic pathogen as safe alternative to chemical based fungicides.

Keywords: *Triticum aestivum* L, neem, tobacco, Jambolana and eucalyptus

F2

[22]

## **CAN ADDITIONAL AMOUNTS OF NPK AND UREA FERTILIZERS AT HEADING STAGE IMPROVE YIELD OF IRRIGATED RICE IN BURKINA FASO?**

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### **ABSTRACT**

It is well known that rice paddy yield is related to nutrient uptake. Recent recommendations of fertilizers in Burkina Faso include NPK fertilizer combined with urea super granules, that allow more availability of major nutrients, mainly nitrogen for an estimated 55 days after application. Significant increase is observed compared to simple urea used by rice farmers, but we do not know if the nitrogen needs of rice are fully met. With the aim to improve fertilizer recommendations for irrigated rice, we conducted a field experiment in the perimeter of Karfiguela to assess the efficiency of doses and timing of fertilizers (NPK, urea) on agronomic performances of Orylux 6 rice variety. The experiment was a split-plot design with the two factors in three replications. The main plots were represented by three different doses of NPK while the subplots were represented by four urea fertilization practices. The performances of fertility management were assessed through the evaluation of some rice agronomic characteristics and major nutrients uptake. The results showed a significant interaction between the different levels of NPK and urea management on rice tillers number, panicle number and rice yield. The best yields are obtained on plots fertilized with NPK (200 kg. ha<sup>-1</sup>) at transplanting combined with 72 kg. ha<sup>-1</sup> of urea super granules applied 10 days after transplanting. From the results, we conclude that additional amounts of urea at late stage of rice is not required, as well as splitting of NPK.

Keywords: soil fertility management, irrigated rice, nutrient uptake, rice productivity, urea deep placement

F3

[23]

### CHANGES IN BEAN PLANT GROWN IN LEAD-CONTAMINATED SOIL

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#### ABSTRACT

Heavy metals are one of the stress factors that cause important problems in plant production. Among the heavy metals that cause a decrease in plant growth and development, lead has an important effect depending on its concentration. In this study, parameters related to plant growth were investigated in beans grown in soil contaminated with lead at different concentrations (0, 1000, 1500, 2000 mg/kg). The potting soil prepared in the greenhouse study was first treated with the indicated doses of lead and left to incubate for three weeks, and then seed was planted. In the study, the effect of lead application was evaluated on stem diameter, plant height, leaf area, leaf fresh weight, stem fresh weight, root fresh weight, leaf dry weight, stem dry weight, root dry weight, chlorophyll SPAD value, chlorophyll a, chlorophyll b, total chlorophyll, electrical leakage (EL) and leaf water relative content (LWRC). According to the results of the study, there was a significant decrease in plant growth parameters, weight values and chlorophyll contents in parallel with the increased lead dose. Also, with increasing lead level, LWRC decreased while EL increased. As a result, it has been determined that lead causes a decrease in plant growth and development in bean seedlings, and it is seen that in the next stage, it will cause significant reductions in yield and cause economic loss of income for the producer.

Key words: bean, heavy metal stress, lead, plant growth

F4

[24]

## OPTIMIZING PHOSPHORUS AND POTASSIUM MANAGEMENT FOR SUSTAINABLE POTATO SEED TUBER PRODUCTION

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### ABSTRACT

Phosphorus (P) and potassium (K) are vital nutrients in potato seed tuber production for healthy crop growth and tuber number, yield, and quality increment. However, because of the absence of defined nutrient recommendations for seed tuber production, potato growers used to apply blanket recommendations of N and P fertilizers in Ethiopia. This management practice increases the cost of production and decreases standard quality seed tuber yield, which elevates its price unavoidably. In this context, we conducted an on-farm seed production experiment to determine the appropriate nutrient management strategy and ensure sustainability. It includes 0 (control), 1/4, 1/2, and full-dose recommended P and K 4\*4 factorial treatments as the main plot factor and three potato varieties as subplot factors in a factorial split-plot design with three replications. The analysis of variance showed no significant ( $p < 0.05$ ) interaction effect between fertility management and the three varieties. However, P, K, and P\*K management affected some specific growth, yield, and quality traits. The results revealed that the application of 1/4 of the recommended P level could maximize medium-sized (standard) seed tuber yield (20.51t) as high as the recommended level (23.51t) and enhance the economic benefit by 385 and 362% medium and total (medium + small-sized) seed tuber, respectively. Thus, we suggest that it is advisable to use P fertilizer below the recommended level for seed tuber production to optimize yield and rate of returns while minimizing resource utilization and environmental risks.

Keywords: potato, phosphorus, potassium, seed tuber, yield

F5

[25]

## THE IMPACT OF COVID-19 ON VEGETABLE FARMERS: A REVIEW

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### ABSTRACT

COVID-19 emerged in Wuhan, China in December 2019 as a novel pandemic in the 21<sup>st</sup> century. In addition to the direct physical health risk from the COVID-19 virus, the mitigation strategies imposed to control the virus spread caused some unfavorable and unexpected socio-economic consequences. Up to date evidence shows that farmers growing perishable products were more badly affected than other types of farmers. Therefore, we conducted a scoping review to investigate the impact of COVID-19 on vegetable farmers. A hundred articles were selected from Google scholar, Web of science and Scopus academic databases using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach. The results showed that there were studies from both developed and developing countries, conducted before and during the pandemic, for a variety of vegetable farmers. Telephone interviews were the main method of data collection used. Reportedly, vegetable production and marketing were mainly affected by the pandemic. International and local travel restrictions affected the supply of fertilizers, pesticides, seeds, and labour and as a result, vegetable production was reduced. Due to market closures and travel restrictions, farmers lost their traditional marketing channels. The demand for vegetables dropped, resulting in reduced vegetable sales and income. This affected the farmers' food security as they could not afford to purchase animal protein and staples, but rather consumed more of their own produce. The reviewed studies provided a good account of the pandemic's impact on vegetable farmers. However, the studies have not discussed in detail the coping strategies used by vegetable farmers during the pandemic. Therefore, more field level studies are suggested to explore the impact on the vegetable sector and vegetable farmers in different countries.

Keywords: COVID-19 impact, vegetable farmers, review

F6

[26]

## **EFFECT OF TEA WASTE BIOCHAR ON PH BUFFERING CAPACITY IN TEA GROWING ULTISOLS OF SRI LANKA**

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### **ABSTRACT**

Productivity of tea growing Ultisols in Sri Lanka declines rapidly due to soil acidification. This study was conducted to determine the effects of tea waste biochar (TWBC) made using different pyrolysis temperatures on short term effects on pH and pH buffering capacity (pHBC) of tea growing soils. Two biochar types were produced using tea factory waste by pyrolyzing them at 300°C (TWBC300) and 500°C (TWBC500). Ultisols (Red Yellow Podzolic soils) collected from Mattakele (MT) and Pallegoda (PG) tea estates with respectively high and low pHBC were treated with 0%, 1%, 2% (w/w) of TWBC. pH changes over 56 days of incubation period were monitored. Using the titration curve technique pH buffering capacity was determined in TWBC treated soils. Application of TWBC increased soil pH soon after their application in both soils but decreased with time. Soils treated with TWBC500 have significantly ( $p < 0.001$ ) higher pH than that of TWBC300 amended soils, at both rates of TWBC application throughout the incubation period in both soils. After 56 days of incubation period, increase in pH in soils treated with 2% of TWBC500 over the control (1 unit in PG and 0.5 unit in MT) was significant ( $p < 0.05$ ) but they were beyond the optimum pH range for tea cultivation. Biochar addition significantly increased ( $p < 0.05$ ) the pHBC in both soils and the highest pHBC was observed in 2% TWBC300 treatment in both soils. Biochar made at low temperature from tea waste can be used as an effective amendment to ameliorate acidity in tea growing Ultisols in Sri Lanka.

Keywords: biochar, pH buffering capacity, pyrolysis temperature, soil pH, tea waste

F7

[27]

## **DROUGHT AND BIOSTIMULANT TREATMENTS AFFECTED ORGANIC ACID CONTENT OF TOMATO SEEDLINGS**

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### **ABSTRACT**

Water stress causes significant problems in plant growth and development. Stress symptoms themselves especially with insufficient water during the seedling period of plants. However, with some applications, the tolerance of plants to water stress can be increased. Therefore, in this study, the effect of biostimulant application on organic content of tomato seedling under water stresses conditions. In the study conducted in the greenhouse conditions, irrigation of the plants was done in a way that the field capacity (100%) and 50% of the field capacity. The product used as a *biostimulant* has 1%Zn, *Bacillus subtilis*, *Bacillus megaterium*, *Aoasprillum* and *Bacillus amyloliquefaciens* (1x10<sup>9</sup> cfu/ml) content, and its solutions prepared at a ratio of 1/10 and 1/5 were given to the plants three times with one-week intervals. The effects of water stress and treatments on organic acid content (oxalic acid, propionic acid, tartaric acid, butyric acid, malonic acid, malic acid, lactic acid, citric acid, maleic acid, fumaric acid and succinic acid) in tomato seedlings were investigated. According to organic acid type, there were increase and decrease with water restriction differed. However, depending on the doses of the applications, it was determined that the negative effect of water stress on the organic acid content was alleviated. As a result, it is thought that the effect of water stress on tomato seedlings in terms of organic acid content can be alleviated by applications.

Keywords: bacteria, drought, organic acid, stress, tomato

F8

[28]

## MAIZE PERFORMANCE AS INFLUENCED BY MANURE AND FERTILIZER IN TITANIUM MINED SOILS

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### ABSTRACT

Mining is an important economic activity that promotes income generation, job creation, and industrialization globally. In spite its economic importance, it is classified as land degradation form that disrupts natural ecosystem through loss of biota and soil health. Paucity of information regarding the performance of reclaimed mined soils in supporting crop production abound in Kenya. To contribute to this knowledge gap, a study was conducted at Base titanium limited –Kwale to investigate the performance of maize (*Zea mays* L.) on post mined soils. The experiment was laid out in a Randomized Complete Block Design (RCBD) with split plot arrangement and replicated three times. Treatments included: fertilizer, manure, fertilizer +manure and control applied to three maize varieties namely: PH4, DK and Kanjerejere. Main plots comprised of varieties while fertilizer/manure treatments were subplots. Data collected included: soil attributes, growth and yield parameters and profitability. Data was subjected to analysis of variance (ANOVA) using R packages and means separated using the Fisher's protected least significant difference (LSD) at ( $P \leq 0.05$ ). Results showed that the soils had low TN, exchangeable P, K, S, Bo and Cu levels. Manure+ fertilizer significantly ( $P \leq 0.05$ ) increased overall plant height by 38%, LAI by 44%, stem circumference by 19.5% root depth by 39%, grain yield by 88%, grain quality by 66% and profitability by 22% compared to control. A significant positive relationship between manure, fertilizer, fertilizer+ manure with plant height, number of leaves, LAI, yield and profitability was observed indicating that manure + fertilizer can support optimal onion production in these soils. Further research is, required to ascertain the long term, maize production strategies that promote sustainable soil development and yield.

Key words: fertilizer, maize, land degradation, manure, mining, reclamation

F9

[29]

## EFFECTS OF BIOSTIMULANT TREATMENTS ON AMINO ACID CONTENT OF TOMATO SEEDLING UNDER WATER DEFICIT

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### ABSTRACT

In this study, the effect of biostimulant application against water stress in tomato seedling period was investigated. In the study conducted in the greenhouse conditions, irrigation of the plants was done in a way that the field capacity (100%) and 50% of the field capacity. The product used as a biostimulant has 1%Zn, *Bacillus subtilis*, *Bacillus megaterium*, *Aosprillum* and *Bacillus amyloliquefaciens* (1x10<sup>9</sup> cfu/ml) content, and its solutions prepared at a ratio of 1/10 and 1/5 were given to the plants three times with one-week intervals. The effects of water stress and treatments on amino acid content (aspartate, glutamate, asparagine, serine, glutamine, histidine, glycine, threonine, arginine, alanine, tyrosine, cysteine, valin, methionine, tryptophan, phenylalanine, isoleucine, leucine, lysine, hydroxyproline, sarcosine and proline) in tomato seedlings were investigated. As a result of this study, the increase and decrease in the amino acid content of the plant leaf with water restriction differed according to the amino acid type. However, depending on the doses of the applications, it was determined that the negative effect of water stress on the amino acid content was alleviated. In this study, it was determined that the effect of applications in reducing the damage caused by water stress on tomato seedlings may also be important in terms of amino acid content.

Key words: amino acid, bacteria, drought, stress, tomato

G1

[30]

## RESOURCE USE PLANNING FOR SUSTAINABLE AGRICULTURE IN THE THAR DESERT REGION OF RAJASTHAN

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### ABSTRACT

Rajasthan lies to the north west of India, just above the Tropic of Cancer and located between 23°30' and 30° 11' North latitude and 69° 29' and 78° 17' East longitude. UN estimates that 6.6% of the world's land mass is deserts and 34.6% is other drylands<sup>1</sup>. The hot arid zone lying west of state of Rajasthan occupies the largest area (19.6 million ha) of the arid ecosystem of the country, and is popularly known as Thar Desert. The Thar Desert is one of the most fragile ecosystems of India. For the purpose of this study arid western and the hyper arid partial irrigated zones have been considered only as the true representatives of Thar Desert. This includes the districts of Jodhpur, Barmer, Bikaner, Churu and Jaisalmer. Drought remains a major determinant of agriculture in the region. Only one fifth of the area (21.3 per cent) is irrigated and rest is under rainfed farming and affected by untimely and scanty rainfall. Crop cultivations is mostly dependent on ground water resources. This leads to excessive pressure on ground water resources. Soils are desert soils, red desert soils and sand dunes Aeolian soils, coarse to loamy coarse in texture. The natural resource base in the Thar is fragile with about sixty per cent of the geographical area as degraded and wasteland. With such weak natural resource base, it has increasingly become important to pay attention to long term concerns like sustainability, efficiency and health of ecosystem. The present study is an attempt to develop resource use planning strategies using linear programming at the zone level with the objective of identifying the interventions for sustainable agriculture for optimum resource use and sustaining the farmers at not below their existing net returns. Interventions considered were Agro-Forestry with Silvi-pasture system, Horti-pasture system and use of micro irrigation. The results suggest that with the suggested interventions, more number of cattle, buffalo and sheep can be sustained along with crop cultivation. Area under kharif cereals like pearl millet and sorghum, kharif pulses like greengram and moth, kharif oilseeds like groundnut and castor seed may be increased and fodder crop may be decreased. Greenhouse gas emissions, working capital requirement and per hectare net returns to farmers increased and labour requirement and water use reduced in all the three interventions.

Key words: resource use, sustainability, Thar desert, agroforestry, silvi-pasture, Horti pasture, micro irrigation

G2

[31]

**THE EFFECTS OF CLIMATE CHANGE ON AGRICULTURAL PRODUCTIVITY:  
A CONCEPTUAL FRAMEWORK**

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**ABSTRACT**

Agricultural productivity has been on a decline in the past fifteen years across the world owing to the unacceptable impacts of the change in the climatic patterns. Climate change is a serious threat in the agricultural sector, leading to reduced yields, high infestation of weeds, pests and diseases. The change in climate is evidently pointed by the increased dry seasons, extremely high temperatures, and depletion of water sources. This paper took the systematic approach to extensively review concepts, causes and effects of climate change in agricultural productivity. Journal articles, books and reports from the FAO and South African Department of Agriculture were reviewed. Results shows that the effects of climate change are extreme in the rural areas and are perceived in terms of decline in farm income and quality of produce. Farmers have come up with adaptive means as they fight to maintain farming resilience. This paper, therefore, concludes that climate change adaptation should be fast-tracked in order to ensure farming resilience and the government should assist farmers with farm inputs and incentives to encourage adoption of adaptation strategies.

Keywords: challenges, adoption, adaptation, profitability and smallholder farmers

G3

[32]

**COMPARATIVE ANALYSIS OF GROUND COVER OF SELECTED CROPS ON  
RUNOFF GENERATED FROM THREE MODERATELY SLOPPY  
EXPERIMENTAL PLOTS IN NORTHERN GHANA**

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**ABSTRACT**

Vegetative cover is essential to reduce the direct impact of rain drops on soil surfaces. But natural vegetation in reservoir catchments and croplands are scanty due to poor farming practices exposing the bare soils to erosion. Cultivation of annual crops on the upstream of reservoir catchments and river banks are common practices in West Africa. Conventional tillage practiced by majority of these farmers along the steep slopes of catchments directly influences runoff accelerating erosion, land degradation and siltation of reservoirs. The aim of this study was to investigate the dynamics of runoff generated from three (3) moderately sloppy experimental plots with different crop canopy types at different growth stages. Plots of different sizes were constructed with cylindrical containers installed at its downstream to collect runoff. Physical properties of soils on the various plots were determined before cultivation. Each plot was planted with unique crops whose canopy was determined using the leave area index measurement approach. Runoff volumes were analyzed against the extent of canopy at each growing stage of the cultivated crops. Results showed that maize which was cultivated on the largest field had the largest canopy cover at the vegetative growth stage and recorded the lowest runoff. At the end of the study, pepper recorded the lowest canopy throughout the growing period and as well the highest runoff. Soybean having the greatest mean cover recorded the lowest runoff at the end of the period. The study further demonstrated the potential for protecting sloppy lands by cultivating plants with large canopies reducing runoff and soil erosion. It is also inferred that the relationship between crop cover and the amount of runoff, varies with the growth stages, crop canopy and the spacing of plants on the field.

Keywords: runoff, soil erosion, vegetative cover, moderately sloppy experimental plots, crop canopy, crop growth stages

G4

[33]

## **THE POTENTIALS OF CROP DIVERSIFICATION FOR INCREASED FARM PROFITABILITY AND CLIMATE CHANGE ADAPTATION: A REVIEW**

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### **ABSTRACT**

Agriculture under the era of climate change is never the same again. Farmers are faced with the task to assess, adopt and implement climate change adaptation strategies in order to remain in business. These they do under the pressure of supplying adequate food and fibre for the consumers, and making profit simultaneously. The adoption of crop diversification came with a promise to provide farmers with an opportunity to meet the increasing demands for food, while making profits. This it does through its three strategies, namely: crop rotation, cover and inter-cropping. Hence, this paper extensively reviewed literature on the potential of crop diversification towards increased farm profitability and climate change adaptation. The study aimed at assessing the impact of crop diversification on crop production, the potentials of crop diversification for climate change adaptation and farm profitability as well as to evaluate the constraints faced with farmers in the implementation of crop diversification. The findings shows that majority of smallholder farmers in uses crop rotation and intercropping as their main strategies. It was further discovered that farmers experience some challenges such as: farmland size, access to water and the lack of financial support to be the most impeding factors in the adoption of crop diversification strategies. It is therefore, recommended that extension services work with farmers to assist source funds to ensure adoption and implementation of crop diversification with ease. These will not only help the farmer, but contributes to the growth and development of smallholder farmers so they can transition from smallholder to commercial farming.

Keywords: challenges, adoption, adaptation, profitability and smallholder farmers

G5

[34]

## **ASSESSMENT OF FUEL SAVING AND CO<sub>2</sub> MITIGATION OF IMPROVED COOK STOVES IN TRIBAL HOUSEHOLD KITCHENS**

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### **ABSTRACT**

A study on “Assessment of fuel saving and CO<sub>2</sub> Mitigation of Improved Cook Stoves in Tribal Household Kitchens” was undertaken. The objectives of the study were (i) To assess fuel saving and CO<sub>2</sub> mitigation potential of different cook stoves in tribal household kitchens. An exploratory and experimental research design was used to analyze the study. For the present investigation, two tribal panchayat samities i.e. Gogunda and sayra were selected purposively. From the selected panchayat samities, one village from each panchayat samitie namely Challi from Gogunda and Bisama from sayra were selected purposively for the study. For assessing the fuel efficiency and CO<sub>2</sub> mitigation potential of different cook stoves in tribal household kitchens, twenty households from both the village (ten from each village) who were willing to install improved cook stoves was taken for experimental analysis. To achieve the results of the present study, the information collected in each phase was scored, coded, categorized, converted into tables, calculated in percentage and analysed through statistical analysis. The major finding of the study reveals that the traditional cookstove has thermal efficiency by approximately 10 percent while consuming approximately 5 kg of fuel per day to prepare two meals a day with average family size five members. The double-pot cookstove can save approximately 1050 kg of fuel wood per annum. The double pot improved cookstove can save approximately 1670 kg of CO<sub>2</sub> per annum, by saving fuel wood.

Keywords: cook stove, fuel saving, household, kitchen and mitigation, thermal efficiency

G6

[35]

## EFFECT OF BIOCHAR AND COMPOST ON CARBON MINERALIZATION OF A CORN GROWING ALFISOL IN DRY ZONE OF SRI LANKA

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### ABSTRACT

Organic matter (OM) application to soils affects not only the content but also different fractions of soil organic carbon (SOC) and rate of SOC mineralization. However, the impact varies depending on the quantity and quality of the applied OM. The effect of OM application on SOC mineralization and fractions of a corn growing Alfisol in the dry zone of Sri Lanka were studied. Rice husk biochar (RH-BC), corn cob biochar (CC-BC) and compost were applied in a field experiment at a rate of 17 Mg ha<sup>-1</sup> (one time) and 10 Mg ha<sup>-1</sup> (four times), respectively and cultivated with corn for two years (i.e., four seasons). Control treatment with no organic amendment also maintained. Soils collected after OM application and end of 2 years were incubated for 28 days to monitor CO<sub>2</sub> emissions gravimetrically. Nonlinear regression analysis revealed that rate of organic carbon (OC) mineralization in all treatments was significantly low after 2 years. At both times, cumulative CO<sub>2</sub> emissions were significantly high in compost amended soils but low in RH-BC amended soils when compared to the control treatment. Biochar applied soils recorded a significantly ( $p < 0.01$ ) high light fraction at both times and occluded fraction after 2 years, when considering the compost added treatment. Though all treatments resulted a decrease in SOC after 2 years, biochar applied soils recorded a significantly higher SOC contents (1.15% in RH-BC and 0.99% in CC-BC), compared to the compost added treatment (0.89%). Therefore, the results show RH-BC is a better organic amendment than the compost or CC-BC for increasing SOC and reducing CO<sub>2</sub> emissions in the studied Alfisol. The research needs to be extended for further observations in SOC mineralization.

Keywords: biochar, compost, soil organic carbon fractions, carbon mineralization

G7

[36]

## FERTILIZER INDUCED CHANGES IN PHOSPHORUS FRACTIONS AND AVAILABILITY IN PADDY GROWING ALFISOLS OF SRI LANKA

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### ABSTRACT

Phosphorus (P) is considered as the most limiting element after Nitrogen in rice growing Alfisols. Inorganic and organic fertilizer application can alter contents of different forms of P in agricultural soils affecting P availability to plants. Changes in P fractions after P fertilizer application were determined in rice growing Alfisols in Sri Lanka. Forty soil samples were analyzed for Olsen P (O-P) and Mehlich-3 P (M3-P) contents and P fixation capacity (P150). Four soils with contrasting O-P contents, i.e. 6.6 mg /kg (S1); 8.2 mg /kg (S2); 20.8 mg /kg (S3), and 54.8 mg/kg (S4), were selected. A pot experiment was conducted using rice var Bg 250 under flooded conditions with two P rates (0 and 24 mg/kg soil) as triple super phosphate. After harvesting rice plants, P fractions in soils were determined using the Hedley's method. A large variation in soil P indices was observed among paddy growing soils with mean±standard deviation values of O-P: 11.6±10.9 mg kg<sup>-1</sup> and P150 :414±174 mg kg<sup>-1</sup>. The O-P contents were positively correlated with M3-P (r=0.60, p<0.001). Significant (p<0.1) changes due to P application were observed in total P concentrations in a given fraction extracted from different soils. Water extractable P content has been significantly increased due to P application in S4 where the highest O-P was observed among the four soils. In contrast 0.1M HCl extractable P content was increased significantly after P application in S1 that had the highest P150. The soil (S2) with the lowest P150 content significantly increased the 0.5M NaHCO<sub>3</sub> extractable P after fertilizer P application. Further studies are required to better understand the dynamics of the P fractions in rice growing Alfisols.

Keywords: alfisols, p fractions, available p, lowland soils, paddy

G8

[37]

## VARIATION IN PH AND ELECTRICAL CONDUCTIVITY IN SOIL SAMPLES COLLECTED FROM PADDY LANDS IN SRI LANKA

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### ABSTRACT

Rice is the staple food for Sri Lankans, and it is widely grown under flooded or alternate wetting and drying conditions in the lowlands of Sri Lanka. Soil pH (soil reactions) and Electrical Conductivity (EC) are considered as two major chemical properties which determine the soil nutrient availability and ultimately crop yield. Therefore, this study was conducted to study the variation of soil pH and EC in soil samples collected from different (1) rice growing soil types, (2) agro-climatic zones (ACZ), and (3) sources of water used for rice cultivation (i.e., major irrigation, minor irrigation or rainfed). Total of 1300 soil samples representing six ACZs (except for Upcountry Wet zone) and water sources were collected through a stratified random sampling approach. In the laboratory, 10 g of airdried and sieved soil sample was mixed with 50 mL of distilled water. Then the sample was allowed to shaken for two hours on an orbital shaker at room temperature. Finally soil pH and EC were measured using pH and EC meter. Soil EC values were in the range of 130  $\mu\text{Scm}^{-1}$  to 1068  $\mu\text{Scm}^{-1}$ , and were differed among ACZs ( $P < 0.05$ ). Up country Intermediate zone recorded the highest (597.7  $\mu\text{Scm}^{-1}$ ) EC value than other ACZ. Soil EC was similar among water sources used for paddy cultivation ( $P > 0.05$ ). Soil pH was differed among ACZs and water sources used ( $P < 0.05$ ). The pH of the paddy soil samples was in the range of 3.01 to 7.63. Soil pH of the samples collected from rainfed fields were lower (4.2) than the soil samples collected from major (5.2) and minor (5.3) irrigation areas ( $P < 0.05$ ). Low country Wet zone recorded the lowest pH (4.26) and Low country Dry zone recorded the highest pH (5.30). This knowledge can effectively be used in managing lowland paddy fields in Sri Lanka.

Keywords: agro-climatic zones, electrical conductivity, irrigation, paddy, pH

G9

[38]

**ECONOMIC BURDEN IN PADDY CULTIVATION: DETERMINE THE NITROGEN AND PHOSPHORUS LEACHING LOSSES FROM INTENSIVELY MANAGED PADDY FIELD UNDER CONTROLLED RUN-OFF CONDITION THROUGH GREY WATER FOOTPRINT APPROACH**

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**ABSTRACT**

Paddy is an important food crop in Asia which demands for high level of Nitrogen and Phosphorus that supplied in straight chemical fertilizers. When use of such high amount of chemical fertilizers, only a portion absorbed by plant and other fraction loss through volatilization, denitrification as same as seeps into the ground water or run-off into the surface water causing economically losses, environmental issues and health problems. This research is designed to quantify the leaching amounts of Nitrogen (as NO<sub>3</sub><sup>-</sup> -N) and Phosphorus and Grey Water Footprint (WFgrey) in controlled run-off condition of paddy cultivation in Rice Research and Development Institute in Low Country Intermediate Zone, Sri Lanka for four consecutive growing seasons from 2015 to 2016 for same rice variety (BG 358). The leachate from the study plots were collected throughout the cropping period and were quantified the total amount of leached NO<sub>3</sub><sup>-</sup> -N and total Phosphate for each cropping season. The leaching losses of NO<sub>3</sub>-N and Phosphate accounted for 8.6 ± 1.8 kg ha<sup>-1</sup> and 0.5 ± 0.1 kg ha<sup>-1</sup> respectively. It contributed 8% of urea and 2% Triple Super Phosphate out of total amount of applied fertilizers. N Fertilizer and P Fertilizer-induce WFgrey for production of one tonne of paddy were quantified as 183 m<sup>3</sup> t<sup>-1</sup> and 58 m<sup>3</sup> t<sup>-1</sup> respectively thereby causing water pollution. The losses of fertilizers from paddy field caused for economic loss. That economic burden could be minimized by controlling the fertilizer losses from the field via enhancing the fertilizer efficiency.

Keywords: paddy, nitrate, phosphate, grey water footprint

G10

[39]

**DEVELOPMENT OF A TOOL TO CALCULATE GREENHOUSE GAS  
REDUCTION ACCORDING TO REDII IN THE BIOMETHANE FUEL SECTOR IN  
GERMANY**

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For biofuels such as biomethane in the form of Bio-Liquefied-Natural-Gas and Bio-Compressed-Natural-Gas, greenhouse gas (GHG) emissions are already taken into consideration during supply and are a crucial criterion in meeting the GHG-quota. Accordingly, proof of GHG-reductions is a precondition for the use of biomethane in the fuel-sector. The GHG mitigation is thereby based on a calculation logic that is partially defined in the REDII. Interviews with biomethane-plant-operators have shown, that the calculation logic of GHG-reduction is too complex for many operators and prevents them from entering the fuel sector as a result. It clearly shows, that both profound knowledge about the basics of REDII as well as the scientific basics are indispensable. On this basis, we developed a Software, to create the GHG-balance for the plant-operators both more easily and rapidly. To calculate the GHG-reduction, the plant-operator merely has to fill out a questionnaire about the plant and the respective input substrates. This data can be submitted into the tool after which the plant-operator immediately receives a GHG-balance in form of a PDF document. In general, the tool has shown that a GHG-balance can be produced immediately, summarizing the GHG-reductions in a report of results. Additionally, the individual GHG calculation, generated by the tool, provides better GHG-reductions than by using default values. In this respect, consultations with industry stakeholders have already shown positive feedback. It can also be concluded from this feedback however, that the tool should be transferred into a web-based version in the long term. The long-term goal should be to create a licensed tool for plant operators. Furthermore, an official approval on European level should be examined.

Keywords: biomethane, greenhouse gas (GHG) emissions, biogas, biofuels, renewable energy for sustainable agriculture, renewable energy sources

G11

[40]

## APPLICATION OF CHEMICAL FERTILIZER IN PADDY CULTIVATION AND WATER POLLUTION DUE TO LEACHATE

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### ABSTRACT

Application of fertilizer in paddy cultivation could threaten water resources with their pollution, where only a fraction of fertilizer being absorbed to the plant while the rest is being leached and reached to ground and surface waters. The current research attempted to investigate water pollution by Nitrate-nitrogen ( $\text{NO}_3^-$ -N) and Phosphate-phosphorus ( $\text{PO}_4^{3-}$ -P) in paddy using a Lysimeter experiment in Low Country Intermediate Zone, Sri Lanka. Non-weighable lysimeters were arranged as per Complete Randomized Block Design (CRBD) with two factors and two levels at two sites in the 2015 Yala season for four three consecutive cropping seasons. The results revealed that a loss of  $\text{NO}_3^-$ -N through leaching accounted for  $8.6 \text{ kg ha}^{-1}$  (8%) for controlled run-off situation and  $3.0 \text{ kg ha}^{-1}$  (3%) for continual run-off situation. The leaching losses of  $\text{PO}_4^{3-}$ -P were  $0.5 \text{ kg ha}^{-1}$  (2%) for both sites. The relationship between  $\text{NO}_3^-$ -N leaching losses and site (controlled run-off and continuous run-off) and gradient (upper and lower) were highly statistically significant, while cropping season (Yala and Maha) and year (2015 and 2016) were not statistically significant at the significant level of 0.05. The relationship between  $\text{PO}_4^{3-}$ -P leaching losses, year and gradient were statistically significant. However, site and cropping season were not statistically significant. This study revealed that the critical element for water pollution was nitrate and a considerable amount of nitrogen and phosphorous leaching losses could occur through paddy cultivation. The results of this study highlight the urgent need for managing fertilizer related water pollution in agricultural areas.

Keywords: paddy, nitrate, and phosphate leaching

G12

[41]

## SOIL PHYSICAL PROPERTIES IN TWO INTENSIVE VEGETABLE CULTIVATING SYSTEMS IN THE CENTRAL HIGHLAND OF SRI LANKA

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### ABSTRACT

Soil quality assessment has been recognized as an important step towards understanding long-term effects of agro-management practices. Most vegetable cropping systems in Sri Lanka are characterized by repeated tillage, over or under fertilization, limited crop rotation with short lived crops could seriously threaten soil physical properties which cannot be restored easily, once degraded. This study determines soil physical quality status in two intensive vegetable cultivating systems of Sri Lanka. Fifty fields of each were selected, from Nuwara Eliya (NE) and Marassana (M). Soil samples were collected from the top soil (0-10 cm) and analyzed for total carbon (TC), texture, bulk density (BD), Saturated-hydraulic conductivity (Ks), wet-aggregate stability (WAS) and field capacity (FC). Result indicated that sand, clay, BD, WAS, C, Ks and FC were significantly different in two contrasting systems at  $p < 0.05$ . Mean sand content was greater in M (66.58%) compared to NE (48.26%) while BD (1.36 gcm<sup>-3</sup>) was higher in M than in NE (1.18 gcm<sup>-3</sup>). WAS was 91.66% in NE soils while it was 65.97% in M and TC % was positively correlated with WAS in NE but in M, it was correlated with textural properties probably due to lower C inputs and high sand content. FC of the NE was 4% and Ks was 5% greater compared to M. Results of this study indicated that frequent tillage and low SOC contents will lower the structural stability and high BD in soils that could lead to lower productivity in vegetable cultivating systems at M. We concluded that more C inputs and proper management practices which preserve OC in soil is needed to improve soil physical properties in M region.

Keywords: physical properties, intensive vegetable cultivation, soil quality, ultisols

H1

[42]

## IMPACT OF ESTABLISHING A FARMER CORPORATION TO REACH THE WELFARE OF FARMERS

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### ABSTRACT

Farmer corporations, a priority program that must be realized to improve the welfare of farmers who are the main support for economic growth in facing challenges, during Covid-19 pandemic. The problem in Indonesia is that most farmers only have a narrow farming scale or less than 0.5 ha, it is almost impossible for farmers to organize themselves effectively and efficiently. For this reason, the research aims to analyze the extent to which the interests of farmers' corporations in improving the welfare of farmers. The research method is sourced from relevant stakeholders from the farmer level to the government, using a SWOT analysis and supporting secondary data, which was carried out in Demak Regency, Central Java Province. The results show that the rice farmer corporations in Demak Regency started from the Citra Kinaraya Multipurpose Cooperative (KSU) as a Primary Cooperative with its main business being the cultivation and marketing of specially packaged rice. Some of the products that have been produced include brown rice, black rice, milky rice and genki rice (mix) with a rice production capacity of around 40-50 tons/month. This capacity has only reached about 5% of the production target of around 875-1000 tons/special rice/month, which is produced from a harvested area of 18-20 ha/day. Currently the Citra Kinaraya Multipurpose Cooperative is developing into a Provincial Primary Cooperative by consolidating farmers outside the district. Demak, namely Kab. Kudus, Grobogan, Banyumas, Sragen, Semarang and Purworejo. In 2020, it has been initiated that this corporation will become a Farmer Corporations Major Project implemented by the Ministry of Agriculture involving Ministries/Agencies and Local Governments and serve as a benchmark in developing 345 Farmer Corporations until 2024

Keywords: farmers, corporation, program, economics, welfare

H2

[43]

**GROWTH AND YIELD PERFORMANCE OF RICE (*Oryza sativa* VAR. NSIC Rc222)  
AT VARYING LEVELS OF NITROGEN FERTILIZER UNDER CARCAR CITY  
CONDITIONS**

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The appropriate rate of Nitrogen fertilizer application assures optimum returns in rice fields. Thus, this study was conducted to a.) evaluate the growth and yield performance of NSIC Rc222; b.) identify the best nitrogen fertilizer level; and, c.) evaluate the profitability of NSIC Rc222 at different levels of nitrogen under Carcar City condition. Field experiments were conducted during dry season from January 31 to May 5, 2020. The area was laid out in Randomized Complete Block Design (RCBD) with three replications. Five nitrogen levels (0,150,120,100 and 75 kg N/ha<sup>-1</sup>) were designated as treatments. Differences were noted on agronomic characteristics, root and shoot parameters as well as yield and yield components. Results showed that application of fertilizer at the rate of 75-60-60 NP<sub>2</sub>O<sub>5</sub>K<sub>2</sub>O significantly headed and matured earlier at 81.67 and 101 days after planting and grew for about 89.10 cm tall. But was comparable to other treatments excluding no fertilizer application. However, application of fertilizer at 120-60-60 NP<sub>2</sub>O<sub>5</sub>K<sub>2</sub>O significantly increased its productive tillers, panicle length, percent filled spikelets, weight of grains per hill, weight of 1000 grains and lower unfilled spikelets. Further, the use of 120-60-60 NP<sub>2</sub>O<sub>5</sub>K<sub>2</sub>O produces higher grain yield of 4.39 t/ha and has a net income of PHP 82,880, followed by 100, 75, 150 and 0 nitrogen with corresponding net income value of 72,895, 66,320, 54,070, and 26,900 pesos per hectare, respectively. Meanwhile, optimum yield and return over cost of production was attained at the rate of 120 N fertilizer application.

Keywords: agronomic characteristic, yield components, root-shoot parameters, economic analysis

H3

[44]

## PERFORMANCE OF SOYBEAN SEED PRODUCTION AND EMERGING TRENDS UNDER CENTRAL EUROPEAN CONDITIONS

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### ABSTRACT

Due to the increase in the world population, the need for sustainable sources has become more critical than ever. With the growing planting areas of legume crops, increased attention has been paid to the ecological security concern. The feed market analysis in Europe indicates that the soybean (*Glycine max* L.) plant is the leading protein crop. However, soybean production in Europe reached 9.5 million tons in the 2021 season, and Europe is still dependent on protein imports. This imbalance between production and consumption results in economic and trade problems. This study aims to determine the soybean seed's production under the various Central European biotic and abiotic stresses. Therefore, this study was conducted to evaluate the effects of the continuously growing importance of soybean and the possible future emerging trends which may require a response to food security and economic crisis. Due to the growing demand for food and feed, the competence in the processing of the soybean industry is crucial. Sustainable management principles affect many interrelated areas similarly to social, economic and environmental parameters. Therefore, sustainable intensification of the agricultural sector might balance the severe effects of climate change and society's growing concern for the environment.

Keywords: *Glycine max* L., soybean, legume crops, seed production, sustainability, food security

H4

[45]

# **LAND-USE PATTERN OF RICE-BASED CROPPING SYSTEMS IN BATTICALOA DISTRICT IN SRI LANKA; AN EMPIRICAL STUDY**

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## **ABSTRACT**

Batticaloa is a major rice growing district in Sri Lanka which is located in the Low country Dry zone, and contributes to approximately 7% of the paddy production in the country during Maha season. The study was carried to assess the rice cultivation practices in Batticaloa district. For that, survey was conducted at the end of the Maha season 2021/22. Data were gathered using structured questionnaire from 780 farmers selected from major paddy track in district through the Agriculture Instructors attached to the Department of Agriculture. From each track, one randomly selected farmer was selected. Information on the rice variety cultivated, fertilizer management practices adopted, water sources used for paddy cultivation and cropping pattern were collected. Results revealed that At 362 was the most widely cultivated rice variety (28.8%) followed by Bg 366 (12%) and At 308 (8.1%). With respect to fertilizer management practices adopted by the farmers, less than 25% of farmers had applied urea and triple super phosphate. However, more than 80% of the farmers had applied muriate of potash. Moreover, 99% of the farmers had applied organic and other types of fertilizers. This includes liquid fertilizers containing multiple elements, fish tonic, bio-fertilizers and organic fertilizer mixtures. Out of the fields surveyed, 47% and 42% of the fields were managed under rainfed or major irrigation systems, respectively. Vegetables (0.28%) and other field crops (0.28%) were grown in paddy lands other than rice (88.21%) as major crops during the previous Yala season. Rest of the lands was kept as fallow. These findings will be useful in making decisions related to the nutrient management in rice-based cropping systems in Batticaloa district.

Keywords: fertilizer, paddy, rice-based cropping systems, variety

Financial assistance from the World Bank, under the Accelerating Higher Education Expansion and Development (AHEAD) (Grant No AHEAD/RA3/DOR/AGRI/PERA-No16)

H5

[46]

## ANALYSIS OF THE SUSTAINABLE DEVELOPMENT GOALS AND ITS RELATION TO PSYCHOLOGICAL STRESS

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### **ABSTRACT**

Psychological health is imperative for the physical constitution of an individual and is intimately related to Sustainable development goals of good health and wellbeing, poverty and employment. Decision making, relationship conflicts, problem solving, as well as chronic health issues faced by an individual, are all influenced by their psychological state. To have a complete understanding, the perceptions of the sustainable development goals with respect to the psychometric analysis of the respondents are verified in this study. The present investigation seeks to estimate the prevalence of challenges in physiological health in association with the SDG in a sample of 150 women from Amsore village in Uttarakhand. All the participants were evaluated by using a two-part semi-structured questionnaire to collect information regarding psychological complaints. Majority of the respondents reported psychosomatic issues like anxiety, instability, obliviousness, incompetency, scepticism and stress-induced appetite reduction causing a severe impact on their social fellowship, interpersonal decision making and parenting style which raises serious concerns over harmonious commissioning of SDGs among the population. The results suggest perspectives for the psychological assistance to eliminate the risk factors and thereby preventing psychological stress.

Keywords- SDG's, psychological health, women empowerment, Wellbeing

H6

[47]

## **NATURAL FARMING IN MODERN TIME: CHANGING CONTEXT AND NEED OF HOUR**

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### **ABSTRACT**

Depending on the issues of productivity, economics, environmental health, climate change effect, resource availability and socio-economic factors in India, alternative forms to substitute high input based modern agriculture are emerging and being practiced by farmers. However, since 2000, after fatigue of Green Revolution, ill health effect and global pressure to protect environmental and soil health, conventional organic, conservation chemical, natural farming, zero budget natural farming and organic farming are prominent farming practices being suggested for sustainability in agriculture bringing a balance in all 3 pillars viz; social, economic and environment of sustainability. Within the generic term 'Natural Farming', there are many sets of practices that could be labelled as agro-ecological or natural but there is a need to codify it in a broader basket of natural farming based on the principles of natural farming. There is a difference of approaches of use of external inputs and use of set of standards between organic and natural farming, though both have many common principles and practices. Community based natural farming with innovative approaches of social linkages, institute collaborations and participatory sharing of resources can help in risk management under changing climate, complex, risk and low input driven situations. India should take the advantage of carbon trading, water footprint, ecological footprint by adopting natural farming in suitable low input and high input areas through better technical skills and resources.

Keywords: natural farming, modern agriculture, sustainability, India, strategies

H7

[48]

**AWARENESS OF CONSUMERS TOWARDS SUSTAINABLE CONSUMPTION**Vyas R<sup>1\*</sup> and Mishra S<sup>2</sup>

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**ABSTRACT**

There is a growing concern for ever increasing levels of consumption in a world full of finite resources and natural ecosystems. Consumption is a physical process of consuming resources. A crucial challenge to achieve sustainability is counteracting the current unsustainable consumption. It has contributed to resource exhaustion, environmental pollution, climate change problems and many more that the world is facing today. To overcome these problems SDGs have been planned to achieve more sustainable lives for all by 2030 and focuses on urgent actions to combat climate change and its impacts, ensuring sustainable consumption and production patterns thereby make cities and human settlements inclusive, safe, resilient and sustainable. The study assesses the awareness of consumers towards sustainable consumption of resources available to them. A validated and pilot tested questionnaire was distributed to the most active group of 240 consumers in the age group of 18-45 years to elicit information regarding their consumption patterns and find out a relationship between sustainable consumption, environment and climate change. The results revealed a significant relationship between awareness towards sustainable consumption, income and education level of consumers. The data revealed that approximately 60 per cent of the consumers belonged to middle income group and were graduates who focused more on money saving products rather than environment saving products. Only 30 per cent of the consumers were engaged in adopting a more sustainable lifestyle and one-fourth of the consumers i.e., 25 per cent have stopped buying certain products due to environmental concerns. The determinants of sustainable consumption elicited were higher cost of eco-friendly products, availability, limited options, income, unawareness, personal preferences and product quality. The study shows there is a need to make consumers more aware towards their environment, changing climate change and sustainable lifestyle.

Keywords: sustainable consumption, environment, climate change

H8

[49]

## RESPONSE OF PROM AND BIODYNAMIC MANURE ON PRODUCTIVITY OF ORGANIC BLACKGRAM

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### ABSTRACT

India is also one of the leading countries in terms of area under cultivation and production of pulses but suffers on the productivity front. Blackgram is one of the major pulses grown in the country. Being a pulse crop, the nitrogen requirement of the blackgram is very less and phosphorus plays a major role in its development being the most important macronutrient. PROM can be utilised as one of the potential input and the two commonly used biodynamic preparations BD-500 and BD-501 can also be utilised for the improvement in the productivity and profitability of organic blackgram. The one season experiment has shown a promising result on the use of phosphate rich organic manure (PROM), BD-500 and BD-501 on the cultivation of blackgram. It can be inferred from the results that the application of organic inputs like 100 per cent RDP + BD-500 (75 g ha<sup>-1</sup>) + BD-501 (2.5 g ha<sup>-1</sup>) and 75 per cent RDP + BD-500 (75 g ha<sup>-1</sup>) + BD-501 (2.5 g ha<sup>-1</sup>) are most efficient and equally effective for obtaining high quantum and quality of growth, yield and quality of the organic blackgram. These treatments were also economically viable. Being equally efficient, application of 75 per cent RDP + BD-500 (75 g ha<sup>-1</sup>) + BD-501 (2.5 g ha<sup>-1</sup>) was suggested over 100 per cent RDP + BD-500 (75 g ha<sup>-1</sup>) + BD-501 (2.5 g ha<sup>-1</sup>), to save the amount of input application.

Keywords: PROM, biodynamic, sustainability, India

H9

[50]

## A REVIEW OF PLANT LEAF DISEASE DETECTION AND CLASSIFICATION BY DEEP LEARNING APPROACHES

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### ABSTRACT

Agriculture is an important sector in India. In developing country like India, employment opportunities are provided on large scale. The agriculture comprises of many crops and nearly 70% of the population is depending on agriculture. In this particular study, we have collected more than 30 papers that are published on plant leaf disease identification and classification using Deep Learning algorithms. The plant leaf disease can be occurred by various factors like bacteria, viruses and fungus etc. Identifying the infected leaves is a demanding task for a farmer and also for a researcher. Now-a-days, farmers are using pesticides on the plants, as a result it affects the human health directly or indirectly and it causes economical loss. Plant Disease Detection techniques are used by the researchers in order to prevent it and the disease is be identified on time. This study will be a helpful resource for the researchers to identify specific type of plant leaf diseases through deep learning techniques. This paper presents a detailed survey on different papers of various plant leaf diseases depending upon some important criteria like number of classes (diseases and healthy), size of image dataset, pre-processing, image segmentation, types of classifiers, accuracy of classifiers etc.

Keywords: deep learning, plant leaf disease detection, classification, transfer

H10

[51]

## UTILIZATION OF PHYTOECDYSTEROIDS IN IMPROVING SERICULTURE PRODUCTIVITY

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### ABSTRACT

The utilization of phytoecdysteroids (PEs) to improve productivity was established in this investigation. High performance liquid chromatography (HPLC-LC-MS) was employed to confirm the occurrence of 20-hydroxyecdysone, the standard PE used from locally available plants which included *Amaranthus spinosus*, *Ipomea pes-capre* and *Portulaca oleracea*. Chromatogram of *P. oleracea* and *I. pes-capre* presented peaks with retention times not significantly different from the standard, indicating presence of 20-hydroxyecdysone. Phytoecdysteroids from the plant sources manifested synchronized maturation of fifth instar silkworms administered per os at 116, 92, 76, 52, 28 hours before spinning with 100% and 50% concentrations. *A. spinosus* does not necessarily contain 20-hydroxyecdysone but its analogue which contributed similar effects with *P. oleracea* and *I. pes-capre*. Control groups of silkworms took approximately 7 hours while 2-3 hours for silkworms treated with PEs for complete maturation, consequently reducing the larval period. There were significant effects on the economic cocoon characters namely, effective rearing rate (ERR), single cocoon weight, cocoon shell ratio, filament length, filament weight and denier regardless of plants sources of PEs, concentration, PE's time of application and their interactions. The benefit-cost ratio (BCR) of 1.06 was highest at the administration of PEs 52 hours before spinning while 92 and 72 hours provided 1.01 regardless of plant sources of PEs and concentrations. Lastly, there was an approximate 40% of time saved during the mounting of matured silkworms for cocoon production. The use of PEs made a reduction of costs in cocoon production and increasing efficiency in silkworm rearing, improving productivity in sericulture, hence, increasing the income of sericulture farmers.

Keywords: sericulture, synchronization, phytoecdysteroid, 20-hydroxyecdysone, economic cocoon characters, benefit-cost ratio

J1

[52]

## EFFECT OF ABIOTIC ELICITORS ON PHYTOCHEMICAL ACCUMULATION IN COCOYAM

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### ABSTRACT

Phytochemicals are products of plant secondary metabolites used by plants in the defence against pests, diseases and other environmental factors. However, these phytochemicals are produced in small amount and may not be adequate for their defence. Plant phytochemicals can be enhanced through elicitation with biotic and abiotic elicitors, there are reports on successful use of biotic and abiotic elicitors in culture room to enhance secondary metabolite production. In this study, we made attempt to increase the quantities of secondary metabolites produced in cocoyam plants by using extracts of ginger, turmeric and garlic rhizomes respectively as abiotic elicitors. 7 groups of one month old potted cocoyam plants were treated for three days with daily foliar applications of the abiotic elicitors. Respectively, groups 1 and 2 received 1% and 5% of ginger extract, 3 and 4 received 1% and 5% of garlic extract, 5 and 6 received 1% and 5% of turmeric extract and group 7 the control received distilled water. The phytochemical levels were measured before and after the treatments. The results showed in general, a dose dependent increase in some specific phytochemicals in the different treatment groups. The application of ginger extract caused highest accumulation of flavonoids ( $3.1\mu\text{g g}^{-1}$ ), alkaloids ( $0.7\mu\text{g g}^{-1}$ ) and phenols ( $0.8\mu\text{g g}^{-1}$ ); application of garlic and turmeric caused highest accumulation of tannins ( $0.8\mu\text{g g}^{-1}$ ) while the highest value for anthocyanin ( $0.7\mu\text{g g}^{-1}$ ) was obtained with the application of turmeric. These increases were significantly higher than the observations in the control. Therefore, foliar application of biotic elicitors promises to be a sustainable way to increase phytochemicals in plants and should be explored for pest and disease management.

Keywords: elicitor, phytochemical, ginger, garlic and turmeric

J2

[53]

**PERFORMANCE OF SEED HUB IN ENHANCING THE QUALITY SEED  
PRODUCTION OF PULSES IN BUNDELKHAND REGION OF UTTAR PRADESH,  
INDIA**

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**ABSTRACT**

Seed hub programme initiated by government of India realising the provision of quality seed in enhancing the production and productivity. Quality seed production is the most critical component for ensuring quality seed supply of pulses at farmer's door steps. Thus, the programme initiated through creation of 150 seed hubs nationwide for increasing indigenous production of pulses. Since, the Bundelkhand as major pulse growing region, seed hub initiated at four Krishi Vigyan Kendras and one at Band University of Agriculture and Technology (BUAT), Banda. The present attempt is to assess the performance of seed hub programme among the 4 KVK's under BUAT, Banda viz. Jalaun, Hamirpur, Mahoba and Lalitpur of Bundelkhand, Uttar Pradesh. Before the commencement of Seed hub scheme in 2016-17, the pulse seed production activities majorly confined to the KVKs farm but with the infrastructural establishment of seed processing plant and storage go down under the scheme, the participatory seed production boosted from 2018-19. The production of four KVKs accounted 5200 quintal quality pulse seed in which, pea contributes maximum (31%) followed by chick pea (26%), lentil (18%), urdbean (15%) pigeonpea (7%) and moongbean (5%) in the total production during 2018-19 to 2020-21, out of which more than 72 percent production were from participation of the farmers. The foundation and certified seed of 18 newly released varieties (under 10 years) of pulses produced which further majorly disposed to state agriculture department, other agencies and farmers. As estimated, the disposed seed is utilized in more than 7500 ha area and benefitted around 23000 farmers per acre basis. The replacement of seed alone increases additional production of 5500 quintal which resulted in additional income of Rs. 3.25cr in Bundelkhand. Further to compute the gains from the project, the KVK's soon reach at break-even point. The KVKs generated cumulative fund of Rs. 3.35 crin the financial year 2020-21 whereas the initial fund release was of Rs. 1 cras revolving fund per KVK. Thereafter the NPV, IRR and B: C computed for the individual KVK under seed hub.

Keywords: seed hub, quality seed production, pulses, KVK, Bundelkhand

J3

[54]

## **EFFECT OF PLANT ESSENTIAL OILS ON PHYTOTOXIC RESPONSES OF CHILLI (*Capsicum annum*) SEEDLINGS**

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### **ABSTRACT**

Excessive use of pesticides can adversely affect the growth of non-target host plants in different ways. Pesticide-induced phytotoxicity can effect non-target plants through elevated levels of reactive oxygen species (ROS) responsible for detrimental effects on cell metabolism and biochemical and other physiological activities. In response to phytotoxicity, plant activates an antioxidant defence system consisting of both enzymatic and non-enzymatic components. In the present investigation, three plant essential oils; Nutmeg oil, Black pepper oil and Clove stem oil were assessed for causing phytotoxicity in chilli. The phytotoxicity induced by these pesticides and plant essential oils at five different concentrations; ¼ X, ½ X, ¾ X, 1 X, and 2 X of chili seedlings were evaluated. Following essential oils exposure for 2 days with 7 days intervals, leaf area, plant height, electrolyte leakage (EL), total chlorophyll content, cell viability, total soluble protein content (TSP), total soluble sugar (TSS), and proline level were measured. Three essential oils-induced concentration and time-dependent phytotoxic responses on chili seedling. According to inhibition concentrations (IC<sub>50</sub>/EC<sub>50</sub>), all the essential oil induced, concentration and time-dependent phytotoxic responses in chili seedlings. Pepper oil is more phytotoxic than Nutmeg and Clove stem oils. Analysis of the data revealed that essential oil application at higher concentrations significantly elevated phytotoxicity. The study concludes excessive use of three plant essential oils adversely effect for the chilli seedling growth. These lines of research work will help to figure out the mechanistic insight and contribute to the development of cleaner crops for minimizing pesticide accumulation.

Keywords: black pepper, clove, nutmeg, oxidative stress

J4

[55]

**EFFECT OF DIFFERENT TRANSPLANTING DATES AND SHOCK PREVENTING METHODS ON THE PERFORMANCE PEARL MILLET (*Pennisetum typhoides* L.) VARIETIES**

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**ABSTRACT**

A field experiment was conducted on loamy sand soil at the Rajasthan Agricultural Research Institute, Durgapura, Jaipur, during two consecutive kharif seasons in 2019 and 2020. The experiment comprises two pearl millet varieties (RHB-173 and RHB-177), four transplanting shock preventing methods (No treatment, Triacantanol @ 0.25 ml/litre, Triacantanol @ 0.50 ml/litre and Leaf clipping) and three dates of transplanting (15<sup>th</sup> – 30<sup>th</sup> June, 1<sup>st</sup> – 15<sup>th</sup> July and 16<sup>th</sup> – 31<sup>st</sup> July) replicated thrice in factorial randomized block design. Result revealed that pear millet growth parameters, yield attributes and yields, net returns and B: C ratio were significantly higher with hybrid RHB-173 as compared to RHB-177. Among transplanting shock preventing methods, triacantanol @ 0.50 ml/litre showed significantly higher plant population, crop growth parameters, yield characteristics and yields, net returns and B: C ratio were significantly as compared to no treatment and leaf clipping, but it remained at par with its lower dose treatment triacantanol @ 0.25 ml/litre. Result further revealed that transplanting of pear millet during 1<sup>st</sup> – 15<sup>th</sup> July gave higher plant population, growth and yield attributes, grain yield, net returns and B: C ratio as compared to 15<sup>th</sup> – 30<sup>th</sup> June, but it remained at par with transplanting during 16<sup>th</sup> – 31<sup>st</sup> July.

Keywords: pearl millet, climate, transplanting, growth, yield, B: C ratio

J5

[56]

## **RICE HUSK BIOCHAR AFFECTS YIELD AND NUTRIENT UPTAKE OF RICE PLANTS IN DRY ZONE SOILS OF SRI LANKA**

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### **ABSTRACT**

Rice husk biochar is a widely used soil amendment to improve soil fertility and crop productivity. However, information on response of rice crop to rice husk biochar application in Dry Zone paddy growing soils of Sri Lanka are lacking. This study assesses the yield and nutrient uptake by rice crop after incorporating rice husk biochar to rice growing soils compared to the farmer soil management practice. The experiment was conducted in rice growing Dry Zone Alfisols in Mahakanumulla area, located in North Central Province of Sri Lanka. Rice husk biochar was produced using an improved batch pyrolizer, “Kunthaniya”, at a temperature of 450°C - 650°C. Twenty rice growing farmers were randomly selected and rice husk biochar was applied (20 t/ha) a plot (100 m<sup>2</sup>) in each farmer’s field during the 2021 Yala season. Inorganic fertilizers were applied according to rates of farmer fertilizer practice. Grain and straw yields were measured in biochar applied plot and farmer managed plot. Crop N, P and K uptake were determined at the end of the growing season. The average grain yield of biochar applied treatment (7.4 Mg ha<sup>-1</sup>, SE±0.5) was higher than the yield of farmer management treatment (7.0 Mg ha<sup>-1</sup>), however this difference was not statistically significant ( $p>0.1$ ). While N and P uptake were not affected, straw yield and straw K content in biochar applied treatment has been increased significantly by 15% and 13% respectively ( $p<0.1$ ) compared to the farmer practice. The results indicated that the application of rice husk biochar to rice growing soils can increase crop K uptake through soil fertility improvement due to increased K availability for the rice crop.

Keywords: rice husk biochar, rice, potassium, Sri Lanka, alfisols, soil

J6

[57]

## NUTRIENT PROFILING OF MELON VARIETIES AT DIFFERENT DEVELOPMENTAL STAGES AND ITS RELATION WITH FRUIT CRACKING

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### ABSTRACT

Melon (*Cucumis melo* L.) is an important cash crop that is grown and consumed all over the world. According to the FAO, the global melon production is 32 million tons from 1.4 million hectare of land. Fruit cracking is a physiological disorder that reduces marketable fruit yield of melon. Plant mineral nutrient concentrations have significant roles on fruit quality characteristics, which influence consumer preference and marketability. The current study was conducted in the experimental field of the Department of Botany, University of Kerala using two different melon varieties, *Cucumis melo* var. *momordica* (Roxb.) Duthie & Fuller (Snap melon) and *Cucumis melo* var. *acidulus* L. Naudin (culinary melon), from January to October 2021. Fruits were harvested at five development stages such as 5, 10, 15, 20 and 25 days after pollination and were analysed for major, secondary and micronutrients in the fruit peel and pulp separately. Results showed that pomological characteristics (fruit size, fruit weight, fruit length, peel thickness etc.) in both the varieties showed significant changes at different growth stages studied. Phosphorus content in the fruit peel was higher in the var. *momordica* at the fruit cracking stage compared to var. *acidulus*. But the potassium content in the fruit peel was low ( $5.3 \pm 2\%$ ) in var. *momordica* at the fruit cracking stage compared to var. *acidulus* ( $7.5 \pm 2\%$ ) and similar differences were also observed in the fruit pulp of both varieties. Micronutrients such as zinc and boron concentrations were lower in var. *momordica* in fruit cracking stage compared to var. *acidulus*. Imbalance in phosphorous and potassium ratio and lower concentrations of calcium and zinc in var. *momordica* can be considered as one of the reasons for its low shelf life and preharvest fruit cracking.

Keywords: melon, fruit cracking, nutrient profile, physiological disorder

K1

[58]

## INNOVATIVE OMICS-BASED APPROACHES FOR REDUCING POST-HARVEST FOOD LOSSES

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### ABSTRACT

The aim of post-harvest product control is to delay spoilage and senescence of agricultural products, by slowing down the natural maturation process and avoiding their quality loss. A wise management of several parameters, such as temperature, O<sub>2</sub>/CO<sub>2</sub> ratio in controlled atmosphere, ethylene levels is necessary to prevent food from becoming unconsumable in short time. However, post-harvest treatments frequently interfere with maturation, resulting into a reduction of the peculiar sensorial and nutritional qualities of the product. In order to limit this effect, in recent times innovative and less invasive methods were investigated, on the basis of the newly available plant genomes. It became possible to analyze phenotypes directly influencing food quality and ripening progression, as well as to unveil complex mechanisms such as the metabolomic, genomic and transcriptomic changes occurring during the post-harvest period. Differentially expressed genes analysis and genetic approaches were adopted to individuate candidate genes related to crop quality traits. Moreover, the recently developed genome editing methods are opening new perspectives to prevent post-harvest food losses. In this work, the aim is to provide a brief overview of the most innovative omics-based methods and of the related techniques, showing some literature examples of studies successfully identifying genes responsible for ripening and senescence progression. We are confident that the novel omics approaches will positively impact these food post-harvest management issues, also proposing new useful insights to be used in breeding programs.

Keywords: post-harvest technologies, post-harvest food losses, genomics, omics approaches, genome editing

K2

[59]

## IMPORTANCE OF GRAM POD BORER MANAGEMENT FOR THE SUSTAINABLE YIELD OF CHICKPEA IN BUNDELKHAND REGION OF UTTAR PRADESH, INDIA

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### ABSTRACT

Bundelkhand region of Uttar Pradesh comprising seven districts namely Banda, Chitrakoot, Mahoba, Hamirpur, Jalaun, Jhansi and Lalitpur is known as pulse bowl of the state contributing 1.35 million tonnes (56.93 per cent) of total pulse production covering 1.21 million hectare area (53 per cent) in 2019-20 of the state. The chickpea is the leading crop in the region covering 0.44 million hectare area (36.5 per cent) with 0.63 million tonnes yield (46.6 per cent) among grown pulses. The average productivity of the chickpea of Bundelkhand region is 1.43 tonnes per hectare compared to 1.37 tonnes per hectare of UP. The climate of the region is well suited for the crop but the synchronization of podding stage of host with peak population of *Helicoverpa armigera* Hübner causes huge losses (up to 90 per cent) and sometimes to the failures of the crop. This is due to its regular occurrence from the vegetative growth to the pod formation stage. Though the concerted efforts have been made by the scientists for the development of high yielding and insect tolerant varieties which has resulted in the increase of yield but the infestation of gram pod borer, *H. armigera* Hübner is still challenging. The development of less preferred / tolerant varieties and the recommendation of effective low dosages of newer molecules of insecticides are contributing in the management of larval population but become inadequate during the synchronization of podding with the high population of pod borer. Considering the climate change, it is becoming essential to find out the suitable sowing time when host can escape the infestation of *H. armigera* by completing the maturity. The use of nipping of plants before flowering is also important in minimizing the population by taking out the early instars from the field. The role of larval parasitoids, *Campoplex chlorideae* Uchida is enormous and plays significant role in the larval management. Many predaceous birds, namely Mynah and Black Drongo are very common in chickpea crop ecosystem during podding stage and their predation can be increased by provision of bird perches in the fields. The inter/mixed cropping systems with certain crops has been found effective in reducing the damage by pod borer. This may be a result of the companion crop harboring higher numbers of natural enemies or non-preference for egg laying by pod borer in a field containing the intercrop. Coriander and other nectar-rich plants encourage parasitoid activity. Considering all these, it feels necessary to integrate all available control techniques to reduce the pest population in the form of effective integrated pest management.

Keywords: *Helicoverpa armigera*, gram pod borer, integrated pest management, chickpea

K3

[60]

**POPULATION STRUCTURE, PATHOGENICITY, AND FUNGICIDE SENSITIVITY  
OF *Colletotrichum* SPECIES CAUSING STRAWBERRY ANTHRACNOSE IN  
EASTERN CHINA**

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**ABSTRACT**

Strawberry anthracnose caused by *Colletotrichum* species is one of the most serious diseases in strawberry fields of China and worldwide, *C. siamense* and *C. fructicola* were found to be the dominant species of *Colletotrichum*. Our group collected 196 *Colletotrichum* strains which were isolated from diseased strawberry plant samples (leaves and crowns) from eight provinces of eastern China. Based on the phylogenetic analysis of the combined ITS and TUB2 alignment and the colony morphological characteristics on PDA, all of these *Colletotrichum* isolates were initially identified as the *C. gloeosporioides* species complex. Among them, 62 strains were chosen for further identification to the species level via phylogenetic analyses of multi-locus sequences of ITS, GAPDH, ACT, ApMAT, CAL, and TUB2. Three species were identified: *C. siamense*, *C. fructicola*, and *C. aenigma*. Isolates of *C. siamense* were tolerant to high temperatures, with a significantly larger colony diameter than the other two species when grown at temperatures above 36°C. Inoculation of strawberry plants confirmed the pathogenicity of all three species. Isolates of *C. siamense* resulted in the highest disease severity. The in vitro sensitivity of *C. siamense* and *C. fructicola* isolates to azoxystrobin and three DMI fungicides (difenoconazole, tebuconazole, and prochloraz) was determined. Both the species were sensitive to prochloraz, tebuconazole, and difenoconazole, but not to azoxystrobin. *C. siamense* isolates were more sensitive to prochloraz than *C. fructicola* isolates. *C. fructicola* isolates were more sensitive to difenoconazole and tebuconazole than *C. siamense* isolates. The present study provides valuable information for effective management of strawberry anthracnose.

Keywords: strawberry, anthracnose, *Colletotrichum*, fungicide

K4

[61]

## EFFECTS OF VARIETY, DEFICIT DRIP IRRIGATION AND RICE STRAW MULCH ON FLOWERING, FRUITING AND YIELD OF TOMATO

*(Lycopersicon esculentus L.)*

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### ABSTRACT

Tomato (*Lycopersicon esculentum* L.) is one of the most important vegetables in the world and its demand has increased making factors affecting its production very key for evaluation. The yields of tomato in Ghana are generally low, as such being supplemented by imports from neighbouring countries. This study investigated the effects of deficit drip irrigation and mulch on flower count, flower abortion, fruiting and yield of two tomato varieties. The experiment was carried out at Savannah Agricultural Research Institute (SARI) experimental field at Nyankpala, Tamale in Ghana from November 2020 to March 2021. It was a 2 x 3 x 3 factorial experiment laid out in a split-split plot design with two tomato varieties (Pectomech and Mongal F1), three drip irrigation regimes: 50%, 75% and 100% of actual crop evapotranspiration (ET 50, 75, 100) and three levels of rice straw mulch (0, 3 and 6 tha<sup>-1</sup>) in four replications. The output of the CROPWAT model indicated highest seasonal water requirement of tomato to be 564 mm at ET100 whilst the lowest of 282 mm at ET50. Soil analysis revealed the soil textural class to be sandy loam with a field capacity of 18.2% at the top-soil, whilst the subsurface soil was 18%. Significant ( $p < 0.05$ ) differences in flower count, flower abortion, fruiting and total fruit yield as influenced by irrigation regime and mulch were observed. Highest total fruit yield of 13.46 tha<sup>-1</sup> was obtained with combined use of Mongal F1 and of ET100, whilst the lowest of 2.04 tha<sup>-1</sup> was recorded from Pectomech tomato and ET50. Therefore, ET100 regime and the Mongal F1 variety could be recommended for sustainable production of tomato.

Key words: deficit irrigation, straw mulching, pectomech, mongal f1, total fruit yield

K5

[62]

**WATER MANAGEMENT PRACTICES AMONG DRY SEASON IRRIGATED  
VEGETABLE FARMERS AS IT REFLECTS THEIR SOCIO-ECONOMIC  
CHARACTERISTICS, IN JIMETA, ADAMAWA STATE, NIGERIA**

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**ABSTRACT**

This study analyzed water management practices among dry season irrigated vegetable farmers as it shows how their socioeconomic characteristics affects their adoption of improved water management practices in Jimeta, Yola North local government area, Adamawa State, Nigeria. The data for this study were obtained by purposive sampling of 100 farmers. To describe the socioeconomic characteristics of the farmers as it affects their water management practices, descriptive analytical tools such as frequencies and tables were used. The finding reveals that 86 percent were males and 45 percent were between the ages of 41-50 years old. Among the sampled population 70 percent are married with family sizes of 44 percent which have a family size of 6 to 10 children. Educationally, 40 percent have non-formal education with 55 percent of the vegetable farmers with farm sizes of 0 to 5 acres. Irrigation farming experience shows that 43 percent have above 25 years' experience, 85 percent rent their farms and 65 percent depend on hired labour on the farms. Farmers membership of cooperative groups shows 57 percent do not belong to a group, 81 percent are involved in other economic activities and 100 percent have never tasted the irrigation water the use. The sampled population shows 60 percent do not know of any improved water management, 69 percent shows negative attitude towards improved management practices and 74 percent shows radio as the major source of agricultural information.

Keywords: sustainable, resource, production, agricultural

L1

[63]

## HARVESTING AGE, YIELD AND NUTRITIVE VALUE OF HYBRID MAIZE VARIETIES FOR FODDER PRODUCTION IN THE MID-COUNTRY, INTERMEDIATE-ZONE

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### ABSTRACT

The scarcity of fodder maize (*Zea mays* L.) varieties in Sri Lanka compelled the farmers to grow grain maize varieties for fodder. Present study investigated the harvesting age, growth, yield and nutritive value (green-chop, silage) of hybrid maize varieties being developed for fodder (PAC-2075720, PAC-2075920, CAI-111) in comparison with grain maize variety (PAC-999SG) popular as fodder in mid-country, intermediate-zone (MCIZ). Maize seeds were sown in early March, 2021 as a Randomized Complete Block Design (n=4) and managed according to the recommendations of Department of Agriculture. They were harvested at 80 and 90 days of age. Plant height, stem diameter, leaf area index and fresh fodder (FM) yield were not different ( $p>0.05$ ) between 80 and 90 days. However, greater DM percentage at 90 days resulted all varieties to recorded greater ( $P<0.01$ ) DM yield at 90 days (19.50–22.93 MT/ha) compared to 80 days (15.89–17.52 MT/ha), hence nutritive value of fodder at 90 days were analyzed. Maize varieties were not different ( $p>0.05$ ) in percentage crude protein (9.57-9.73), neutral detergent fiber (62.22-69.70) and acid detergent lignin (9.56-11.78). Although, CAI-111 had taller plants with wider stems and produced greater FM yield ( $p<0.05$ ), their DM and organic matter (OM) contents were the lowest ( $p<0.05$ ). While PAC-2075720, PAC-2075920 and PAC-999SG were not different ( $p>0.05$ ) in OM digestibility (64.09-65.61%) and metabolizable energy (ME, 9.56-9.80 MJ/kg DM) they were greater than CAI-111 ( $p<0.05$ ). More importantly, fodder of the grain maize variety PAC-999SG was superior ( $p<0.05$ ) to others in terms of digestible OM (14.25 MT/ha) and ME (224.23 GJ/ha) yield. Silage produced from maize varieties were comparable ( $p>0.05$ ) and acceptable in terms of pH, DM, Soluble carbohydrates, lactic acid, OM digestibility and ME levels (4.09-4.22, 25.24-31.55%, 2.18-2.80%, 2.51-3.92%, 61.13-69.37% and 9.10-10.37 MJ/kg DM, respectively). Present investigation recommends harvesting hybrid maize varieties for fodder at 90 days in MCIZ. It does not support introduction of PAC-2075720, PAC-2075920 and CAI-111 varieties being developed in place of the grain maize variety PAC-999SG for fodder production in MCIZ. Further, genetic improvement on forage qualities of PAC-2075720, PAC-2075920 and CAI-111 is suggested prior to release them as fodder varieties.

Keywords: fodder, silage, dry matter yield, digestibility, metabolizable energy

L2

[64]

## EFFECT OF PRE AND POST EMERGENCE HERBICIDES ON WEED CONTROL EFFICIENCY AND PRODUCTIVITY OF BLACKGRAM (*Vigna mungo* L.)

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### ABSTRACT

Blackgram (*Vigna mungo* L.) is one of the most important pulse crop grown across India. In blackgram, heavy weed infestation during rainy season is the main factor for low productivity of the crop. A field experiment was conducted on clay loam soil during Kharif season, to study the bio-efficacy of combination of herbicides against complex weed flora of blackgram. The experiment consisted of thirteen weed control treatments comprising of Pendimethalin 750 g/ha PE; Pendimethalin 750 g PE /ha fb IC and HW at 40 DAS; Imazethapyr + Pendimethalin (RM)- 750g/ha; Imazethapyr + Pendimethalin (RM) 750g/h fb mechanical weeding at 40 DAS; Imazethapyr 60 g/ha PoE; Imazethapyr + Imazamox 60 g/ha PoE; Acifluorfen + Clodinofof propargyl 245 g/ha PoE; Imazethapyr + Quizalofop-ethyl (TM) 60 + 60 g/ha PoE ; Imazethapyr + Propaquizafop 60 + 75 g/ha; Oxyfluorfen + Imazethapyr 150+75 PE(2 DAS)+ PoE (15-20 DAS) ; IC fb hand weeding at 20 and 40 days after sowing and weedy check (control) that replicated thrice in RBD. Application of Imazethapyr 10% SL 60 g/ha + Propaquizafop 10% EC 75 g /ha (Tank Mix) at 15- 20 DAS recorded lowest weed dry matter (7.01 g/m<sup>2</sup>) at 60 DAS and it was found at par with Imazethapyr 10% SL + quizalofop-ethyl 5% EC 60 g/ha (Tank Mix) at 15- 20 DAS and Imazethapyr + Imazamox 60 g/ha PoE. Maximum weed control efficiency at 60 DAS of total weed flora (89.59%) recorded with same treatment followed by Imazethapyr 10% SL + quizalofop-ethyl 5% EC 60 g/ha (88.13%) at 15- 20 DAS and Imazethapyr + Imazamox 60 g/ha PoE (86.97%). Highest seed yield (755.67 kg/ha) was recorded with IC fb hand weeding at 20 and 40 days after sowing and it was found at par with application of Imazethapyr 10% SL + quizalofop-ethyl 5% EC 60 g a.i/ha (Tank Mix) at 15- 20 DAS and Imazethapyr + Imazamox 60 g/ha PoE. The highest net returns (Rs. 35092/ha) and BC ratio (2.0) were realized with early post-emergence application of Imazethapyr + Imazamox 60 g a.i/ha at 15- 20 DAS. It is concluded that post-emergence application of Imazethapyr + Imazamox 60 g/ha at 3-4 leaf stage or 15-20 DAS appears to be a promising weed management practice for managing broad spectrum weeds and obtaining higher seed yield and profitability of kharif blackgram.

Keywords: blackgram, pre and post emergence herbicides, seed yield, weed control efficiency

L3

[65]

### **CASE STUDY: SHOULD THE NON-DESCRIPTIVE (LOCAL) BUFFALO HERDS IN WALIGEPOLA, SRI LANKA BE UPGRADED USING MURRAH SEMEN?**

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#### **ABSTRACT**

Fat in buffalo milk greatly influence the milk price and taste of Curd (Meekiri). The annual milk production of 1,800 buffalo milch cows in Rathnapura District was only 1,7 million liters. However, buffalo farmers in Waligepola veterinary division of Rathnapura District reluctant to upgrade the non-descriptive (Local), low producing buffalo herds by artificially inseminating (AI) the cows with Murrah semen. They believe that Murrah crossbred cows produce milk with low fat content. The present study investigated the influence of genetic make-up (Non-descriptive vs. Murrah crossbred) and stage of lactation on milk fat content of buffalos managed in Waligepola veterinary division. The experiment was conducted as a randomized complete block design (n=10). Non-descriptive and Murrah crossbred buffalo cows in the second or third lactations were divided into 3 groups based on the stage of lactation; early-lactation (4-12 weeks), mid-lactation (13-24 weeks) and late-lactation (25-32 weeks). The cows were hand milked once a day at 6.00 a.m. and the milk fat content of each cow was determined. Both genotype and stage of lactation significantly ( $p < 0.05$ ) influenced the milk fat content. The mean milk fat content during the 32 weeks lactation of Murrah crossbred buffalos were greater ( $P < 0.05$ ) compared to that of Non-descriptive buffalos ( $6.98 \pm 0.22$  % vs.  $6.38 \pm 0.20$  %). Particularly during the mid-lactation period, Murrah crossbred buffalos had greater ( $p < 0.05$ ) milk fat content compared to that of Non-descriptive buffalos ( $7.35 \pm 0.23$  % vs.  $6.40 \pm 0.16$  %). Further, in both genotypes milk fat percentage gradually increased with advancing the lactation period. Thus, the present study concludes that upgrading the Non-descriptive buffalos using Murrah semen resulted greater milk fat content in Murrah crossbred buffalo cows. Therefore, farmers should be convinced to inseminate the Non-descriptive buffalo cows using Murrah semen and upgrade the herds.

**Keywords:** murrah crossbred, milk fat content, stage of lactation, artificial insemination (AI)

# POSTER PRESENTATIONS

P1

[66]

## EVALUATION OF DIFFERENT POULTRY BREEDS UNDER ORGANIC PRODUCTION SYSTEM

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### ABSTRACT

An experiment was designed to evaluate growth and production performance of four poultry breeds namely Mewari, Rhode Island Red, Kadaknath and Pratapdhan, to assess the suitability of chicken germplasm for organic poultry management system. Ninety straight run chicks of four weeks of age of each breed were randomly divided into three replicates of 30 chicks in each. Birds were housed in backyard housing system as per standards of organic poultry farming. Chicks were offered isonitrogenous and isocaloric chicks feed (CP- 21% and ME 2900 Kcal) up to 8 weeks of age thereafter grower feed (CP-17% and ME - 2600 Kcal) up to 20 weeks of age and then layer feed (CP-17% and ME – 2700 Kcal) up to 40 weeks of age was given. The birds had access to free choice water throughout experimental period. The feed intake was affected by the breeds which was significantly ( $<0.05$ ) higher in Pratapdhan (4501.85 g) followed by Mewari (3467.53g), RIR (3748.22g) and Kadaknath (2829.76g), respectively. The body weight gain was significantly higher in Pratapdhan (1462.93 g) followed by Rhode Island Red (1054.78 g), however, lower gain in body weight was observed in Mewari (779.10 g) and Kadaknath (799.44 g), respectively. The feed conversion efficiency was 3.56, 3.82, 3.93 and 4.20, respectively in Pratapdhan, RIR, Kadkanath and Mewari chicken but the difference among different breeds was non-significant. Based on results of stress biomarkers, it was found that the stress level was higher in RIR as compared to other breeds. Looking to the growth, feed conversion ratio and economics it may be inferred that the performance of Pratapdhan was better among all the breeds studied when reared under organic management system.

Keywords: breed, backyard, organic feed, production system

P2

[67]

## **ASSESSMENT OF GENETIC VARIABILITY AND CHARACTER ASSOCIATION FOR YIELD AND ITS COMPONENT TRAITS IN BARLEY (*Hordeum Vulgare* L.)**

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### **ABSTRACT**

Genetic variability and character association were studied for grain yield and its components in 29 genotypes including 15 crosses, 12 lines and 2 commercial varieties of barley. These genotypes were evaluated in Randomized Block Design during Rabi, 2020-21. The results indicated significant differences among the genotypes for all the traits viz., days to maturity, tillers per plant, spike length, number of grains per spike, grain yield per plant, hectoliter weight, bold grain, husk content, protein content and starch content indicating the presence of sufficient variability among the genotypes for various traits. The values of phenotypic coefficient of variation (PCV) were slightly higher than that of genotypic coefficient of variation (GCV) for all the traits studied, indicating less effect of environment on the expression of characters studied. The high values of PCV and GCV were observed for grain yield per plant, biological yield per plant, tillers per plant, spike length, grains per spike and husk content. The high heritability coupled with high genetic advance as percent of mean was observed for biological yield per plant, grain yield per plant, tillers per plant, spike length, grains per spike, husk content, bold grain and protein content indicating a predominance of additive gene effects for these traits. In the present investigation, grain yield was positively and significantly correlated with tillers per plant, biological yield, spike length, grains per spike, bold grain, plant height and days to maturity. The biological yield had a positive significant correlation coefficient and it showed the highest positive direct effect on grain yield. Therefore, greater emphasis should be given to these characters while selecting for higher yield and related traits.

Keywords: barley, character association, genetic advance, GCV, PCV, heritability



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