RUFORUM
Capacity Building in Agriculture

02ND RUFORUM Triennial Conference
12-16 August 2024
Namibia

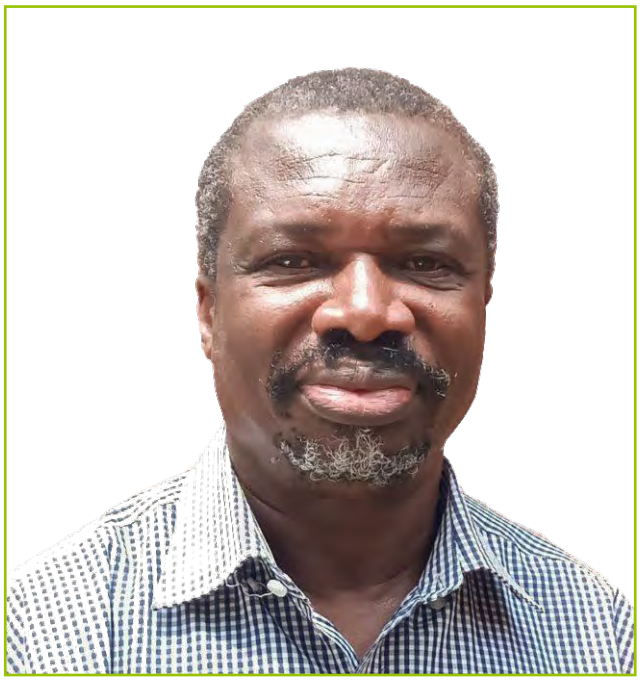
20th Anniversary
RUFORUM
2004-2024

RUFORUM Working Document Series
Volume 23 (1) 2024

BOOK OF ABSTRACTS

ISSN 1607 - 9345

FOREWORD



The Second RUFORUM Triennial Conference unfolded under the compelling theme, "Operationalising Higher Agricultural Education and Research Ecosystems for Innovation, Industrialisation and Economic Development in Africa: A Call for Action." This gathering marked a significant chapter in redefining how universities can contribute to Africa's socio-economic progress. Central to the discussions was a collective commitment to reshaping education, turning knowledge into action, fostering innovation within industries, and enhancing learning pathways into sustainable livelihoods.

These proceedings encapsulate the valuable insights drawn from various research findings and policy discussions that emerged during the conference. They reflect the strong academic involvement that characterizes the RUFORUM network and provide a strategic framework for leveraging African higher agricultural education to tackle urgent development challenges. As the continent navigates demographic changes, climate challenges, and shifting global markets, the imperative to strengthen ties between academia, industry, and government has never been more urgent.

The proceedings shine a spotlight on innovative research initiatives, essential institutional reforms, and youth-centric programs that demonstrate how African universities are driving industrialization and promoting inclusive economic growth. They also emphasize the need for resilient research ecosystems, investments in entrepreneurial education, and collaboration across various sectors.

We extend our heartfelt thanks to all contributors, including students, educators, researchers, policymakers, and private sector partners, whose invaluable work and insights enrich this publication. It is our hope that these proceedings will ignite renewed dedication and proactive initiatives across Africa and beyond.
Together, let us heed this call for action.

Prof. Majaliwa Mwanjalolo
Manager Research, Innovation and Development

PRESENTED ABSTRACTS

Thematic Area 1:
Educating Africa-Implementing Transformative Higher Agricultural Education to meet Africa's Human Capital Needs

Subtheme 1a: Supplying Africa's 2nd decade (2024-2034) work force

VENUE: Mercure Hotel, Room KUISEB 1
CHAIR: Prof. Goretti Nabanoga, Makerere University
RAPPORTEUR: Dr. Allan Waniale and Dr. Blessing Odogwu

RUFORUM Working Document Series (ISSN 1607-9345), 2024, No. 23
Available from http://repository.ruforum.org

Abstract No: 001 -OP
Session: Supplying Africa's 2nd decade (2024-2034) work force
Date and Time: **Wednesday 14 Aug. 2024 | 08:35 - 08:45**

Exploring the gap: Assessing the discrepancies between traditional graduate training and modern research demands

Mageto, P.

Africa University, 1 Fairview Rd, Old Mutare, Zimbabwe
Corresponding Author: dvc@africau.edu

The changing world of work requires equipping students with an entrepreneurial attitude that enables them adapt to rapid technological advancements, interdisciplinarity, focus on real-world applications and societal impact. It is therefore imperative that graduate training programmes equip students with these abilities for increased work transitions. A study was conducted to investigate the ability of traditional graduate training to meet the evolving demands of modern research and cross disciplinarity that equips students for the emerging world of work in science. Both qualitative and quantitative data were obtained from key stakeholders including academic advisors, industry professionals and funding agency representatives. To clarify the research landscape, similar themes and patterns were identified by subjecting the data to thematic analysis. The study shows that whereas traditional graduate training programs are excellent at developing disciplinary expertise and research skills, they are unable to equip students with entrepreneurial skills, interdisciplinary collaboration, project management and communication skills. These major skill gaps are essential for work transitioning of graduate into the modern research landscape, which values interdisciplinary research, team science, and translational outcomes. The findings of this study highlight the urgent need for universities and research institutions to re-evaluate and restructure graduate training programs to bridge the gap between traditional educational models and contemporary research demands.

Keywords: Graduate training, research landscape, soft-skills, work transitions

Abstract No: 002 -OP
Session: Supplying Africa's 2nd decade (2024-2034) work force
Date and Time: Wednesday 14 Aug. 2024 | 08:35 - 08:45

Building the future one health workforce in eastern and southern Africa: Gaps and opportunities in higher education

Richards, S.

International Livestock Research Institute (ILRI), Old Naivasha Road, P.O. Box 30709, Nairobi 00100, Kenya
Corresponding Author: s.richards@cgiar.org

The Quadripartite and the One Health High-Level Expert Panel have emphasized investing in the One-Health (OH) workforce to effectively address its development issues. However, there is limited consensus on required competencies that also vary widely and may not align with regional needs, posing challenges for training and research initiatives. This study aimed to develop an inventory of OH education offered by Higher Education Institutes (HEIs) in Eastern and Southern Africa (ESA) as well as define the competencies relevant for OH training in the region. A survey involving HEIs offering OH education in 11 countries of ESA was conducted focusing on key informants. These were purposively sampled using criteria such as expertise and involvement in OH programmes. Snowball sampling was used to identify additional HEIs or individuals. Data on OH education programmes, competencies, resource-needs, and employability of graduates were collected. Results were validated by OH education experts in each country. Descriptive statistics were used for data analysis. Forty-two questionnaires from 29 HEIs were completed, involving 166 education interventions. 69% of the courses contributed to a degree, and 21% contributed to degree/diploma award with 10% missing data. Master's degree programmes were predominant. The essential technical competencies for the OH workforce included epidemiology, OH principles, infection, antimicrobial resistance, and numerous cross-cutting skills. There is a diverse landscape of OH education across HEIs in ESA. While technical competencies were recognized as essential, standardization of competency frameworks and increased awareness of available OH education remain challenging due to disciplinary priorities. Strengthening OH education and workforce development in ESA necessitates greater collaboration and standardization of competency frameworks.

Keywords: Education, competencies, cross-cutting skills, one-health

Abstract No: 003 -OP
Session: Supplying Africa's 2nd decade (2024-2034) work force
Date and Time: Wednesday 14 Aug. 2024 | 08:45- 08:55

Leadership and institutional development for higher education institutions in Africa: The university of Port Harcourt experience

Owunari, A. G.

University of Port Harcourt. Address: PMB 5323. Choba Port Harcourt Rivers State Nigeria
Corresponding Author: owunari.georgewill@uniport.edu.ng

This paper focuses on leadership and institutional development for higher education institutions (HEIs) drawing from experiences at the University of Port Harcourt, Nigeria. The paper discusses two important issues of leadership and institutional development drawing from experiences at Port Harcourt university that have underpinned the transformation of the institution a leading academic institution in Nigeria and

Africa. Leadership in this context refers to guiding a group of persons in an organization to a desired direction of collective interests. Key elements of effective leadership include: good intelligence about the institution, team work, confidence and trust building among staff and students and the broader ecosystems, reward systems for celebrating achievements and productivity for staff, students and partners, and levering existing and emerging networks to facilitate leadership. By harnessing good-leadership qualities, the university is building the right academic business ecosystems that promote entrepreneurship in HEIs of Africa. Institutional development in this context, refers to steps or actions taken to create positive change and growth in an institution through effective mobilisation of its human, financial and natural resources.

Keywords: Entrepreneurship, institutional-transformational, soft-skills, transformational-leadership

Abstract No: 004 -OP
Session: Supplying Africa's 2nd decade (2024-2034) work force
Date and Time: Wednesday 14 Aug. 2024 | 09:05 - 09:15

Implementing transformative higher agricultural education to meet Africa's human capital needs: The Case of UM6P

El Habti, H.

Mohammed VI Polytechnic University, Lot 660, Hay Moulay Rachid Ben Guerir, 43150, Morocco
Corresponding Author: hasna.ziraoui@um6p.ma

Africa's agriculture faces a challenge of low productivity affecting its ability to effectively underpin development. Improving productivity requires among others, enhancement of labour productivity. Higher Education has a significant role in improving labour productivity by equipping the next generation of agriculture workers with necessary competencies to address emerging challenges. Generation of contemporary agri-innovations to solve production and productivity challenges is also needed. Africa's transition to a knowledge-based economy requires that universities converge, share knowledge and resources, and learn from each other to achieve success at scale. That is the mission of UM6P whose training programmes are underpinned by: (a) Implementing R&D in engineering, agriculture, energy-transition, healthcare, digitalization and urbanization; (b) Training forward-looking ethical thinker's, workers and leaders; (c) Providing tailored executive education and lifelong learning; (d) Providing entrepreneurship education and enabling environment for entrepreneurs. UM6P is implementing four actions that comprise its transformative education agenda: (1) Establishing a college of agriculture fit-for-purpose structured to reinforce synergies across research teams; linking extension services to research and training, and engaging the UM6P Africa Business School to implement a Master of Agribusiness Innovation that covers agriculture science, business management and innovation; (2) Strengthening doctoral training by improving access through strategic initiatives such as: 100 PhD for Africa and the African Scholarship Program with the CGIAR; (3) Designing an enabling environment for students to thrive by providing fair access to education by excluded communities- 75% of students receive scholarships, 59% of students are female, while digital learning enhance accesses and collaboration, and entrepreneurship and incubation programmes enhance innovation and; (4) Deploying non-conventional programs at scale such as the 1337 Coding School that uses peer learning to allow students unleash their creativity through project-based learning. The challenges notwithstanding, Africa's HEI's can by collectively leveraging each other's strengths contribute to development of a knowledge-based economy and competent workforce generation capable of addressing food sovereignty, climate adaptation, energy transition, and sustainable industrialization in Africa.

Keywords: Agricultural-education, partnerships, transformational-education

Abstract No: 005 -OP
Session: Supplying Africa's 2nd decade (2024-2034) work force
Date and Time: Wednesday 14 Aug. 2024 | 09:25 - 09:35

Training for the transformation of the agricultural sector in Benin: Ongoing experience at National University of Agriculture, Benin Republic

Djossa, A.B.,* Avocevou, A.C., Adandonon, A. & Chadare, F.J.

Université Nationale d'Agriculture, BP 114, Sakété, République du Bénin
***Corresponding Author:** djossabruno@gmail.com

Agriculture is the leading economic sector in Benin accounting for about 32.7% of GDP, 75% of export revenues, 15% state revenues and employs 70% of the population. Accordingly, Benin is emphasizing the development of its agricultural sector to strengthen food and nutrition security and increase household income and grow its economy by improving productivity and attractiveness of agriculture as an investment destination. The National University of Agriculture (UNA), as a higher education institution, strives to train competent workforce capable of effectively delivering on governments programmes that enhance economic growth, social welfare and wellbeing of population. UNA is doing so through a three-pronged approach i.e., 1) conducting applied research, to generate solutions for increasing agricultural production and productivity; co-creation through industry-university linkages that enhance entrepreneurship-oriented training and supports work transitions. Using these approaches UNA has developed technologies in the fields of mechanization and renewable energy for agriculture to reduce drudgery and enhance labour efficiency. The Partnerships with industry (professionals, companies and state institutions), bridges training and the realities of the professional world with industry providing internship placements as well as research and learning opportunities for students and staff. This model also enables the industry support university activities and education. Government focus on strengthening Technical and Vocational Education and Training (TVET) has also been integrated in the University that is training new types of teachers for TVETs. UNA has been chosen to develop and provide competence-based market-oriented training in collaboration with the University of KwaZulu-Natal. Such training often requires infrastructure and facilities that governments often do not sufficiently fund. To implement such opportunity, UNA is cost-leveraging its implementation through partnerships with other African universities and networks such as RUFORUM. The RUFORUM partnerships, enhances networking, resource mobilization, capacity building of staff and students, as well as policy engagement for mission delivery.

Keywords: Agricultural training, skills, jobs and entrepreneurship, TVETs, university-industry linkage, Benin

Abstract No: 006-OP
Session: Supplying Africa's 2nd decade (2024-2034) work force
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Effectiveness of entrepreneurship education courses in fostering entrepreneurial mindsets among undergraduate students: Insights from International University of Management's (IUM) Strategic Management Programme

Silohenda, A.

International University of Management, 21-31 Hercules Street, Dorado Park Ext 1, Windhoek, Namibia
*Corresponding Author: h.amuthenu@ium.edu.na

Entrepreneurship education can foster entrepreneurial mindsets and skills among students and the future workforce. However, the effectiveness of entrepreneurship education on venture creation remains a topical issue. This study assessed whether entrepreneurship education curriculum enhance student understanding of entrepreneurial concepts and their willingness to engage in venture creation activities. A mixed-methods approach was used to collect data on the assessment of entrepreneurship education. Quantitative data was collected through surveys administered to students, while qualitative data was obtained through focus group discussions involving in-depth interviews with selected students and faculty members. The survey questionnaire includes items designed to measure students' perceptions about venture creation before and after completing their entrepreneurship education. Preliminary findings show that IUM's entrepreneurship education courses may not significantly change students' perceptions about venture creation. Qualitative data provided insights into the challenges limitations the effectiveness of entrepreneurship education such as absence practical experiences, insufficient support networks, and perceived risks associated with entrepreneurship. The findings of this study highlight the need for re-evaluation and enhancement of entrepreneurship education courses within the strategic management of undergraduate degree program at IUM. The implications of these findings for skilling for the next generation of strategic managers is discussed.

Keywords: Entrepreneurial-education, entrepreneurial mindsets, future workforce, Namibia

Subtheme 1b: Emergent issue-Digitizing education

VENUE: Mercure Hotel, Room KUISEB 1
CHAIR: Prof. John Makokha, University of Nairobi
RAPPORTEUR: Dr. Mieshi Belay and Acila Mary Goretti Sr.

RUFORUM Working Document Series (ISSN 1607-9345), 2024, No. 23
Available from http://repository.ruforum.org

Abstract No: 007-OP
Session: Emergent issue-Digitizing education
Date and Time: **Wednesday 14 Aug. 2024 |10:35 - 10:45**

Advances in digital technologies: Opportunities and threats to quality graduate research and training in Africa

Mirembe, D.P.

College of Computing and Information Sciences, Makerere University, P.O.Box 7062, Kampala, Uganda
Corresponding author: dpmirembe@gmail.com; drake.mirembe@mak.ac.ug

Rapid advancement in digital technologies is changing the way in which graduate training and research is done in Africa and world over. The digital tools by nature are dynamic and pervasive, an attribute that allows education sector stakeholders to be more connected than ever before. These advancements unlock opportunity for enhancing the quality, accessibility for education and research and innovation. Collectively they allow innovative research methodologies to be applied across traditional knowledge spaces and boundaries through increased access to expertise, infrastructure ubiquitously. Today, virtual training and laboratories demonstrate the ability for technology to deliver graduate training more equitably. Artificial Intelligence (AI) an emerging field enhances the ability to manage complex tasks while enabling creativity for developing new theories, conducting in-depth research by academia. Therefore, AI is performing the role of the virtual assistant hence supplementing academic capabilities for the teacher. On the other hand, advances in digital technologies and their use for graduate training and research in Africa and world over poses some serious challenges. Africa is grappling with ICT Infrastructure deficiencies, electricity challenges, inadequate internet connectivity and technological resources that are affecting effective integration of digital tools in the education sector. The gap between digital migrant teachers and digital native students is affecting integration causing a digital divide which calls for more ICT literacy training. The inequalities in access and use of the advanced technologies are causing cybersecurity threats and data breaches which is causing integrity questions in the academic works from graduate students. Plagiarism is seen to be on the increase amongst graduate students since the world of free resources is around them and can't use them well for advancing academic excellence. Advancement in technology allow the world to be a global village hence allowing collaborative research to be eminent. This is causing copyright and patent abuse where some collaborative supervisors are taking graduate students research and publish them as their own without permission. This is causing erosion of the graduate training and research ethics hence threatening collaboration efforts across Africa.

Keywords: Artificial intelligence, digital tools, ducation quality

Abstract No: 08-OP
Session: Emergent issue-Digitizing education
Date and Time: Wednesday 14 Aug. 2024 |10:45 - 10:55

Generative artificial intelligence in academia: An exploration of AI-Sandbox experiments in higher education

Matlhoko, K.S., Tinta, N., Redelinghuys, N. & Combrink, H.M.V.E

University of Free State, P.O. Box 339 Bloemfontein, 9300
Corresponding Author: Ketshepileone@gmail.com

This study investigates the integration of Generative Artificial Intelligence (GAI), an efficient technology capable of creating human-like content, in the UFS. The focus is on the "AI-Sandbox" training for academic staff to use GAI tools for teaching, learning, and administrative tasks, particularly upskilling teachers who often lack digital skills. In the realm of writing, AI can improve efficiency and productivity by simplifying certain tasks. The aim of this study was to identify patterns in attitudes and user behaviour towards GAI technology in education. The study used the Technology Acceptance Model (TAM) to elucidate factors driving university staff's adoption of GAI. The AI-Sandbox' a structured and controlled environment for testing innovative technologies was used. Data collection was achieved through an online survey administered before and after the 'AI-Sandbox' experiments, and involved 89 participants. The study provided insights into the usage rate of different AI tools, the frequency of AI use, and the comfort level of staff using AI. The results indicate that the AI-Sandboxes assisted in increasing participants' understanding of GAI tools, with the overall majority (92.31%) agreeing that the experiments assisted their understanding. Furthermore, the AI-Sandboxes enhanced participants' level of comfortability with and adoption of GAI for higher education. Integrating GAI in higher education requires policy implementation and pedagogical shifts. It implies upskilling staff and making great changes in teaching methods. However, the reliance on digital devices and internet access highlights the digital divide, such as needing laptops, phones, and the internet.The AI-sandbox experiments proved to be a helpful tool in exploring GAI tools in education. The willingness of the participants to learn and explore what technology has to offer, despite uncertainties, indicates a positive attitude towards AI adoption.

Keywords: Acceptance, artificial intelligence, generative AI, higher education, regulatory sandbox

---

Abstract No: 09 -OP
Session: Emergent issue-Digitizing education
Date and Time: Wednesday 14 Aug. 2024 | 10:55 - 11:05

Examining the impact of ChatGPT Robot on critical thinking and innovation in Technical and Vocational Education and Training trainees: Implications for assessment and quality assurance

Kambeyo, L.[1] & Kapolo, B.[2]

[1]University of Namibia, Rundu Campus, P/Bag 88, Rundu
[2]Nakayale Vocational Training Centre, P O Box 910, Outapi
Corresponding Author: lkambeyo@unam.na

This study investigated the impact of Artificial Intelligence (AI), specifically the Chat Generative Pre-Trained Transformer (ChatGPT) Robot, on the critical thinking and innovation capabilities of students enrolled in Technical and Vocational Education and Training (TVET) programs. The aim was to assess how the integration of ChatGPT, affected the critical thinking skills of TVET students and their ability to

innovate. The study investigated the broader consequences of this integration for assessment practices and quality assurance within the TVET sector. We used a qualitative research approach, involving document analysis and interviews with TVET instructors. This methodology allows for a nuanced examination of the AI ChatGPT ramifications for both educational practices and assessment methods in TVET. The study found duality of this influence with ChatGPT, significantly enhancing students' critical thinking and innovation skills, fostering improved problem-solving abilities and deeper comprehension of intricate technical subjects. Conversely, also found that potential negative influence such as overreliance, dependency, and possible addiction to ChatGPT, which may hinder students' independent thinking and innovation capabilities. The study recommends a proactive approach to quality assurance that includes ongoing monitoring of AI integration in TVET. Quality assurance measures should encompass both AI-related benefits and potential challenges, ensuring that students do not over rely on AI tools. This approach aims to strike a balance between leveraging the advantages of AI and fostering students' independent thinking and innovation. Implications for future research include exploring the long-term effects of AI integration in TVET and developing strategies to mitigate overreliance while maximizing the benefits. Additionally, the development of guidelines for responsible AI use in TVET remains a promising area for further investigation.

Keywords: Artificial Intelligence, ChatGPT Robot, critical thinking, innovation, quality assurance

Abstract No: 010 -OP
Session: Emergent issue-Digitizing education
Date and Time: **Wednesday 14 Aug. 2024 | 11:05 - 11:15**

Remote sensing: The promise for geospatial science and big-data for better precision and foresight planning

Gidudu, A.

Faculty of technology, P.O.Box 7062 Kampala Uganda Makerere University
Corresponding Author: anthony.gidudu@gmail.com

Agriculture is the mainstay of several African economies, with the sector projected to be a 1 trillion US dollar economy by 2030. However, that vision of success captured in national to continental development blueprints can only happen if the continent harnesses science tools and services. Globalisation has unlocked opportunity for business at scale, while access to digital tools unlock opportunity to access and make precise decisions. For agriculture, precision tools and techniques, as well as advances in geospatial sciences can improve decision making required for increasing production and productivity. Precision tools in agriculture integrates various technologies by influencing how environmental information is collected, processed and used for decision making. Precision agriculture enhances water use efficiency, identifies optimal production environments, specifying when it can be done and the inputs needed among others. This requires lots of data (big data) for informing analyses and making meaningful inferences. Remote Sensing is one of the drivers of Precision Agriculture, impacting how data is collected, processed and results shared. By leveraging advances in earth observation, enable to collect data regularly, synoptically and accurately, unlocking opportunity for improved temporal, spatial, radiometric and spectral resolution in Precision Agriculture. The development of Unmanned Aerial Vehicles or drones coupled with Satellite technology, have increased capacity for imagery, at higher spatial resolution. Furthermore, faster processing speeds, cloud computing, and quantum computing, allow for greater data handling and analyses, enabling users and scientists make precise decisions that impact time and space boundaries. Adoption of machine learning and deep learning algorithms are ultimately improving the collection of detailed information. Notwithstanding these advances in science and innovation, there still remains the challenge of how results can be leveraged and developed into

products and services that benefit local farmers. Accordingly, there is need for growth of improved GSM connectivity and growth of local competence for development of local geospatial tools tailored to local circumstances. Other potential areas of application and opportunities from geospatial science and Big-Data for increasing agricultural value chain productivity are discussed.

Keywords: Digital applications, GSM, machine learning, precision-Agriculture, precision-tools

Abstract No: 011 -OP
Session: Emergent issue-Digitizing education
Date and Time: **Wednesday 14 Aug. 2024 | 11:15 - 11:25**

The Fourth industrial revolution (4IR): How can Africa leapfrog to deliver on its promise?

Otto, F.

Mountains of the Moon University, P. O. Box 837, Kasindikwa, Lake Saaka, Fort-Portal, Uganda
Corresponding Author: francis.otto@mmu.ac.ug

Industrialization underpinned by new science innovations has played a major role in advancement of human civilization on the earth. Science innovations were core to the rapid growth in the 18th century starting in 1760 as the first industrial revolution (1IR) that relied on water and steam driven mechanization. This transformed society from predominately agricultural and feudal societies to semi industrialized and urbanizing communities. The second industrial revolution (2IR) started in the 19th century underpinned by the invention of the internal combustion engine, driven by leading fossil fuels as well as electrification that led to rapid industrialization that moved by the world out of the great depression of the early 1900's. In the 1960's the world experienced another phase on industrialization (3IR), characterized by the use of electronics and information technology for automating production systems. Collectively, this led to marked economic growth across the world. Early this century the globe begun experiencing the fourth industrial surge characterized by automation and data driven systems in manufacture and other production systems that include among others cyber-physical systems, Internet of things, robotics, industrial internet of things, 3D printing, cloud computing, cognitive computing, and artificial intelligence. The 4IR enhances operational flexibility needed in any business environment to increase efficiencies and effectiveness as we fuse physical, digital and biological aspects of human enterprises. Africa has experienced an increase in broad band coverage with Eastern and Southern Africa leading in deployment of fifth generation (5G) network capability. This foundation can be leveraged to increase productivity and grow Africa's economy. Indeed, the African Union believes that the continent could leapfrog to the 4IR from the 3IR where it currently is, if the right skills, policies and investments are made. Africa's higher education and science ecosystems have a role to play by creating relevant products and services, as well as a competent human resource to underpin the adoption and leverage of the 4IR. Universities, governments and development partners must collectively address the challenges of funding, infrastructure, and skilling facing the continent if a leapfrog is to happen. This paper discusses the opportunities and requisite investments needed for Africa to harness 4IR.

Keywords: Africa 4IR, big data, data driven systems, industrialization

Abstract No: 012 -OP
Session: Emergent issue-Digitizing education
Date and Time: **Wednesday 14 Aug. 2024 | 11:35 - 11:45**

Revolutionizing Namibian landscape management: Leveraging digital tools and technologies for sustainable agriculture and agroforestry

Iita, A.
International University of Management, Private Bag 14005 Bachbrecht, Windhoek, Namibia
Corresponding Author: abedinekelaiita@outlook.com

In Namibia, the quest for sustainable agricultural practices has never been more urgent. As the nation faces challenges of food security and environmental sustainability, integration of new, affordable, and accessible technologies is paramount. Adoption of innovative tools and techniques at the landscape level can maximize access to science solutions for increasing the country's agricultural and agroforestry output. Innovative tools such as Geo-tagging, Wiki-mapping, spatial survey apps, and open-source GIS software offer advanced capabilities for monitoring and communicating landscape dynamics. Geo-tagging involves attaching geographical location data to various media, enabling precise tracking of agricultural activities. Wiki-mapping platforms like Open Street Map or Google Earth provide collaborative mapping tools, facilitating community involvement in land management. Spatial survey apps for smartphones and tablets enable field data collection with ease, while open-source GIS software packages offer powerful analytical capabilities without prohibitive costs. Namibia's diverse agricultural landscapes include pastoral livestock keeping, production-oriented livestock husbandry, game ranching, conservation, dryland cropping, and inland fishing. Enhancing production efficiency in these sectors is crucial for sustainable agricultural development. Adopting sustainable grazing practices and improving water management can optimize pastoral livestock keeping. Similarly, implementing precision farming techniques can boost yields in dryland cropping areas. The question of land tenure in communal areas is central to optimizing land use efficiency. Traditional communal land tenure systems may pose challenges to effective resource management and investment in agriculture. Exploring the necessity of changing these systems is essential for promoting sustainable land use practices. Alternative approaches, such as community-based land management schemes, could empower local communities while ensuring sustainable resource utilization. Overall, deploying innovations that address systemic challenges will enable, Namibia chart enhance productivity, environmental resilience, and create socioeconomic prosperity.

Keywords: Agriculture, digital tools, geo-tagging, GIS, sustainable-production, Namibia

Abstract No: 013 -OP

Session: Emergent issue-Digitizing education

Date and Time: Wednesday 14 Aug. 2024 | 11:45 - 11:55

Modeling the effects of climate change on cassava yield in Eastern DR Congo

Yamungu, A.B. B.,[1, 2, 3,] Majaliwa, M. J., G.,[3] Egeru, A. [1, 3] & Dossa, B. M.[1]

[1]Department of Environmental Management, Makerere University
[2]Université Espoir du Congo de Baraka
[3]Regional Universities Forum for Capacity Building in Agriculture (RUFORUM)
Corresponding Author: b.yamungu@ruforum.org

Climate change is projected to significantly impact agricultural production and productivity across Africa. This study evaluated the effects of climate change and variability on cassava productivity in two territories of South-Kivu province of the DR Congo where cassava is a dominant crop and staple food. Both field work and crop modelling were used. The Decision Support System for Agrotechnology Transfer "DSSAT" crop model simulation for cassava under current and future climate was used to assess the effect of climate change and variability on cassava yield for two representative concentration pathways (4.5 and 8.5) and three sliced periods (2010-2039, 2040-2069 and 2070-2099). Climate, soil and crop yield, and field management data were collected from the study sites. Results show that cassava productivity increment will range between 23.8% and 97.1 % in the study area for the different climate regimes and emission scenarios. This present a good opportunity for the local government to promote cassava among smallholder farmers in order to address food security and increase household incomes.

Keywords: Cassava, Climate change, DR Congo, DSSAT, Fizi, Kabare, productivity

Thematic Area 2:

Sustainably Growing the Economy and Feeding Africa

Subtheme 2a: Increased production, productivity and competitiveness

VENUE: Mercure Hotel, Room KUISEB 2
CHAIR: Dr. Alice Mutiti Mweetwa, University of Zambia
RAPPORTEUR: Mr. Daniel Muhindo and Ms. Racheal Ninsiima

Welcome Remarks by Session Chair

RUFORUM Working Document Series (ISSN 1607-9345), 2024, No. 23
Available from http://repository.ruforum.org

Abstract No: 016 -OP
Session: Increased production, productivity and competitiveness
Date and Time: **Wednesday 14 Aug. 2024 | 08:35 - 08:45**

Are agroecology, sustainable intensification and nature positive complementary or opposing pathways to transformation of Africa's smallholder Agriculture

Kihara, J.

Alliance of Bioversity International and CIAT
Corresponding Author: J.Kihara@CGIAR.ORG

Decades of discourse around seemingly contrasting approaches to transformation of Africa's smallholder Agriculture have not resolved the appropriate pathway. Strong positions continue to play through agroecology, sustainable intensification or nature positive solutions and a myriad of other terms that stand somewhere along the natural systems-intensive conventional farming continuum. These positions are supported by arguments and data observed, albeit some at very small local scales, in relation to relative benefit to soil health, crop productivity, human wellbeing (e.g. food security) and regional/ national economics. The left (natural systems/organic) while strongly associated with environmental benefits is deemed unable to meet the food demands of the population. The right (high chemical inputs) considered unsustainable, is not widespread in sub-Saharan Africa where agriculture remains mostly low input. Within the purview of sustainable intensification, Integrated Soil Fertility Management (ISFM) entails judicious use of mineral fertilizers combined with organic resources to enhance agronomic gain including environmental goals. Agroecology supports a transformation of systems to embrace more sustainable practices including input reduction without jeopardizing food security. Its dimension of social movement and co-creation approaches support more strongly development of solutions with equity and higher chances of applicability. On the other side, nature positive supports creation and maintenance of "nature parks" within farms and landscapes that blend and support the overall functioning of the farms. However, the application of nature positive has often extended to embrace aspects embodied within agroecology including circularity principles. Thus, while specific cases for sustainable intensification, agroecology and nature positive can be made, the boundaries across are blurred. In these discussions, we show that the pathway for Africa smallholder agriculture is context dependent and each approach can play a role under specific conditions. One-fits all 'prescription' is not a solution. Successful agricultural transformation in Africa require interventions at both the field scale (SI involving diversifications) and landscape level (restoration practices) that are achieved as complementary strategies through the different approaches.

Keywords:

Abstract No: 017 -OP

Session: Increased production, productivity and competitiveness

Date and Time: Wednesday 14 Aug. 2024 | 09:15 - 09:25

Provitamin-A biofortified East African Highland bananas: an essential technology for addressing nutrition security

Namanya, P., [1*] Buah, S.,[1,4] Tindamanyire, M.J.,[1] Walugembe, J., Wegesa, J., Kubiriba, J., [1] Jean-Yves Paul, J.Y.,[2] Harding, R.,[2] Dale, L. J.[2] & Tushemereirwe, K.W.[1]

[1]National Agricultural Research Laboratories, Kawanda, Wakiso, Uganda.
[2]Centre for Agriculture and the Bioeconomy, Queensland University of Technology, Brisbane, QLD, Australia
[4]Kyambogo University, Kampala, Uganda

***Corresponding Author:** bwesigyep@gmail.com

Biofortification of staple foods such as the East African Highland cooking Banana - Matooke can be leveraged as an ideal vehicle to deliver regular consumption of micronutrients such as pro-Vitamin A to alleviate deficiencies. With over 65% households in Uganda dependent on bananas for nutrition and income, a biofortified staple crop can be a cheap remedy to Vitamin-A deficiency for millions of children and women. Banana is generally low in vitamin A and therefore needs biofortification. Banana cultivars such as Nakitembe and Kabana 7H [HybridM9] were therefore genetically engineered with banana-derived genes to express elevated levels of pro-vitamin A carotenoids in the fruit. A regulatory confined field trial of ten elite events, each with 20 replicates, were planted at four agro-ecologies in Uganda to determine the best performing events for biosafety approval and eventual release to farmers. Two elite events of cultivar Nakitembe accumulated more than 2-fold β-carotene equivalents being 23.2 and 19.6 µg/g dry weight, while maintaining an average yield of 30.5 Kg and 27.5 Kg comparable to the control at 35.5 Kg. In addition, although the best transformation events of the Hybrid M9 accumulated more than 3-fold β-carotene equivalents with an average 26.9 and 23.1 µg/g dry weight, compared to 7.9 µg/g dry weight β-carotene equivalents from non-transgenic controls; there was a significant ($P < 0.05$) yield penalty with an average bunch weight of 14.6 kg and 15.1 kg compared to the control bunch weight of 27.2 kg. The adoption and utilization these improved bananas for their health benefits remains open despite the yield drag. Once biosafety and food evaluation of lead transformation events for the cultivar Nakitembe is complete, the biosafety dossier to release the final product will be presented for regulatory approval.

Keywords: Agronomy, biosafety, cooking banana, field trial, pro-Vitamin-A carotenoids

Abstract No: 018 -OP
Session: Increased production, productivity and competitiveness
Date and Time: Wednesday 14 Aug. 2024 | 09:25 - 09:35

Comparative genetic evaluation of Zimbabwean Red Dane and Jersey cattle breeds

Nyamushamba, G.

Faculty of Agriculture, Women's University in Africa, P.O. Box, MP 1222, Mt Pleasant, Harare, Zimbabwe
Corresponding Author: gbnyamushamba@gmail.com

Zimbabwean Red Dane and Jersey are major cattle breeds underpinning Zimbabwe's diary industry. This paper examines genetic and phenotypic parameters for milk, fat and protein yields, key elements of milk quality for various uses in order to inform production performance of dairy cattle breeds commonly used in Zimbabwe. A total of 10 154 and 10 986 unedited Red Dane and Jersey 305-day lactation records respectively, were obtained from Livestock Identification Trust (LIT) containing 26 herds (1 Red Dane herd and 25 Jersey herds), with Red Dane calving in the period 2001 to 2021, and Jersey cows calving in the period 2001 to 2021. The General Linear Model (GLM) procedure of Henderson Type III sum of squares in Statistical Analysis Systems (SAS) was used to determine the environmental factors with the fixed effects model containing herd-year-season (HYS), calving interval and age at calving. All the factors significantly ($P<0.0001$) affected the milk, fat and protein yields. The month from June to July gave the highest milk production for the Red Dane breed and for the Jersey it was September and December. Genetic and phenotypic parameters were estimated using ASReml and the sire model. Heritability estimates for Red Dane cattle milk yield, fat yield, protein yield, fat percentage, protein percentage were 0.18, 0.14, 0.14, 0.24 and 0.24 respectively and for Jersey cattle milk yield, fat yield, protein yield, fat percentage, protein percentage were 0.25, 0.26, 0.26, 0.27 and 0.28 respectively. The corresponding repeatability estimates for Red Dane cattle were 0.36, 0.35, 0.36, 0.34, and 0.28 respectively, and for Jersey cattle were 0.37, 0.36, 0.37, 0.38 and 0.40 respectively. Genetic and phenotypic correlations among milk production traits for both Red Dane cattle were high (0.75 to 0.96) and (0.39 to 0.81) respectively and for the Jersey cattle, the phenotypic correlations were (0.67 to 0.86). Herd-year-season, calving interval and linear and quadratic effects of age at calving are the major sources of variation in 305-day yields of milk, fat and protein for Red Dane and Jersey cattle in Zimbabwe. It is thus necessary to pre-adjust data for these environmental factors when carrying out genetic evaluations of production traits in Zimbabwean Red Dane and Jersey cattle.

Keywords: Dairy cattle, calving, heritability, genetic factors, phenotypic parameters, milk quality, Zimbabwe

Abstract No: 019 -OP
Session: Increased production, productivity and competitiveness
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Mercury as a contaminant of emerging concern in food: A case study of marine and freshwater fish

Hilkka Ndjaula

University of Namibia: Henties Bay, Erongo Region, Namibia
Corresponding Author:

Fish and food of aquatic origin are an essential part of a balanced human diet. They are a source of healthy protein, polyunsaturated fatty acids, minerals and vitamins. In addition to its nutritional value, fish can be a source of contaminants of emerging concern (CECs), including mercury (Hg), which are discharged into the environment from a diverse range of sources. Acceptable levels of contaminants in food are set by regulation, and the maximum level of mercury in most species of fish and fish products is 0.5 mg/kg or 1.0 mg/kg. The objective of this study was to determine the concentration of mercury is commonly consumed fish. We observed that methylmercury (MeHg) content varied between 0.076 - 0.637 mg/kg. The levels of mercury in various fish varied, with freshwater and marine species having differing levels. This study is the first of its kind to provide a baseline for monitoring mercury as a micropollutant in the Namibian aquatic environment. These results highlight the need to develop standards that will guide consumer exposure to CECs that come with increased productivity of food systems in response to food insecurity, both on land and in water. It also provides consumers with valuable information towards dietary decisions.

Keywords: Fish, food safety, marine, mercury, micro-pollution, Namibia

Subtheme 2b: Resilient agrifood systems and health

VENUE: Mercure Hotel, Room KUISEB 2
CHAIR: Dr. Judith Leo, The Nelson Mandela African Institution of Science and Technology
RAPPORTEUR: Mr. Darius Kiamwe and Mr. Jean Nacishali

Welcome Remarks by Session Chair

Abstract No: 020 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 10:35 - 10:45**

Securing food safety across Africa: IITA and other international partner efforts to combat Aflatoxin and other mycotoxins contamination in Africa's food chain

Mahuku, G.,[1] Ortega-Beltran, A.,[2], Kamau, J.,[3] Akello, J.,[1] Makumbi, D.[4] & Menkir, A.[2]

[1]ITA-Uganda, Kampala, Uganda
[2]IITA-Ibadan, Nigeria
[3]IITA-Kenya, Old Naivasha Road, Nairobi, Kenya
[4]CIMMYT, P.O. Box 1041 Village Market-00621 Nairobi Kenya
Corresponding Author: G.Mahuku@cgiar.org

Mycotoxins are toxic secondary metabolites produced by certain fungi in agricultural products that, depending on the concentration, are harmful or lethal to humans and animals. Exposure to mycotoxins is a worldwide concern as their occurrence is increasing although there is variation among geographical regions. The presence of mycotoxins in foods and feeds depend on a variety of management and environmental factors in the field, during storage, and/or processing of the commodities. Environmental conditions such as high temperature and humidity increase the risk of fungal growth and mycotoxin production. Other factors include pH, fungal strain, and substrate. Prevention and control of mycotoxins requires an integrated approach that starts in the field and continues throughout the whole food chain. The most effective methods are those carried out before the fungal infestation and mycotoxin production on the plant. In the last decade, significant advances have been made in research and technology that have contributed to expanded capabilities and knowledge in detection and measurement, characterization, control, and management of mycotoxins in different agricultural commodities. As mycotoxin contamination is a multi-sectorial problem, it requires a multi-pronged approach involving collaborations among different sectors encompassing health, trade, and agriculture. This paper outlines advances in research and technology that have been undertaken by the CGIAR and partners. The development and scaling of integrated mycotoxin management strategies, with emphasis on mycotoxin prevention in the field using mycotoxin resistant germplasm, coupled with biological control agencies, and good agricultural and postharvest practices will be highlighted. Challenges and gaps that need to be addressed will also be highlighted to ensure reduced mycotoxin contamination across Africa and beyond to contribute to food safety and security.

Keywords: CGIAR, food-safety, aflatoxins, food-contamination, IITA

Abstract No: 021 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 10:45 - 10:55**

Postharvest: Securing Africa's food wastage and unlocking economic growth through science

Umezuruike, L.O.

Stellenbosch University, Stellenbosch, South Africa
UNESCO International Centre for Biotechnology, Nsukka, Nigeria
Corresponding Author: opara@sun.ac.za

There is an overwhelming agreement among African governments, policy makers and development practitioners that Africa's agrifood systems need urgent transformation to assure food and nutrition security and drive economic growth and rural development. As a young and urbanizing continent, Africa faces development challenges, that coupled with existential threats such as climate change and biodiversity loss, it must embrace modern science to secure its future against food insecurity, youth unemployment, and poverty. Traditionally, Africa has grown its agriculture through extensification and sustainable intensification of smallholder agriculture, with little investments on the postharvest (post-production) side of the agri-food system. The low productivity and limited competitiveness of Africa's agri-food systems are exacerbated by food wastage (postharvest losses and food waste) and capacity for the stringent quality standards of intra-Africa and international trade. To assure food security, Africa imports food with nearly US$60-75 billion spent annually and projected to exceed US$90 billion by 2030. Yet Africa's postharvest losses exceed 20% for cereals and >50% for perishable products, equivalent to USD 48 billion per annum. Saving this harvest must become a critical part of Africa's agricultural transformation agenda. The African development Bank estimates that transforming Africa's agriculture within a decade and ending food import requires US$30-40 billion per year. In 2014, a total of US$12 billion was invested in agriculture by all African countries. The removal of barriers to Africa's agricultural development could triple output from US$280-313 billion per year to US$1 trillion by 2030. Clearly, the benefits of transforming Africa's agriculture sector are enormous and self-evident. However, several questions remain: a) what specific investments were made at each stage alone the agricultural value chain, b) what cross-cutting and economy-wide investments were made which support and drive agricultural productivity growth and poverty reduction, c) what investments were made in the postharvest sector vis-à-vis the production sector to save Africa's harvest, promote value-addition, and link production markets, and d) what are the impacts of these investments based on verifiable evidence, including the commitment of African governments to "reduce post-harvest losses at least by half by 2025"? This paper highlights the state of African agriculture, identify critical investment opportunities along the value chain towards Africa's Green Revolution, and discuss the role of scientific research and technological innovation. It also provide an exploratory mapping of postharvest research in Africa to identify critical issues facing the continent's agri-food systems and drawing from the history of both extensification and intensification models of agricultural development, it outlines a Postharvestification Model – based on one crop/value-chain at a time, for building Africa's capacity in agri-food systems research and technological innovation to secure Africa's food wastage and unlock economic growth through science.

Keywords: Food security, food wastage, food imports, postharvest

Abstract No: 022 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 11:05 - 11:15**

Reframing the climate debate: Adaptation and mitigation in African agriculture

Mwape, A.

New Zealand Agricultural Greenhouse Gas Research Centre (NZAGRC)
Grasslands Research Centre, Tennent Drive Private Bag 11008. Palmerston North 4442. New Zealand
Corresponding Author: Ackim.Mwape@nzagrc.org.nz

This paper explores the significant challenge and opportunity presented by agricultural greenhouse gases (GHGs) in Africa, identifying key sources, future trends and the pressures from population growth and urbanization. It highlights the efforts of the Global Research Alliance on Agricultural Greenhouse Gases (GRA) in increasing GHG measurement capabilities and fostering dialogue on addressing agricultural emissions in Africa. The paper argues that prioritizing adaptation over mitigation is counterproductive and stresses the importance of a balanced approach that emphasizes production efficiency per unit of GHG. It calls for a transformation in Africa's agricultural food systems to increase productivity, alleviate poverty, and deliver mitigation benefits by shifting the narrative from Africa as a victim of climate change to recognizing its potential to mitigate it. The necessity for developing a comprehensive knowledge base for both adaptation and mitigation is emphasized, along with the risks of delaying research in these areas. The paper acknowledges that GHG emissions from Africa's agricultural food systems will likely increase but advocates for enhancing production efficiency. Finally, the paper underscores the need for building concern and capabilities for climate adaptation and mitigation before implementing regulations. It highlights the pivotal role of higher education institutions (HEIs) in driving innovation, conducting research, training future leaders, and developing effective mitigation strategies to transform African agriculture into a climate-resilient and low-emission sector, ensuring food security and environmental sustainability.

Keywords: Africa, climate change, greenhouse gases

Abstract No: 023 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 11:15 - 11:25**

Cereals and legumes for the drylands of Africa: Technologies, innovations and development by ICRISAT in Africa

MacDonald, B.

International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), BP 320, Bamako, Mali
Corresponding Author: Bright.Jumbo@icrisat.org

Nearly 41% of arable land in SSA is classified as arid and semi-arid, receiving low and erratic rainfall (300–600 mm per annum). In those drylands smallholder agriculture is the main source of livelihoods, with farming communities facing a high risk of crop failure and loss of livestock, due to increased frequency of drought and heat stress as a result of climate change. To secure their production against the increasing threats, science must provide solutions. ICRISAT and partners have therefore developed various agricultural innovations and technologies to secure arable agriculture in drylands of SSA. The technologies include resilient and productive varieties of legumes and cereals (229 (Sorghum), 113 (Pearl Millet), 29 (Finger millet), 65 (Chickpea), 37 (Pigeonpea), 155 (Groundnut); natural resource

management practices, good agronomic practices, digital technologies and solar based irrigation systems among others. These technologies were developed in partnership with National Agricultural Research and Extension Systems and the private sector. Of significance are improved crop varieties that increase productivity by up to 60% under conducive conditions and by at least 20-30% above local land races under non-favourable conditions. ICRISAT also supports last mile delivery of improved varieties by investing in early generation seed (EGS) and seed planning by the NARES and private sector. Between 2007–2017 ICRISAT produced 498,000 tons of certified seed of legumes in SSA, planted on 5.0 million ha by 25 million smallholders in 15 countries. 6.1 million tons of grain worth US$ 3.2 billion was generated in the local economy. ICRISAT has also developed soil and water conservation technologies to control erosion and prevent land degradation. ICRISAT is deploying Intelligent Agricultural Systems Advisory Tool and digital water management tools for providing data-driven, location-specific advisories to farmers for irrigation water management in semi-arid agroecologies. Additionally, ICRISAT continues to build capacity of diverse value chain actors in SSA semi-arid agroecologies, to secure arable crop production and productivity. These highlighted technologies if appropriately applied can contribute to achieving sustainable and resilient food systems in SSA.

Keywords: Agriculture, Africa, drylands, ICRISAT, EGS, resilient-technologies

Abstract No: 024 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 11:35 - 11:45**

Advancing nutritional security and health: NARO's pioneering research and cultivation efforts in biofortified bean development

Nkalubo, S.T.

National Crops Resources Research Institute, P.O.Box 7084, Kampala, Uganda
Corresponding Author: tamusange@gmail.com

Uganda faces significant challenges in addressing malnutrition and nutritional deficiencies, particularly in rural areas where dietary diversity is limited. Beans are a staple food in Uganda, offering a promising vehicle for biofortification efforts aimed at improving the population's nutritional status. The National Agricultural Research Organisation (NARO) has undertaken pioneering research to develop and cultivate biofortified bean varieties that are rich in essential micronutrients such as iron and zinc. This paper presents an overview of NARO's research and development efforts in biofortified bean cultivation, highlighting the methodologies employed, key findings, and the impact on nutritional security and health in Uganda. NARO's research has involved advanced breeding techniques to enhance the micronutrient content of beans without compromising yield or resistance to pests and diseases. Field trials and agronomic studies have been conducted across various agro-ecological zones in Uganda to ensure the adaptability and acceptability of these biofortified varieties among local farmers. The results demonstrate significant improvements in iron and zinc content, contributing to better health outcomes, particularly for women and children who are most vulnerable to micronutrient deficiencies. The dissemination and adoption of biofortified beans have been supported by targeted outreach programs, involving collaboration with local communities, agricultural extension services, and policymakers. These efforts have not only improved dietary quality but have also promoted sustainable agricultural practices and increased farmer incomes. This work underscores the critical role of biofortified crops in combating malnutrition and enhancing food security, and it calls for continued investment in biofortification research and support for scaling up these innovations.

Keywords: Biofortification, Nutritional Security, Malnutrition, Beans, Micronutrients, Agricultural Research, Food Security, Sustainable Agriculture

Abstract No: 025 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 11:45 - 11:55**

Analysing the contribution of commercial agriculture on household food and nutrition security in Lesotho

[1]Nkoko, N., [2] Natasha, C. & [2]Swanepoel, J. W.

[1]National University of Lesotho, P.O. Roma 180. Roma, Lesotho
[2]University of the Free State, 205 Nelson Mandela Dr, Park West, Bloemfontein, 9301, South Africa\
Corresponding Author: nthabelengnkoko@gmail.com

Transitioning from subsistence to commercial agriculture is a developmental approach to alleviate poverty. The study assessed the contribution of commercial agriculture to household food and nutrition security in Lesotho. A propensity score matching method was used as a quantitative approach to estimate the contribution of commercial agriculture on household food and nutrition security. Face-to-face interviews with key informants addressed the qualitative approach. The study results show that commercial agriculture decreased household food insecurity by -2.84, and increased household and women's dietary diversity score by 1.02 and 0.568 respectively. All key informants alluded to the positive effect of commercial agriculture on household food and nutrition security. The nutrition-sensitivity of agriculture increases the likelihood to yield positive food and nutrition security outcomes. Interventions that support the commercialization of agriculture must intentionally capacitate farming households on the channels through which commercial agriculture can be maximized to enhance their food and nutrition security.

Keywords: Commercial-agriculture, dietary-diversity, food-insecurity, Lesotho, propensity-scores, SGDs

Abstract No: 026 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 11:45 - 11:55**

Enhancing sustainable agriculture and economic growth in Africa: A comprehensive study of cassava value chains and household food security

Ntsiapane, A.,[2]Filippi, V. & Abioye, O.

University of the Free State, P.O. Box 339. Bloemfontein 9300
[2]International Fund for Agricultural Development, Agricultural Research for Development (AR4D)
International Institute of Tropical Agriculture (IITA)
Corresponding Author: ntsiapanealina@gmail.com

In Africa, agriculture remains a vital driver of economic growth and food security. Cassava, a staple crop across the continent, sustains millions of smallholder farmers and plays a key role in guaranteeing food security. Understanding the complexities of cassava value chains, from production to marketing, is paramount for informing effective policies to enhance agricultural productivity, support incomes, mitigate food insecurity, and build awareness on the environmental impact associated with its production. This paper examines the internal dynamics along cassava value chains, including access to markets, seed system, and inputs supply, to dissect the implications for food security, sustainability and the broader economic development. Moreover, it evaluates the impact of interventions such as gender-inclusive agricultural practices and the adoption of digital tools on agricultural productivity and

livelihoods. The analysis employs a multistage sampling technique, where data on 783 cassava farmers in Ogun State, Nigeria, was collected and analyzed using inferential statistical techniques. The study offers insights into the key hindering factors and bottlenecks along the cassava value chain and elaborate on the potential of digital tools, such as the IITA Herbicide Calculator, Area Calculator for Land and automated Monitoring and Evaluation systems, to make cassava production more efficient, sustainable and profitable. Among the main findings, we observe that only a minority (6.6%) of farmers are fully integrated into the cassava value chain. In summary, this study dissects the internal dynamics of cassava value chains and points out the significance of context-specific interventions to inform effective policies, which promote good security and empower farmers through improved access to markets, and enhanced agricultural productivity.

Keywords: Cassava, digital innovation, economic development, household food security, sustainable agriculture, value chains

Abstract No: 027 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 12:05 - 12:15**

Trait preference and variety choices by sorghum and finger millet farmers: Implication for demand led breeding in Uganda

Adikini, S.,[1] Hamba, S.,[1] Kasule, F.,[1,2] Mayanja, I.,[1] Biruma, M.,[1] Kakeeto, R.,[1] Natabirwa, H.,[3] Sanya, L.N.,[4] Rubin, D.,[5] Occelli, M.[6] & Ugen, M.A.[1]

[1]National Semi-Arid Resources Research Institute (NaSARRI), National Agricultural Research Organization, P. O. Box 56 Soroti, Uganda
[2]Interdepartmental Genetics and Genomics (IGG), Iowa State University, Ames, IA 50011, USA
[3]Food Biosciences and Agribusiness Center, National Agricultural Research Laboratories (NARL), National Agricultural Research Organization, P.O Box 7065, Kampala, Uganda
[4]School of Agricultural Sciences, College of Agricultural and Environmental Sciences, Makerere University, P.O. Box 7062, Kampala, Uganda
[5]Cultural Practice, LLC, Bethesda, MD USA
[6]Cornell University, Ithaca, NY, USA
Corresponding Author:adikiniscovia@gmail.com

Sorghum and finger millet are climate-resilient crops that are deeply rooted in the agri-food systems of semi-arid communities in Uganda and provid food, nutrition, and income security. Despite the efforts to develop, release, and disseminate improved varieties, sorghum and finger millet productivity remain low in Uganda. The low productivity is in part due to limited understanding of desired traits by stakeholders in both commodities value chains. Such traits are inadvertently not included during the breeding process limiting adoption of improved sorghum and finger millet varieties. This study aimed to identify and profile the sorghum and finger millet varietal traits preferred by farmers and consumers in Uganda. The study specifically focused on how the traits vary among women and men in the Uganda sorghum and finger millet value chains. Data was collected using semi-structured questionnaires among 309 households (136 sorghums and 173 finger millet) in Bushenyi, Rukiga, Lira, and Nwoya districts, and we triangulated questionnaire responses with qualitative information from 11 focus group discussions and 3 key informant interviews. Using descriptive statistics and probit regression models, we find that the majority of the farmers (92%) prefer growing landrace varieties of sorghum and finger millet, compared to only 8% growing improved varieties. High yielding, early maturity, big heads and grains, as well as good taste, were among the most preferred traits by the farmers. The most preferred varieties of sorghum, were Kyatanombe in Rukiga and Kabiir in Lira and Nwoya while for finger millet

were Kaguma in Bushenyi, Ajuko Manyige in Nwoya, Kal Atar, and Okello Chiba in Lira districts. The farmers' choice of variety depends on a combination of traits, including agronomic, marketing, and consumption traits. Gender, marital status, education levels, and occupation are the major socio-demographic factors that influence specific preferences related to the sorghum and finger millet variety. This study laid the foundation for designing a gender-responsive sorghum and finger millet product profile to guide the development and release of new varieties by the breeding program in Uganda. This is envisaged to enhance the adoption and uptake of the released varieties by smallholder farmers to transition from subsistence to commercial farming, thereby improving food, nutrition, income security, and resilience to climate change.

Keywords: Finger millet, landrace, sorghum, trait preferential, variety-adoption, Uganda

Abstract No: 028 -OP
Session: Resilient agrifood systems and health
Date and Time: **Wednesday 14 Aug. 2024 | 12:05 - 12:15**

A geochemical baseline study of giant kelp (Macrocystis pyrifera) at the Atlantic ocean kelp blue farm to assess carbon sequestration potential

Daniel, L.S.[1] & Mutjida, P.[2]

[1]University of Namibia, P O Box 99530, Windhoek
[2]Kelp Blue, Luderitz, Namibia
***Corresponding author:** daniels@unam.na

Elevated levels of carbon dioxide (CO_2) in the earth's atmosphere are driving global climate change, a phenomenon whose adverse-affect is considered one of the 21st century grand challenges. The ocean is a good carbon sink being home to various fauna and fora and other forms of macro and microscopic oragnisms such as phytoplankton that take up carbon dioxide, converting it to biomass, which then sinking to the deep ocean, sequestering carbon. Giant kelp (Macrocystis pyrifera) forests that grow in oceans can absorb CO_2 from the atmosphere and sequester it in the deep ocean. To grow these forests, the right biogeochemical conditions (temperature, nutrients, oxygen, salinity, pH, trace metals and ions) within the ocean is vital to assess the sequestration potential and the impacts on the ocean health. This study monitored the biogeochemical changes at the Kelp Blue pilot farm and its surrounding areas, to create a baseline on the chemical composition of the farm and close environments within the Atlantic Ocean. The geochemical parameters were measured using both in-situ probes and laboratory analyses. Sediments were analysed for trace metals using a portable XRF and for carbon content using Loss on Ignition (LOI) method. The concentrations of nutrients in seawater samples were determined by spectrophotometry. The study shows that geochemical parameters changed in relation to the seasonality and geographical positioning. In a season when the upwelling system was strong, the concentration of nutrients, acidity and salinity increased significantly. Higher concentrations of phosphates (614 µg/L) were found in areas close to islands due to .the presence of guanos. These shows that cultivated kelp can co-exist with natural existing kelp beds in this ecosystem, and they can thrive more predominantly in season of great influx of nutrients during the season of strong winds. With a dynamic Benguela currents upwelling eastern boundary, kelp forests have an enormous potential to grow faster and can function as carbon absorber and eventually sequester carbon. This study recommends that a continuous monitoring of the water and sediment geochemical changes be done as the scale of operation expands.

Keywords: Climate mitigation, carbon sequestration, biochemical, giant kelp

Abstract No: 029 -OP
Session: Building Resilient Agrifood Systems and Health
Date and Time: **Wednesday 14 Aug. 2024 | 08:35 - 08:45**

Securing livestock productivity: Advances in livestock vaccine development in Uganda

Majalija, S., Kabi, F., Dhikusooka, M., Matovu, M., Mugerwa, S., Kasaija, P., Emudong, R., Halid Kirunda, Contreras, M., Gortazar, C., De la Fuente, J., Rutaisire, J. & Baguma, Y.

National Livestock Resources Research Institute (NALIRRI), Uganda; National Agricultural Research Organisation (NARO). P.O. Box 5704, Kampala
Corresponding author: saraali67@gmail.com; Samuel.majalija@naro.go.ug

The annual loss attributed to ticks and tickborne diseases (TTBDs) in livestock in Uganda is estimated at USD 1.1 billion. Tick control mainly relies on the chemical acaricides. However, acaricide-resistant ticks have emerged reducing the effectiveness of chemical control. Thus, the NARO embarked on the development of Subolesin (SUB)-based vaccines for the control of the most important tick species (Rhipicephalus appendiculatus, R. decoloratus and Amblyomma variegatum), affecting production of local and improved breeds of cattle in Uganda. The results showed the possibility of using SUB antigens for the control of multiple tick species in local and crossbred cattle and suggested the use of R. appendiculatus SUB to continue vaccine design and formulation for the control of cattle ticks in Uganda. During the 12-month field evaluation trial period, cattle were sprayed utmost twice, due to the low numbers of ticks. The findings indicate that the SUB-based vaccine is protective against multiple cattle tick infestations under field conditions in different agro-ecological zones of Uganda. SUB anti-tick vaccines are strategic innovations which are environmentally sound, most sustainable and effective alternative for the control of multi-species tick infestations. Additional research aimed at vaccine development for other livestock diseases of economic importance: African Swine Fever, Food and Mouth Diseases are on-going.

Keywords: Akirin, cattle, subolesin, tick, Uganda, vaccine

Thematic Area 3:

Unlocking Inclusive and Broad-Based Economic Opportunity

Subtheme 3a: Inclusive resourcing for equitable economic growth

VENUE: Mercure Hotel, Room KUISEB 3
CHAIR: Dr. Alfred Alumai, Muni University
RAPPORTEUR: Mr. Noel Mweta and Mr. Henry Nyuma

Welcome Remarks by Session Chair

RUFORUM Working Document Series (ISSN 1607-9345), 2024, No. 23
Available from http://repository.ruforum.org

Abstract No: 030 -OP
Session: Inclusive resourcing for equitable economic growth
Date and Time: **Wednesday 14 Aug. 2024 | 08:45- 08:55**

Building rural enterprises and productivity through farmer-based commodity cluster models: lessons from the out- of- school youth interventions in northern Ugandan

Mugonola, B., Kawanguzi, T. D., Okwera, S. & Nangobi, R.

Gulu University, Faculty of Agriculture and Agribusiness P.O.Box 166 Laroo Division, Gulu, Uganda
Corresponding Author: B.mugonola@gu.ac.ug

Out-of-school youths (NEET) have rarely been targeted in many farmer-led development interventions, despite their significant contributions to the unemployed population in sub-Saharan Africa. While several interventions have supported farmer groups with inputs; like the National Agricultural Advisory Services (NAADS) in Uganda, the NEETs have been conspicuously absent in such interventions. Most of these interventions assumed homogeneity of smallholder farmers and yet this is far from reality. In this paper, we present and shares lessons from a youth farmer-based clustering model purposefully designed to support NEETs in northern Uganda. A tailored theory of change was conceived to intentionally stimulate creation of decent and gainful employment opportunities in selected agri-value chains for young people. Using group level participatory vegetable learning plots, youths were trained in GAPs for vegetable production, participatory market assessments, value addition and economic viability assessments of selected enterprises. Following this engagement, 20 youth groups were formed, accessed input markets, and adopted production of market demanded vegetable varieties. After two production cycles, we have seen growth in youth enterprises, yields, and incomes at both individual and group levels. Currently, the youths have solar dried vegetables, diversified into other products and services, created bulking centers, and registered producer groups and cooperatives. We contend that government and development partners should provide tailored entrepreneurship, technical training, mentorship, and business development services to youths. Further, there is need to ease the registration processes for youth groups and provide requisite rural infrastructure. Additionally, NEET focused markets access and financial linkage programs are equally important.

Keywords: Homogeneity of farmers, Northern Uganda, out of school youth, theory of change, vegetable production

Abstract No: 031 -OP
Session: Inclusive resourcing for equitable economic growth
Date and Time: **Wednesday 14 Aug. 2024 | 09:05 - 09:15**

Agricultural Input Subsidies in Malawi: Lessons learned and future options

Batizani, D.

Malawi University of Science and Technology P.O. Box 5195. Limbe, Malawi
Corresponding Author: dbatizani@must.ac.mw

Agricultural input subsidies have been a cornerstone of Malawi's agricultural policy for decades, aiming to improve smallholder farmer productivity and food security. However, the effectiveness and sustainability of these subsidies have been subject to debate and scrutiny. Understanding the lessons learned from past experiences is crucial for shaping future policies in Malawi's agricultural sector. This study aimed to analyze the effectiveness and challenges of agricultural input subsidies in Malawi, identify key lessons learned, and propose viable options for future policy directions. A comprehensive review of existing literature, policy documents, and empirical studies related to agricultural input subsidies in Malawi was conducted. Qualitative and quantitative data were analyzed to assess the impact, efficiency, and sustainability of past subsidy programs. The results highlight both successes and challenges of agricultural input subsidies in Malawi. While subsidies have contributed to increased agricultural productivity and food availability in the short term, they have also faced issues such as targeting inefficiencies, market distortions, and fiscal constraints. Moreover, dependency on subsidies has hindered the adoption of sustainable agricultural practices and market-oriented approaches among smallholder farmers. Drawing from the lessons learned, several policy options are proposed for the future of agricultural input subsidies in Malawi. These include targeting mechanisms to ensure subsidies reach the most vulnerable farmers, promoting agroecological practices and diversified cropping systems, enhancing market integration and value chain development, and gradually transitioning towards more sustainable and market-driven agricultural policies.

Keywords: Agricultural productivity, input subsidies, smallholder agriculture, Malawi

---

Abstract No: 031 -OP
Session: Inclusive resourcing for equitable economic growth
Date and Time: **Wednesday 14 Aug. 2024 | 09:25 - 09:35**

Assessing effectiveness of the African continental free trade role in sustaining economic integration amid deglobalization trends

Adeyanju, A.

International University of Management, 21-31 Hercules Street, Dorado Park Ext 1, Windhoek, Namibia
***Corresponding Author:** a.adeyanju@ium.edu.na

Amid the global retreat from interconnected markets, the African Continental Free Trade Area (AfCFTA) appears as a critical counterforce, promising to redefine economic integration in Africa; this study assesses its capacity to navigate the great fracture of globalization. It is undoubtedly true that globalization has powered the global economy since the end of the Cold War in the early 90's. Globalization creates economic integration, but geopolitics and regionalism in recent years, have charted an era of deglobalization. Hence, this study assesses the economic resilience of the AfCFTA member countries, by adopting a pre-post analysis of economic trends before and after the ratification of the trade agreement. The panel data consisted of 43 member countries and 5 economic variables which

include: the Gross Domestic Product (GDP), trade volume, Ease of doing business, Foreign Direct Investment (FDI), and economic diversification. The result show resilience and upward trajectory trends among some economic indicators, which can be attributed to the AfCFTA. Albeit the insurgence of geopolitical instability among some sub-Saharan African countries, by strengthening the AfCFTA, and building economic resilience, African countries have the potential to stay on course toward sustainable development.

Keywords: Africa, AUC, globalisation, free-markets, trade

Abstract No: 032 -OP
Session: Inclusive resourcing for equitable economic growth
Date and Time: **Wednesday 14 Aug. 2024 | 09:35 - 09:45**

Women empowerment in cassava production and processing on household food security in Odeda local government area, Ogun state, Nigeria

Fakoya, E.

Federal University of Agriculture Abeokuta, P.M.B 2240, Abeokuta, Ogun State, Alabata Road, Abeokuta, Ogun Sate, Nigeria
Corresponding Author: fakoyaeo@funaab.edu.ng

The impact of climate change on agriculture has become a crucial challenge in many parts of the world, particularly in sub-Saharan Africa. Climate changes affect agriculture in several ways, one of which is its direct impact on food production. This study examined the effect of climate change adaptation strategies on arable crops production efficiency in Odeda local government area, Ogun state. A simple random sampling technique was used to select 120 respondent farmers for the study. The study revealed that the majority of the farmers were older (41-80 years old, 51%), with limited formal education (primarily attending primary school, 43%) and small to medium-sized households. Most farmers were male (55%), married (44%), operated on inherited land (77%) and had limited access to agricultural extension services (57%) and credit facilities (77%), indicating potential challenges in adopting climate change adaptation strategies. Furthermore, the study found that farmers encountered several challenges, with non-availability of farm labour (54%) being the most severe obstacle, and most farmers (73%) implemented specific adaptation strategies, with changing planting dates (54%) being the most common. The study concluded that climate change adaptation strategies have positive effects on arable crop production in the study area. This study therefore recommended that training and capacity-building programmes should be provided for farmers, focusing on climate-resilient agricultural practices, sustainable farming techniques, and effective utilization of adaptation strategies and should also address specific challenges faced by arable crop farmers in the study area

Keywords: Cassava, climate adaptation, food security, Nigeria

Abstract No: 033 -OP
Session: Inclusive resourcing for equitable economic growth
Date and Time: **Wednesday 14 Aug. 2024 | 09:35 - 09:45**

An economic analysis on access and the availability of beef in the Omusati region

Ingula, S.

Ministry of Agriculture, Water and Land Reform, Government Office Park, Luther Street Private Bag 13184. Windhoek Namibia
Corresponding Author:

Omusati region northern Namibia is predominantly agricultural region of Namibia that focuses on both crop and livestock production. The region faces a significant challenge of household food insecurity and hunger, with approximately 50.7% of the population experiencing multidimensional poverty. Access to and availability of beef at the household level remains limited in the region, even though cattle farming is a common agricultural activity and a significant portion of agricultural households rear livestock. Beef in the region is mainly sold through informal markets. Communal farmers practice seasonal livestock management, keeping animals near their homes during the rainy season and migrating during the dry seasons. Given the pivotal role of livestock in the livelihoods of these rural communities access to beef can be a determinant of survival especially during lean periods as a source of food and income security. This study was conducted to identify demographic and socio-economic factors that influence household access to beef. Interviews were conducted involving key informants in the beef industry to collect qualitative data, and provide valuable insights on the local beef industry in Omusati. In addition, a cross-sectional survey was conducted on households to assess factors influencing household access to beef. The study was conducted in the Okahao, Ruacana, Outapi and Tsandi constituencies of Omusati region. A probability sampling method was used, specifically simple random sampling, to select 100 households engaged in the study. Principle Component Analysis (PCA) was used to determine the factors that influence households access and availability to beef. The results show that there is a significant relationship between income and beef consumption. Larger household size decreased the likelihood of beef consumption due to financial constraints. Education level, age, and sex significantly influenced access to beef. Beef cattle supply was positively affected by livestock number, gender of household head, price perception, credit access, grazing land size, and market information.

Keywords: Cattle, food security, livestock, household resilience, Namibia

Subtheme 3a: Wealth and Youth Employment

VENUE: Mercure Hotel, Room KUISEB 3
CHAIR: Dr. Alfred Alumai, Muni University
RAPPORTEUR: Mr. Noel Mweta and Henry Nyuma

Welcome Remarks by Session Chair

RUFORUM Working Document Series (ISSN 1607-9345), 2024, No. 23
Available from http://repository.ruforum.org

Abstract No: 034 -OP
Session: Wealth and Youth Employment
Date and Time: **Wednesday 14 Aug. 2024 | 10:35 - 10:45**

The significance of practical agri-entrepreneurial education to tackle youth unemployment challenge in Africa: lessons from Gulu University, Uganda

Ongeng, D.

Gulu University, P.O. Box 166, Laroo, Gulu City, Uganda
Corresponding Author: duncanongeng@gmail.com

Entrepreneurship in the agri-food sector is believed to be one of the tangible options for creating dignified jobs and work opportunities for young people in Africa. However, the lack of employment for the more than 400 million of Africa's population of young people (15-35 years), suggests that among other issues, their entrepreneurship engagement in the agri-food sector is limited. This paper provides lessons on ecosystem-wide practical agri-entrepreneurial education approach at Gulu University designed to build the capacity of young people for entrepreneurship and job creation in the agri-food sector. Globally, a critical examination of how entrepreneurship education is delivered reveals the existence of a dichotomy. On one side, is the theoretical teaching about entrepreneurship to learners, and on the other hand is the practical training of young people for entrepreneurship. Gulu University applies the Agribusiness Innovation Model to deliver practical agri-entrepreneurial education to young people. Using this model, learners (in groups) conduct value chain analysis to identify business opportunities, which are translated into business ideas and crafted into business plans. The plans are evaluated for financial soundness and practicability. Using the supervised student enterprise scheme portfolio, each learner group is supported with seed funding (grant) to experiment the business plan. The Student-Centered Outreach model is then used to extend successfully experimented business plans to TVETs, Out-of-School youths and refugees, thus creating an ecosystem-wide agri-entrepreneurial education platform for young people. Two key lessons have been learnt. First, practical entrepreneurial education should be ingrained in the curricula for learners (university) to build sense of seriousness in the training. Secondly, the student enterprise scheme provides young people with job and work opportunities as well as business acumen and funds to make them bankable.

Keywords: Agri-entrepreneurship, agribusinesses, transformational education, Uganda, youth

Abstract No: 035 -OP
Session: Wealth and Youth Employment
Date and Time: Wednesday 14 Aug. 2024 | 10:45 - 10:55

Climate smart mushrooms (*Pleurotus abalonus*) cultivation and processing as pathway for enhancing entrepreneurship, resilience and food security of women in Benin

Chadare, F.J.,[1] Bonou, A.,[1] Avocevou, C.,[1] Salako, V.,[2] Agossadou, J., Fadeyi, O.[3] & Assogbadjo, A. E.[2]

[1]Université Nationale d'Agriculture (UNA), Laboratoire de Sciences et Technologie des Aliments et Bioressources et de Nutrition Humaine, Ecole des Sciences et Techniques de Conservation et de Transformation des Produits Agricoles. République du Bénin
[2]Faculty of Agronomic Sciences, University of Abomey-Calavi
[3]Faculty of Agronomy, University of Parakou

Corresponding Author: fchadare@gmail.com

Edible mushrooms, particularly Pleurotus abalonus, offer a sustainable alternative to meat consumption, providing significant nutritional benefits and addressing food security and climate resilience challenges in Benin. This proposal aimed to enhance the edible mushroom value chain to foster climate resilience and empower women in Benin. The experiment consisted of cultivating mushrooms in greenhouses equipped with evaporative charcoal cooling systems and solar lamps. Charcoal was sourced from managed forests or agricultural waste was used. Processing involved mild heating/drying using solar dryers and possibly biogas. Harvested mushrooms will undergo standard characterization for nutritional and physical parameters. Optimal microclimate conditions for mushroom cultivation and drying using green techniques were identified, promising higher yields and improved organoleptic quality. Additionally, nutritional, physical, and sensory characteristics were evaluated. Training initiatives and a multi-actor e-platform will be used to promote women's empowerment and climate resilience, enhancing the profitability of mushroom production. This study will optimize sustainable mushroom cultivation and processing techniques, boosting yield and quality while fostering women's empowerment and climate resilience in Benin.

Keywords: Climate resilience, mushroom cultivation, sustainable Agriculture, women's empowerment

Abstract No: 036 -OP
Session: Wealth and Youth Employment
Date and Time: Wednesday 14 Aug. 2024 | 10:55 - 11:05

Enhancing rural economies through sustainable wool sheep farming in Eastern Cape, South Africa: Successes, challenges, lessons-learned, and future prospects

Kriek, J.D.

National Woolgrowers' Association of South Africa, 41A Pickering Street, Newton Park, Gqeberha, 6001, South Africa

Corresponding Author: dan@nwga.co.za

Wool production has traditionally played a pivotal role in the economic landscape of rural South Africa, as a source of livelihoods. It is also a major source in foreign exchange earning. The National Wool Growers Association of South Africa (NWGA) has led rural Training and Development initiatives, since 1997 that have fostered rural development and leveraged government support in the Eastern Cape province. This paper reviewed the NWGA programmes in the Eastern Cape for their effectiveness in terms objectives, implementation methods, achievements and future prospects. The paper examines the establishment of fundamental infrastructure for optimizing harvesting and processing of wool; the enabling market preparedness and formal auction accessibility; training and mentorship opportunities

for producers; engagement of Young Graduates students to bolster long-term sustainability; Institutional support and shepherd progression; regular monitoring to gauge the impact of the programme; partnerships with commercial ram breeders for genetic improvement; construction of shearing sheds according to industry standards; access to formal auctions and training in wool handling and sheep shearing as well as regular training in various aspects of sheep farming and mentorship programmes. Given the presence of over 1600 wool-producing communal sheds in the Eastern Cape, ongoing actions aim to consistently increase the well-being of wool sheep producers and foster sustainable rural development. The ongoing initiative extends upon preceding endeavors aimed at bolstering rural economies via wool sheep husbandry. By persisting in genetic enhancement, infrastructure augmentation, market preparedness, and training provisions, the various programmes endeavor to uphold enduring sustainability and economic advancement within communal regions.

Keywords: Eastern Cape, farmer associations, South Africa, wool, wool- market

Abstract No: 037 -OP
Session: Wealth and Youth Employment
Date and Time: **Wednesday 14 Aug. 2024 | 10:55 - 11:05**

Alternative pathways for universities to engage rural youth in productive and income generation activities: Lessons from the ARIHUB-RECAP experiment at Haramaya University, Ethiopia

Endris, G. S., Wordofa, G.M., Aweke, C.S. & Hassen, Y.J.

Haramaya University, P.O. Box 138. Dire Dawa, Ethiopia
Corresponding Author: getchs2006@gmail.com

Youth under- and unemployment is a formidable challenge undermining poverty alleviation efforts in Africa and Ethiopia in particular. The promotion of youth-focused agribusiness enterprises has been identified as a priority area to promote youth employment. Higher learning Institutions have a pivotal role to play in providing skills and training critical to entrepreneurial success at scale as well as incubation, acceleration and financing for start-ups. University incubators are increasingly considered alternative pathways to engage rural youth in productive and income-generation activities. University incubators offer a facilitative environment within which universities can meet multiple objectives including revenue generation through mobilizing corporations with financial advantage, legal and technical support, and government and philanthropists to contribute to university advancement. We draw upon a university-based Agricultural and Innovation Incubation Hub (ARIHUB) designed to enhance the entrepreneurial competencies and innovativeness of local youth groups and students at Haramaya University. This paper aims to generate insights into how such mechanisms can facilitate effective mentorship and engage rural youth and students in productive and income-generating activities. Lessons from the ARIHUB experiment generally suggested that provided they are supported, local youth can develop a strong entrepreneurial orientation and appreciate the potential contribution of agripreneurship for poverty reduction and employment. The other important lesson gained from the project was that capacity-building efforts inculcate in the local youth and graduates a greater sense of accomplishment and accountability. Innovation Incubation-based models are very important mechanisms for unlocking youth potential and, therefore need to be promoted. University incubators offer an ideal environment within which universities can meet multiple objectives including revenue generation through mobilizing corporations with financial advantage, legal and technical support, and government and philanthropists to contribute to university advancement. The implications of the study for enhancing work transitions are discussed.

Keywords: Ethiopia, employment, incubation hubs, work transisions, youth

Abstract No: 038 -OP
Session: Wealth and Youth Employment
Date and Time: Wednesday 14 Aug. 2024 | 11:05 - 11:15

Innovation incubation and entrepreneurship for natural products: Experiences from the PHARMBIOTRAC innovation hub, in Uganda

Weisheit, A.

Pharm-Biotechnology and Traditional Medicine Center (PHARMBIOTRAC), Mbarara University of Science and Technology (MUST), P.O. Box 1410 Mbarara, Uganda
Corresponding Author: aweisheit@must.ac.ug

The Pharm-Biotechnology and Traditional Medicine Center (PHARMBIOTRAC) incubation hub supports is academicians, students and innovators to commercialize their research products for wider use by the publics. The center leverages the rich ethnobotanical among communities and the fact that working with science enables the translation into commercializable that benefit value chain actors from production to utilization. The center incubation systems involve: Application, description of the project, project review, prototyping, quality assurance, intellectual property management, a business clinic and commercialization among others. PHARMBIOTRAC engages with individuals, private sector and regulatory bodies to take up new innovations. Over 30 prototypes /products have been developed comprising of herbal medicines, cosmetics, pharmaceutical ingredients and herbal beverages that are owned by individual proprietors or and companies. The centre developed a therapeutic product for treatment of COVID-19. The incubation centre has made strides in nurturing local innovations and is supporting for them to be translated into commercial products by entrepreneurs, a trend that is increasing. The centre seeks strategic partnerships with both public and private agencies to grow its incubation capacity as well as scale-up its engagements between universities and the public.

Keywords: Commercialization, entrepreneurship, innovation-incubation, natural-products

---

Abstract No: 039 -OP
Session: Wealth and Youth Employment
Date and Time: Wednesday 14 Aug. 2024 | 11:15 - 11:25

Financial profitability of smallholder farmers enterprises adopting the Sasakawa Africa Association business models of APEC and PESP in three villages of Mali

Sissoko, Y., Bakary S. & Amadou B.M. T.

Sasakawa Africa Association , Rue 431, Porte 61 Près Place CAN et Mairie centrale de la CIV BP E3541, Mali, Bamako
Corresponding Author: coubasko@yahoo.fr

Agriculture remains the mainstay of Mali's economy with the sector employing nearly 70% of the 22.4 million population. The sectors commercialization is seen as a vehicle to fighting poverty by increasing household incomes, improving food security and generating foreign exchange for the country. The Impact of the sector nevertheless remains low, with poverty rates mostly associated with rural areas reaching 52.5% in 2021. The Sasakawa Africa Association (SAA) aims to help smallholder farmers transition from subsistence to market-oriented agriculture through two business models: the Agro-Processing Enterprise Center (APEC) and the Private Extension and Service Provider (PESP). The APEC model focuses on value addition by processing local products, while the PESP model provides pre- and post-harvest services. Both models intend to generate income and reduce poverty. Between 2018

and 2021, SAA established 11 enterprises (five APEC and six PESP) in the villages of Monzomblena, Samanko, and Siranikoro in Mali. A socio-economic study was conducted to evaluate both models' performance, profitability, and challenges. The study involved all 11 enterprises and collected both primary and secondary data via focus group discussions and questionnaires. Key variables included: business operations, Benefit/Cost Ratio (BCR), and marketing strategies. Results show that APEC and PESP enterprises were profitable, with positive BCRs across all enterprises. The average BCR was 0.82, for APEC enterprises, compared to PESP enterprises (0.49). The most efficient enterprise was the PESP Thresher in Siranikoro (BCR 2.08), while the least efficient was the PESP Mill in Samanko (BCR of 0.03). Despite profitability, enterprises faced significant challenges, including high costs of raw materials and fuel, frequent equipment breakdown, and poor management practices. Up to 54% of the workforce were women showing a biases for women, particularly in cereal milling and groundnut processing, while men dominated threshing and hulling activities. Training on business management was beneficial, with enterprises utilizing an average of 81.2% of the recommended tools. In conclusion, the APEC and PESP models have demonstrated financial viability and potential for promoting youth and women employment in agriculture. Implications of the models are discussed.

Keywords: Agriculture, agro-processing, business models, benefit/cost ratio, cooperatives, private extension

Abstract No: 040 -OP
Session: Wealth and Youth Employment
Date and Time: **Wednesday 14 Aug. 2024 | 11:35 - 11:45**

Magnitude and trends of flood occurrence in Nyamukubi catchment, Kalehe Territory, Eastern DR Congo

Ruhambya, M.B.[1*], Majaliwa, M.J.B.[1], Bagula, M. E.[2], Bagalwa, M.[3] & Yazidhi, B.[1]

[1]Department of Geography, Geo-informatics and Climatic Sciences, Makerere University, Kampala Uganda
[2] Faculté des Sciences Agronomiques et Environnement, Université Evangélique en Afrique, Democratic Republic of Congo
[3] Department of Biology, Centre de Recherche en Sciences Naturelles, Lwiro, Democratic Republic of Congo
Corresponding Author: benruhambya@gmail.com

Floods hazards are a common and prevalent hazard in Nyamukubi catchment, Kalehe Territory, Eastern DRC, and often result in damage to the community. Despite the prevalence of flood hazards, there is a paucity of information and knowledge regarding the magnitude and trends of flood hazards in Nyamukubi catchment. The objective of this study was to determine the magnitude and trends of flood hazards in Nyamukubi catchment as a preliminary step in flood risk reduction. To achieve this, the magnitude and trends of flood hazards were determined using time series analysis in discharge data simulated from the Soil and Water Assessment Tool (SWAT) rainfall- runoff model. The results indicated that, over a 28-year period, 24 flood hazard events were recorded in the study area. The number of flood events reached its maximum value in the years 1998, 2001, 2009, 2012 (two flood events per year). The flood event with the highest discharge volume occurred in October 2014 (44.09 m3/s). The Standards Precipitation Index (SPI) demonstrated a correlation between flood occurrences and periods of high precipitation (September to May). The results of the Man-Kendall statistic test indicated that there is no apparent linear trend in the number of flood hazards and rainfall over the 25-year period under consideration (p-value < 0.13).

Keywords: Flood hazards, catchment, risk-reduction, DR Congo

Thematic Area 4:

Economic Trends, Best -Practices, Policy-Practice and Futures

Subtheme 4a: Innovations for growing Africa's agriculture and related sectors

VENUE: Mercure Hotel, Room KUISEB 4
CHAIR: Dr. Vincent Mgoli, Lilongwe University of Agriculture and Natural Resources
RAPPORTEUR: Mr. Lacely Nheya, Mr. Emmanuel Pope and Ms. Claire Nabatta

RUFORUM Working Document Series (ISSN 1607-9345), 2024, No. 23
Available from http://repository.ruforum.org

Abstract No: 041 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: **Wednesday 14 Aug. 2024 | 08:35 - 08:45**

The changing world of agricultural extension and advisory services: What can Africa learn and business models and leveraging the knowledge and digital revolution taking place globally

Silim, N. M.

African Forum for Agricultural Advisory Services, P.O. Box 34624, Kampala, Uganda
Corresponding Author: msnahdy@afaas-africa.org

Agricultural extension services are essential for improving agricultural productivity, enhancing farm incomes, and promoting sustainable agricultural practices. However, traditional public extension models face challenges in reaching a large number of farmers, especially in resource-constrained settings. This paper reviews various business agricultural extension approaches that are currently being implemented globally which include, in general; Public-Private Partnership (PPP), Pluralistic Extension Model, Fee-for-Service Model, Farmer/Cooperative Extension Model and Digital Extension Models, among others. Each model has its strengths and weaknesses, and their effectiveness depends on context-specific factors. It also explores the potential of digital solutions in revitalizing agricultural extension services to enhance farmer knowledge using various digital tools and platforms, such as mobile apps, social media, digital marketplaces and e-extension platforms, that can facilitate knowledge sharing, farmer engagement, and capacity building. Additionally, we highlight the benefits and challenges of adopting digital solutions including increased accessibility, real-time information dissemination, and data-driven decision-making. We emphasize the need for a hybrid approach, combining traditional and digital methods to ensure inclusive and sustainable agricultural development. By leveraging digital solutions, agricultural extension can become more efficient, effective, and responsive to the needs of farmers, ultimately contributing to improved agricultural productivity and food security. The findings suggest that a combination of models, leveraged by digital solutions, can lead to sustainable agricultural development, improved farm productivity, and enhanced business growth. The paper concludes by emphasizing the need for a holistic approach to agricultural extension services that incorporates business principles and sustainability goals.

Keywords: Agriculture, agricultural extension, advisory services, bundled-services

Abstract No: 042 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 08:35 - 08:45

Transformative and impactful agricultural technology transfer and dissemination: lessons from NARO, Uganda

Sadik, K., Kugonza, J., Nahayo, E., Mbihayeimaana, J., Otim, N., Mbigidde, V., Kapalaga, G., Zawwdde, B. & Baguma, Y.

National Agricultural research Organisation, Uganda P.O.Box 5704, Kampala
Corresponding Author: kassim.sadik@naro.go.ug; sdkassim@gmail.com

Agriculture remains the mainstay of the people of Uganda in terms of food, raw materials and employment provision. There has been increasing need for a resilient food system to respond to the growing population, urbanization and climate change as well as raw materials and value-added prototypes to accelerate agro-industrialization and job creation. National Agricultural Research Organization (NARO) responded to these R&D triggers by enhancing productivity through generation and promotion of highly productive resilient agricultural technologies for food, nutrition, industry and market. It participatorily generated over 1000 problem-solving and demand driven technologies. However, a number of these technologies have not widely permeated the communities. Low adoption and utilization of improved technologies continued to be associated with poverty and food insecurity in some rural parts of the country. This undermines NARO's mission of innovating for sustainable agricultural transformation and efforts towards building a dynamic agricultural research innovation system to support societal competitiveness. To address this challenge, NARO has in the last five years reoriented the responsiveness of her strategic plan with more emphasis on innovations for industry and niche market; adopted vertical and horizontal technology transfer mechanisms; strengthened her policy frameworks for outreach, commercialization, intellectual property management, knowledge management and communication; espoused strategic partnerships, collaborations and alliances for generation and dissemination of research products and services; developed a comprehensive strategy for technology dissemination in the country. This paper is intended to share lessons on building an efficient technology transfer and dissemination system for enhanced utilization of research products and services, transformation of agriculture, agro-industrialization, job creation, improved livelihoods and socio-economic development.

Keywords: Adoption, agricultural technology, dissemination, innovations

---

Abstract No: 043 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:05 - 09:15

From University pilot to community scale: Evidence of how transitioning from teaching to learning entrepreneurship shaped refugee livelihoods

Odongo, W.

Gulu University P.O.Box 166 Laroo Division, Gulu, Uganda
Corresponding Author: odongo78@gmail.com

The linear approach of technology transfer is widely criticized for being non-responsive to the development needs of the marginalized and vulnerable communities. As such, universities have been urged to play an active role, within their community engagement mandate, in facilitating inclusive innovation and entrepreneurship development. Entrepreneurial capacity building amongst the youths and marginalised communities is critical in addressing the malignant unemployment, rural poverty

and creation of responsible citizens. Realising this need, Gulu University extended its innovative and experiential Student Enterprise Scheme (SES) to facilitating farm based micro-enterprises development in refugee and host communities in West-Nile sub-region of Uganda. The core of this intervention is to train and mentor refugees and host communities to start and run micro-enterprises as an alternative source of livelihoods. In one year of implementation, 413 were able to successfully identify, develop and implement various business ideas with technical guidance and backstoping from the university. Business survival stood at 60%, three years post project intervention. Experiences gained show that community engagement can be harnessed to facilitate an inclusive innovation system. However, for this to be effective, an interface structure, faculty supervision, and community leadership is critical. In conclusion, stimulating sustainable enterprise development in marginalized communities largely depends on how the interventions are packaged. Further, active engagement of marginalized communities in decision-making does not only give beneficiaries opportunity to contribute and own the development process but also enables the University to learn from the community, and informs intervention design. The SES model therefore shows positive potentials in improving entrepreneurial mindset amongst both university students and marginalized communities.

Keywords: Host communities, innovations, interactive learning, marginalised communities, refugees University community engagement

Abstract No: 044 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:15 - 09:25

Leveraging intellectual property for enhanced commercialization of agricultural research in Africa: A case study of the national agricultural research organisation

Nahayo, E., Mbihayeimaana, J. & Kassim, S.

National Agricultural research Organisation, P.O.Box 5704, Kampala, Uganda
Corresponding Author:wenahayo@gmail.com

Despite the clear advantages that commercialization of research outputs presents to the economy and institutions, public research and development organizations in sub-Saharan Africa struggle to commercialize their research results. Intellectual property (IP) management has been suggested as a strategic tool for commercialization of research results. At a national level, delivering research results to the market leads to economic development by creating new businesses, industries and employment opportunities. Furthermore, at institutional level, revenues generated from commercialization of research outputs can be ploughed back to sustain research and innovation activities. The main objective of this study is to distill and disseminate key lessons including both effective strategies and challenges encountered, from experiences of the National Agricultural Research Organisation (NARO) in the commercialization of research results. The study utilized a case study design where information was gathered through comprehensive analysis of the NARO's intellectual management practices. Data was collected using qualitative data collection techniques, including participant observation and review of organizational documents. The study shows that NARO's systematic approach to IP management has significantly enhanced the commercialization success of some of her key research outputs. Key strategies include active private sector engagements, signing of Intellectual property licensing agreements, market surveillance, technology incubation and regular compliance monitoring of signed IP agreements. Additionally, the study highlights several challenges such as the absence of some critical national policy frameworks for IP management and technology transfer, low levels of IP awareness among different stakeholders and poor enforcement of IP rights. The findings provide public research and development institutions with actionable strategies for improving IP.

Keywords: Commercialization, intellectual property, research results

Subtheme 4b: Supplying Africa's 2nd decade (2024-2034) work force

VENUE: Mercure Hotel, Room KUISEB 1
CHAIR: Prof. Isa Kabenge, Makerere University
RAPPORTEUR: Mr. Clement Okechukwu Attamah , Mr. Bantuzeko Fabrice and Ms. Tatenda Murefu

RUFORUM Working Document Series (ISSN 1607-9345), 2024, No. 23
Available from http://repository.ruforum.org

Abstract No: 045 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: **Wednesday 14 Aug. 2024 | 09:35 - 09:45**

Socio-economic huddles for accessing smallholder-small scale innovations for unlocking economic opportunity: What have we learnt from agriculture and related sectors

Mugisha, J.

College of Agricultural and Environmental Sciences, Makerere University, P.O. Box 7062 Kampala, Uganda
Corresponding Author: johnnymugisha@gmail.com

In the recent decades, use of innovations in the African agricultural sector has been at an increase. Smallholders are increasingly adopting innovative approaches and scientific research products to increase productivity of their enterprises, diversify household diets, and build resilience to climate change, local market dynamics and global market trends. The innovations include a range of process innovations to improve agricultural production techniques, product innovations to improve quality and value of products, organisational and marketing innovations to improve performance of supply chains. However, compared to developing countries in other continents, both innovativeness and use of innovations are low, with high heterogeneity skewed to the smallholders. Many smallholder firms have been left behind in a vicious cycle of low innovativeness - low innovation adoption – low productivity. This has increasingly widened the productivity gaps between the innovation- and the non-innovation users, exposing the latter to risks of being eliminated by and from the market economy. This paper discusses the socio-economic challenges limiting the smallholders in Africa to innovate, and to access and utilise the existing appropriate innovations. The hurdles, varying in magnitude from one agricultural system to another, include insufficient financial and human capacity, low marginal returns to innovation, lack of market demand for the innovation, risk aversion and uncertainty, and unfavourable policy and regulatory environments. There is no singular prescription to overcome these limitations but a blend of, among others, human capacity building and empowerment, provision of financial and market access support and policy and regulatory support.

Keywords: Agriculture, enterprises, innovations, smallholder firms

Abstract No: 046 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Climate change impact on the suitability of major staple crops in Uganda: Implications for adaptation and mitigation policy

[1]Majaliwa, J.G.M, [2]Nampijja, J., [1]Yamungu, A. B.B, [2]Sebuliba, E., [2]Kizza, C.L. & Abiba M. A

[1]Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), P.O. Box 16811, Kampala, Uganda
[2]LesRams Consult, P.O. Box 29832, Kampala, Uganda
Corresponding Author: m.majaliwa@ruforum.org

Climate change is likely to profoundly affects the suitability of major crops, altering their growth patterns, yield potential, and geographic distribution. This is likely to exacerbate the already fragile conditions of smallholder farmers on the continent. Understanding these spatio-temporal dynamics is crucial for developing adaptive strategies to sustain agricultural productivity and ensure food security in the face of climate change. This study i) projected the changes in temperature and rainfall under different climate regime and ii) assessed their effect on the suitability of major crop (coffee, banana and sorghum) in Uganda. Climate projection was done for the two emission scenarios RCP 4.5 and RCP 8.5 for the mid-century. Crop suitability was done using ArcGIS based Multi-Criteria Decision Approach. An equal weighted Analytical Hierarchical Process (AHP) was used to generate suitability map for the major crop. The AHP included a selection of different criteria used for analysis and categorized according to their usefulness in relation to the growth requirements of the selected crops (Lithology, soil physicochemical, slope, elevation, soil loss and climate). The overall study shows that the average temperature is likely to increase for all climate regimes while the sign of the relative change in rainfall is most likely to be agro-ecological dependent. The absolute change in minimum temperature is likely to exceed that of the maximum temperature for all ago-ecological zones. Climate change could push the growing conditions of the major crops beyond the limits they can tolerate in many agro-ecological zones, jeopardizing the food security of millions of people in the country.

Keywords: Climate projection, land quality, crop productivity, emission scenarios, Uganda

Abstract No: 047 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Groundnut, an opportunity grain legume crop for unlocking livelihood opportunity: The demand and supply of new technology as a key driver for increased productivity

[1]Okello, DK., Chapu, I., [1]Anguria, P. Osia, P., [1]Owiny, R., [1]Oyaro, D., [1]Namutosi, P., [1]Happy, D., [2]Fonceka, D., [3]Hoisington, D. & Ugen, M.A.

[1]National Semi-Arid Resources Research Institute, P. O. Box 56, Soroti, Uganda
[2]Centre d'Etude Régional pour l'Amélioration de l'Adaptation à la Sécheresse (CERAAS), BP3320 Thiès, Senegal
[3]Athens, CAES Campus 218 Hoke Smith Building, Athens, GA 30602
Corresponding Author: kod143@gmail.com

Groundnut (*Arachis hypogaea* L.), also known as peanut, is the second most important legume after beans (*Phaseolus vulgaris* L.) in Uganda. Introduced from Latin America by Portuguese explorers around 1862, groundnut is extensively used for food, feed and commerce. Challenges includes Biotic stresses (Pests-Leafminer, aphids, thrips, bruccids; Diseases-Early and late Leafspots, Groundnut rosette, Rust, Aflatoxin), abiotic stresses (drought, heat), weak seed systems, understaffed extension personnel and low adoption of improved varieties. Long term research in Uganda has led to commercialization of 29 varieties that have contributed to addressing the above challenges. Owing to the erratic climate, ever changing consumer preferences and increasing population calls for new, fast, efficient and adapted demanded technologies. Such research and innovations includes: Validated target product profiles and market segments, diverse germplasm breeding pool and demanded varieties, recommended management options (biological, chemical, cultural, IPM), deployment of modern tools (QA/QC, molecular), Mechanization (on-field and off fields), Digitization of operations (data capture and managements; ICT for seed tracking and traceability); Machine learning models deployment (for precise early detections, prediction), Rapid cycle of varietal turnover (short replacement cycle), Innovative extensive awareness campaigns, Incorporation of Gender and Youths issues and operating in Public Private Partnership.

Keywords: *Arachis hypogaea*, grain legumes, livelihoods, Uganda

Abstract No: 048 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Is it Possible for Africa to Feed Itself? The prospects for traditional farming systems and smallholder agriculture

[1]Swanepoel, F., [2]Stroebel, A., [1]Minialo, S., [3]Dorvlo, S., [1]Mentz-Coetzee, M., [4]Quinn, C., [1]Mkandawire, E., [5]Dougill, A. & [6]Madzivandila, A.T.

[1]University of Pretoria, South Africa
[2]University of Mpumalanga, South Africa
[3]University of Ghana, Ghana
[4]University of Leeds, UK
[5]University of York, UK
[6]FANRPAN, South Africa

Corresponding Author: kod143@gmail.com

The agricultural sector is the world's largest single employer, employing 900 million people (30% of the global workforce), and is the largest source of income and jobs for poor, rural and smallholder households. It is by-and-large a successful sector – there has been significant improvements in productivity and food production over the past five decades, mainly as a consequence of scientific advances, increased fertilizer-use and favourable rainfall patterns. And yet, 240 million people of people in Africa go hungry every day. Where therefore is the disconnect between food production and food security on the continent? Why does the continent spend $80 billion per year importing food, when so many of its residents are farmers, and how can this situation be changed? Food systems transformation plays a key role in achieving multiple SDGs. The extent to which such transformations can sustainably eliminate hunger and ensure that everyone has access to affordable, safe, healthy, and nutritious food (SDG 2) relates to institutional, socio-economic, and environmental transformations. There are multiple pathways through which the necessary transformative changes can take place, and there is need to enhance our understanding of how this change takes place. In the African context, this paper maps the African food systems, maps the policy landscape, and attempt to advance our understanding of pathways to the plate. The paper adopts a socio-economic systems approach to African food systems, underpinned by a scoping of the relevant literature concerning the challenges and knowledge gaps facing food systems change in Africa. The evidence base related to food systems in the African context remains underdeveloped. The food systems framework will provide a tool to enable regionally-focused analyses of African food systems to address this gap. The paper will identify pertinent, pressing research gaps and potential leverage points for transformative change, particularly in relation to the crucial current food system failures prevalent across Africa – efficiency, safety, reliability/resilience, inclusiveness, affordability and nutrition. The paper recognises gender and poverty as cross-cutting issues, influencing not only labour, inputs and the types of farming systems (supply side), but also diets and food cultures (demand side). It recognises formal and informal supply chains through which food moves from farm to consumer and the different actors and regulations that govern those chains (and the interactions between them). It recognises key emerging actors within the food systems, such as "agripreneurs" setting up businesses in the agri-sector, and critical drivers of change (e.g. urbanisation and the growing African middle class).

Keywords: Agripreneurs, agrifood systems, food security, resilience, SDGS

Abstract No: 049 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Mitigating Effects of climate change using safflower

Emongor, V. E.

Botswana University of Agriculture and Natural Resources, Private Bag 0027 Gaborone, Botswana
Corresponding Author: vemongor@gmail.com; vemongor@buan.ac.bw

Safflower (*Carthamus tinctorius* L.), is an annual multipurpose oil seed crop that is adapted to arid and semi-arid lands (ASALs). Climate change is enhancing salinity and drought in ASALs due to low or no precipitation and high temperatures that are inducing high evapotranspiration and depletion of underground water resources. Salinity and drought stress are the major factors limiting crop productivity in agricultural systems in ASALs. Growing drought-tolerant crops such as safflower in the ASALs can help ensure food security and sustainability. Although safflower is known to be drought tolerant, there is a need to select genotypes that would better adapt to drought-stress conditions promoted by climate change in the ASALs. Therefore, the objective of this study was to to assess safflower genotypes for drought tolerance. Greenhouse and field experiments were undertaken to evaluate the response of safflower genotypes to drought stress induced at different developmental stages. The treatments were stress condition (stressed and control), developmental stages (rosette, branching, and flowering) and five safflower genotypes (Sina, Gila, Kenya9819, Turkey, and PI537636). The results showed that drought stress reduced leaf chlorophyll content, leaf relative water content (LRWC), and plant height depending on genotype, duration of water stress, and phenological stage of safflower. The results further showed that the contents of ascorbate peroxidase (APX) and proline content increased in stressed plants depending on genotype, duration of stress and phenological stage of safflower. There was significant (P 0.05) genetic variation to drought stress, duration of water stress and phenological stage of safflower as evidenced by different contents of chlorophyll content, LRWC, proline, and APX, and plant height. Biplot analysis showed that the genotypes Kenya9819 and Gila were the most drought tolerant and susceptible, respectively. The results of the current study further showed that drought stress tolerance was very complex, and it involves several mechanisms either working synergistically or independently based on the traits involved.

Keywords: Biplot, *Carthamus tinctorius* L., drought tolerance, genotypes, drought tolerance mechanisms

Abstract No: 050 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Recent progress on agricultural biotechnology research and development in Uganda

Alicai, T., Odipio, J., Wagaba, H., Esuma,W., Aleu, J., Okao-Okuja, G., Namuddu, A., Omongo, C., Bwesigye,N.P., Barekye, A., Arinaitwe, A., Kabi, F., Majalija, S., Yada, B. & Baguma, Y.

National Agricultural Research Organisation, Uganda
Corresponding Author: talicai@hotmail.com

Agriculture in Uganda is faced with a wide array of challenges. These include frequent droughts, declining soil fertility, several disease epidemics, high pest prevalence, diversity and outbreaks. Other critical challenges are rapid population growth, widespread malnutrition and urbanization associated with shifts in consumer preferences. Biotechnology has been used in Uganda to address such problems of national significance that cannot be easily solved using traditional approaches. This includes addressing productivity challenges such as cassava brown streak disease, banana bacterial (Xanthomonas) wilt (BXW), potato late blight, drought, pests including cassava whiteflies and stem borers in maize. Other major biotechnology interventions have been on development of bananas with elevated pro-Vitamin A levels and anti-tick vaccine for tick control in cattle. Agricultural biotechnology research and development interventions in Uganda are at different points along the innovation pipeline from discovery to deployment. Current biotechnology opportunities in Uganda include facilities, expertise, product candidates, farmer, market and industry needs. The implications of these scientific advances for improving Uganda and indeed Africa's agricultural productivity are discussed.

Keywords: Agriculture biotechnology, agri-technologies, innovations, molecular biology, production challenges

---

Abstract No: 051 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Impacts of present agricultural policies on sustainable food security in Kenya

Kipkoech, A.K.

Moi University, P. O. Box 3900 - 30100, Kesses, Eldoret
Corresponding Author:

Kenya's pursuit of food security has been elusive despite various policies and programs implemented to address food insecurity. The study analyzes the factors that continue to make Kenya food insecure, focusing on the productivity of national fertilizer subsidy programs and other national agricultural policies on sustainable food security in Kenya. The study used an explanatory and descriptive research design and a case study approach, focusing on farmers in Moiben sub-county of Uasin Gishu county, Kenya. Results showed that majority of farmers (63.7%) had obtained some form of government support in their farms in the last five years, with the fertilizer subsidy received by 94.2% of households. Most farmers (83.4%) still preferred the fertilizer supplied by the government under the subsidy program. There was a big variation in maize yield obtained by farming households with a mean of 16.1±3.3 bags per acre (3.5 tons/ha), that was 59.5% of maize yield potential of 6t ha^{-1}. Only a small percentage (12.6%) considered the formulation when purchasing fertilizer for maize production with most farmers (83.4%)

still preferring the fertilizer supplied under the subsidy program regardless of the formulation. The study concludes that maize yield has continued to decrease in spite of continuous government programs of fertilizer subsidy and other policies, pointing to the fact that the policies may not be working or are not implemented in a way that benefits farmers. There is a need for increasing investment in research so that government can use local research outcomes as a basis to program roll-outs.

Keywords:

Abstract No: 052 -OP
Session: Innovations for growing Africa's agriculture and related sectors
Date and Time: Wednesday 14 Aug. 2024 | 09:35 - 09:45

Examination of the effects of African Continental Free Trade Area (AfCFTA) Framework on the Continent's agricultural products trade market

Nyambe, S.

University of Namibia, Private Bag 13301, 340 Mandume Ndemufayo Avenue, Pionierspark, Windhoek, Khomas, Namibia

Corresponding Author: shepherdmn01@gmail.com

The African Continental Free Trade Area (AfCFTA) represents a significant step towards integrating Africa's economies and fostering intra-African trade, including in agricultural products. However, the impact of AfCFTA on the agricultural trade market is not yet fully understood. The study seeks to analyze the changes in trade patterns, market dynamics, and competitiveness of African agricultural products under the AfCFTA framework. It also aims to assess the challenges and opportunities that AfCFTA presents for African agricultural trade. The study will employ a combination of qualitative and quantitative methods. Qualitative analysis will involve a review of policy documents and literature on AfCFTA and agricultural trade in Africa. Quantitative analysis will include the use of trade data to track changes in trade patterns and market shares of agricultural products. Preliminary findings suggest that the AfCFTA framework has the potential to significantly boost intra-African trade in agricultural products. However, challenges such as non-tariff barriers, infrastructure deficits, and limited access to finance may hinder the full realization of these benefits. The study will provide insights into the impact of the AfCFTA framework on the African agricultural trade market. It will also offer recommendations for policymakers, stakeholders, and practitioners to enhance the benefits of AfCFTA for the agricultural sector in Africa.

Keywords:

PRESENTED POSTERS

Abstract No: 01 -PP

Resistance of banana cultivars against *Fusarium oxysporum* f.sp.cubense (Foc) in Southern Ethiopia

Bekako, Z., Fininsa,C., Kedir, B. & Mohanmmed,A.

Haramaya University, P.O. Box 138. Dire Dawa, Ethiopia

Corresponding Author:

Fusarium wilt caused by the fungal pathogen Fusarium oxysporum f.sp. cubense (Foc) is one of the major threats challenging the banana industry in Ethiopia. It affects the production and productivity of both commercial and local banana cultivars; especially in southern Ethiopia where banana is dominantly grown. This study was conducted to evaluate the resistance of commercial banana cultivars against the disease at Arba Minch Agricultural Research Center, Ethiopia. In 2021/22 an experiment was conducted involving seven commercial banana cultivars in completely randomized design with factorial arrangement with three replications. Observations of external leaf symptoms and internal rhizome discoloration were made to determine the responses of the cultivars and evaluated using standard scales of leaf symptom index (LSI) and rhizome discoloration index (RDI). Data on incubation period, disease incidence and percent severity index were collected and subjected to the analysis of variance using the SAS software version 9.2 and means were compared using LSD test (± 0.01). The result obtained from the responses of the cultivars showed that William and Grand Naine hybrids were categorized as resistant but Poyo and Ducasse hybrids were categorized as susceptible and highly susceptible, respectively. Butuzua, Giant Cavendish and Dwarf Cavendish hybrids were found to be tolerant to the disease. In addition, the analysis of variance indicated that incubation period and severity values ranged from 10-46 and 13.33 - 63.33%, respectively. It is recommended that those susceptible and highly susceptible cultivars should be replaced by the resistant ones to reduce the devastation posed by the disease and tolerant cultivars could be maintained in production with the implementation of effective integrated disease management practices. It is also suggested that the diversity of Fusarium oxysporum f.sp.cubense (Foc) and its race identification should be the future research directions in the study area.

Keywords: Cultivar, fusarium, incidence, Index, resistance severity

---

Abstract No: 02 -PP

Adoption of information and communication technologies among Sasakawa Africa Association farmers

Traore, A.B.M.

Sasakawa Africa Association, Rue 431, Porte 61 Près Place CAN et Mairie centrale de la CIV BP E3541, Mali, Bamako

Corresponding Author: amadouballatraore@yahoo.fr

Agriculture is one of the pillars of economic growth in Mali contributing 36% of GDP and employing 80% of the population. It is also a sure mechanism for retaining young people in the country if it can grow be a rewarding sector of the economy. Currently, the sector faces many challenges such as low productivity driven by among others limited use of improved agricultural practices and technologies as well as climate change induced drought. This has intensified food insecurity and vulnerability, with close to 25% of households facing food insecurity, and up to 40% of children under five years, affected by malnutrition. Access to agricultural extension and advisory services in Mali remains low, often non-functional or inadequate in relation to farmers' expectations. Yet a robust extension system is key to catalyzing productivity growth. Adoption of digital tools in the extension services will help to shrink the gap between extension services providers and farming population currently at 1 agent for 500 farms twice the recommended ratio of 25 per agent. In Mali both third-generation (3G) and 4G

network coverage are over 80% across the entire country unlocking opportunity to harnessing digital technologies for provision of advisory services. In Mali, Orange Mali and other agricultural extension agencies or NGOs have developed and piloted the use of digital tools and services to improve access to knowledge and services by farming communities. The digital tools facilitate farmers' access to improved agronomy, technologies and innovations, as well as agricultural markets. Sasakawa Africa Association (SAA), in accordance with its 2021-2025 strategic plan and also, with the advent of the Covid-2019 pandemic in Mali in 2020, launched an electronic extension pilot project equip the effects of the Covid-2019 pandemic on farming populations. The project provided farmers, extension agents and seed inspectors/controllers with smartphones to provide advisory services. Training modules were also developed shared through social media applications such as WhatsApp and Facebook and YouTube. However, no empirical data exist on their adoption rate by the farmers. Thus, this study will focus on this, in order to encourage a large scale deployment of ICT in agriculture in Mali.

Key words: Advisory services, Agriculture- extension, Mali, Sasakawa

Abstract No: 03 -PP

A systematic review of the extent and impacts of farmer-led irrigation development in Sub-Saharan Africa: Lessons for Zimbabwe

Tsiko, C.

Chinhoyi University of Technology Private Bag 7724. Chinhoyi, Zimbabwe
Corresponding Author: ttsiko@gmail.com

Irrigation is a critical component of agriculture that can improve crop productivity underpinning food security, and poverty alleviation, especially in the face of population growth and climate change. Zimbabwe's irrigation sector comprises both large and smallholder systems. Farmer-Led Irrigation Development (FLID) used by the vast majority of smallholder and involves supporting farmers acquire and use irrigation for production. Currently, considerable variations exist in the irrigated area estimations undertaken by different government agencies in Zimbabwe. This lack of real-time data hinders informed decisions regarding crop planning, water allocation, and infrastructure development and can be remedied by upgrading existing irrigation statistics. The objectives of this paper were to review FLID operations in sub-Saharan Africa (SSA), observe patterns, cross-cutting issues, and draw parallels to the extent, successes, and challenges of FLID could inform the Zimbabwean scenario. The actor-oriented approach; mapping and the Sustainable Livelihoods Framework (SLF) provided the conceptual underpinnings of this paper. The study used the Google Scholar database accessed in February 2023 and followed the PRISMA guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses). The initial literature search yielded 399 documents that were published in the period 2012 through 2023. After screening for relevance to SSA 78 documents underwent full analysis and after full text analysis, only 32 documents were included in the analysis. The study shows that FLID is more extensive and diverse than previously believed, and it creates jobs, boosts agricultural production and nutrition. Whilst public sector and government interventions can accelerate FLID, farmers face challenges of access to water, financial resources, appropriate technology, and markets but they show their agency by being innovative and devising ways of coping with life even under stress and uncertainty. In line with the Sustainable Livelihoods Framework, throughout sub-Saharan Africa, FLID actors are able to succeed in the production process, sell their produce and earn financial capital which they can invest in physical capital. In this way, despite limited case studies in Zimbabwe, parallels can be drawn across sub-Saharan Africa on the successes and challenges of FLID. Therefore, it is crucial to accelerate FLID operations in Zimbabwe. This will allow for new policy formulation and inclusion of FLID, especially since Zimbabwe is still formulating its National Irrigation Policy while having a Statutory Instrument for irrigable area regulations (SI 38 OF 2021). Zimbabwe can also learn from successful FLID practices and address common challenges faced by farmers in SSA.

Keywords: Agriculture, Dryland farming, irrigation, smallholder farmers, SSA, Zimbabwe

Abstract No: 04 -PP

A geochemical baseline study of giant kelp (Macrocystis pyrifera) at the Atlantic Ocean kelp blue farm to assess carbon sequestration potential

Daniel, L.S[1]. & Mutjida, P[2]

[1]University of Namibia, Po Box 99530, Windhoek
[2]Kelp Blue, Luderitz, Namibia

Corresponding Author:

The raised levels of carbon dioxide (CO_2) in the earth's atmosphere have contributed to global climate change, which has adversely affected a wide range of individuals, communities, and organizations. One of the ways to mitigate climate change is to grow Giant kelp (Macrocystis pyrifera) forests that can absorb CO_2 from the atmosphere and sequester it in the deep ocean. To grow these forests, the right biogeochemical conditions (temperature, nutrients, oxygen, salinity, pH, trace metals and ions) within the ocean is vital to assess the sequestration potential and the impacts on the ocean health. This study aimed at monitoring the biogeochemical changes at the established Kelp Blue pilot farm and determine the baseline of the chemical composition of the farm and near the Atlantic Ocean. The geochemical parameters were measured using both in-situ probes and laboratory analyses. The sediments were analysed for trace metals by using a portable XRF and for carbon content using Loss on Ignition (LOI) method. The concentrations of nutrients in seawater samples were determined by spectrophotometry. The geochemical parameters changed in relation to the seasonality and geographical positioning. In a season when the upwelling system was strong, the concentration of nutrients, acidity and salinity have increased significantly, compared to other seasons. Higher concentrations of phosphates (614 µg/L) were found in areas close to the islands. This is due to the presence of guanos. The cultivated kelp can co-exist with other natural existing kelp beds in this ecosystem, and they can thrive more predominantly in season of great influx of nutrients during the season of strong winds. This study recommends that a continuous monitoring of the water and sediment geochemical changes be done as the scale of operation expands.

Keywords: Climate mitigation, carbon sequestration, biochemical, giant kelp

Abstract No: 05 -PP

Empowering Women in Malawian agriculture for climate adaptation and sustainable development: A Holistic Approach

Batizani, D.A.V

Malawi University of Science and Technology. P.O. Box 5195 Limbe, Malawi
Corresponding Author: dbatizani@must.ac.mw

Agriculture is the predominant source of employment for 70% of women in Malawi. Despite their substantial contribution, women in agriculture confront persistent gender disparities in vulnerabilities, resource access, and productivity. These inequities hinder their ability to adapt to climate change, diverging from their male counterparts in developing nations. Addressing the gender gap in agriculture to mitigate climate change necessitates more than equitable resource distribution. It relies on women's control over resources, involvement in decision-making, and alignment of resources with their needs and priorities. Effective solutions must empower women, transform gender dynamics, and enhance agricultural productivity sustainably. However, realizing these objectives demands the implementation of technologies within a framework that reinforces mutual resource support, enhances women's asset control, fosters equitable decision-making, and strengthens capacity-building initiatives. The study emphasizes the pivotal role of gender dynamics in agricultural adaptation to climate change, stressing that addressing gender disparities entails more than just equitable resource distribution. It underscores the importance of women's control over resources, their participation in decision-making, and aligning

resources with their needs and priorities. Additionally, it highlights the significance of implementing technologies within a framework that reinforces mutual resource support, enhances women's asset control, fosters equitable decision-making, and strengthens capacity-building initiatives. In summary, the findings underscore the imperative of holistic approaches that prioritize women's empowerment and equitable resource management for effective climate adaptation and sustainable agricultural development.

Keywords: Asset control, climate change adaptation, decision making, gender disparities

---

Abstract No: 06 -PP

Education for employment: A survey of entrepreneurship education in twelve African Agricultural Universities

Soulimani, A.A.

Mohammed VI Polytechnic University Lot 660, Hay Moulay Rachid Ben Guerir, 43150, Morocco
Corresponding Author: adnane.soulimani@um6p.ma

High youth unemployment in Africa presents a significant challenge. Policymakers are increasingly exploring entrepreneurship as a potential solution. Building a successful national entrepreneurial ecosystem, however, necessitates a systemic approach where education plays a pivotal role. This study intended to survey entrepreneurship education in twelve African agricultural universities participating in the TAGDev 2.0 project, funded by the MasterCard Foundation. The research seeks to identify successful practices that can inform the development of customized programs for African higher education institutions. A mixed-methods approach utilizing online surveys and semi-structured interviews with various stakeholders at each university was employed. Students, researchers, professors, incubation program managers, and others involved in entrepreneurship initiatives were among the interviewed. Results from this study provide first-hand insights into the design and implementation of existing entrepreneurship programs, including curriculum and pedagogy. This research identified successful practices in African agricultural universities, leading to the development of more customized and effective entrepreneurship programs. The study contributes essential knowledge towards building thriving African entrepreneurial ecosystems that foster job creation.

Keywords: African entrepreneurial ecosystems, entrepreneurship education, Morocco

---

Abstract No: 07 -PP

Soybean production experiences, constraints and breeding trait preferences in Malawi: Smallholder farmers' consultation and implications for breeding programs

Jere, Z.M

Mzuzu University, P / Bag 201, Luwinga, Mzuzu, Malawi
Corresponding Author: jerezondiwe@gmail.com

The study was conducted to analyze smallholder farmers' soybean experiences, production constraints and breeding traits preference in Malawi. A cross-sectional study was conducted with 278 smallholder farmers, two farmers focus group discussions and five key informant interviews were conducted. Data on soybean production experiences, constraints and trait preferences was analyzed into percentages and Relative Importance Indices to rank traits and constraints. The results indicated that most of the respondents (60%) have never attended soybean production training, get new varieties information from

agricultural extension workers (86%), most knew Tikolole variety (87%), and grew Tikolole (72%) in 2022/23 growing season. About a third of them got soybean seed from friends and relatives (37%). The main constraints are: lack of better markets, high disease incidences, low yield, high pest incidences, high cost of improved seed, lack of rust resistant varieties, unpredictable rainfall, low seed viability, and inadequate extension services. The farmers preferred soybean traits are: high yielding, high biomass yield, drought tolerant, high pest resistance, high disease resistance, low soil nutrient requirement and high threshability. Therefore, breeding programs should not only accentuate on processors but also smallholder trait preferences such as high yielding, high biomass yield, drought tolerant, high pest resistance, high disease resistance, low soil nutrient requirement and high threshability to foster adoption and address constraints.

Keywords: Malawi, pest resistance, soybean production, seed viability, Tikolole variety

---

Abstract No: 08 -PP

Predicting nitrogen uptake in paddy rice using UAV-multispectral imaging in the eastern Democratic Republic of Congo

Iragi, D.M.

Université Catholique de Bukavu, P.O. Box 285 Bukavu, D.R Congo

Corresponding Author: dimuhindo@gmail.com

Nitrogen is a key input for increasing rice yield. Laboratory nitrogen assessments have the disadvantage of being destructive, time consuming and expensive. A field nitrogen monitoring study was conducted in the Ruzizi plain in the Eastern Democratic Republic of Congo (DRC) in 2022. The aim of the study was to estimate paddy rice nitrogen uptake using Unmanned Aerial Vehicle (UAV)-based multispectral imagery and machine learning techniques. Spectral data was collected at rice tillering and panicle initiation stages from a split split-plot in a randomised complete block design experiment. Four modelling approaches; two decision tree-based models (Random Forest and Extremely Randomised Trees) and two linear-based models (Multiple Linear Regression and Support Vector Machine), were used in data analysis. The findings suggested that paddy rice traits predictions were critically sensitive to the timing of image acquisition, and were not largely affected by the choice of the model. The most accurate nitrogen uptake prediction was made at the panicle initiation stage (R2= 0.75, RMSE= 0.09 t N ha-1, and RMSPE= 23%). The analysis of feature importance demonstrated that the VARI, MCARI, and RVI indices were crucial in predicting the uptake of nitrogen in paddy rice. This research further established that UAV-based indices were able to assess field scale nitrogen uptake changes. The UAV technologies can therefore be used by decision-makers to improve fertiliser application practices in order to close the rice yield gap in DRC.

Keywords: D.R Congo, nitrogen uptake prediction, random forest, Ruzizi, spectral data

---

Abstract No: 09 -PP

DArTseq SNP-based genetic diversity and population structure of spider plant (*Cleome gynandra* L.) landrace populations from Zimbabwe

Mativavarira, M.

Sorghum and Millets Research Unit, Department of Research and Specialist Services (DR&SS), Zimbabwe
Corresponding Author:pmmativavarira@gmail.com

Spider plant (*Cleome gynandra* L.) is valuable Africa's Indigenous Vegetable (AIV), contributing to food, nutrition and income for farmers. Despite its significance, limited information exists on the genetic diversity of this important but neglected crop. This study assessed the genetic diversity and population structure of 40 spider plant landraces from Zimbabwe, using 1365 DArTseq SNP markers. The mean polymorphic information content (PIC) of the SNP markers was 0.20, indicating moderate informativeness. The observed heterozygosity (Ho =0.22) was higher than the expected heterozygosity (He=0.19) attributed to high out-crossing, while a negative average fixation index (Fis = - 0.08) observed showed similarity among landraces within populations of spider plant. Low to medium pairwise population differentiation (Fst) ranged from 0.044 to 0.143. Analysis of molecular variance revealed 11 % and 20 % genetic variation between and within populations respectively, with 69% variation among individual landraces. The mean gene flow (Nm=2.103), and population differentiation (Fst=0.106), indicated high gene flow and significantly moderate population differentiation, respectively. Structure, grouped the 40 landraces into three subpopulations (K=3), with admixtures. The observed low to moderate genetic diversity observed underscores the importance of incorporating divergent sources of variation for adaptation to climate change.

Keywords: Climate change adaptation, differentiation, gene flow, SNP makers

Abstract No: 010 -PP

Microhistological analysis, selective grazing and native grass nutritional evaluation in drought-stricken arid rangelands

Washaya, S.

Africa University P. O. Box 1320 Mutare, Zimbabwe
Corresponding Author:washayas@gzu.ac.zw

The nutritional status evaluation for rangeland animals is practically impossible. The present study aimed to evaluate the nutritional status of extensive grazing cattle using faecal indices as predictors of nutrient intake. A total of 24 cows were randomly selected for the study. The animals were grouped and identified according to their parities as P1 (n=6), P2 (n=6), P3 (n=6), and P4 (n=6). The predominant grass species were determined, representing the two seasons (wet and dry) and were subjected to proximate analysis. Fresh faecal samples (~5 g), were collected once every month and were subjected to bromatological, and NIRS analysis. Parity and season influenced the preference of grass species by cows ($P < 0.05$). A forage species-by-season interaction was observed for all the chemical components under consideration ($P<0.05$). A forage species-by-season interaction influenced the digestibility values for grass species ($P<0.05$). The season influenced the overall diet digestibility ($P<0.05$), while parity did not ($P>0.05$). Our study demonstrated that CP, NDF, TDN and their interactions could be responsible for plant selection, the proportion of grass species in faeces is dependent on the season and that NIRS is an accurate tool for the prediction of faecal constituents in grazing species.

Keywords: Digestibility, grazing species, NIRS analysis, smartphones, Zimbabwe

Abstract No: 011 -PP

The need to supplement current input controls with output controls in commercial fisheries management of Lake Malawi

Mulumpwa, M. S.

University of Malawi, P.O. Box 191, Zomba, Malawi
Corresponding Author:mulumpwa.mexford@gmail.com

Fisheries resources continue to decline globally amidst ever increasing human population. Malawi is not spared as research has shown that most of economically important fish species populations are dwindling. In response, Government of Malawi has instituted a closed season for commercial fishers from 1st December to 28th of February to allow fish population rejuvenate. Previously, only small-scale fishers were subjected to closed season from 1st November to 31st January. Commercial fishery which is categorized into commercial (Stern trawlers) and semi-commercial (Pair trawlers) fishery dates back to late 1960s. All commercial fishers in Malawi operate on Lake Malawi. Lake Malawi has the highest fresh water fish species in one place in the whole world, totaling to over 700 endemic fish species. All fisheries regulations employed in Malawi regarding control of fisheries effort are input-control measures. This study was conducted among commercial fishers to assess catch composition and catch per unit effort (CPUE). Secondary time-series catch data (1976 to 2022) obtained from Department of Fisheries was used. Estimation of MSY and optimum fishing effort at MSY of largescale fisheries in Malawi using linear Schaefer model showed that catch MSY was 266.96 tons/year and fmsy was 1953 fishing days. Trend of observed catch and CPUE were declining over the years. Mean catches in 76 years, recent 10- and 5-years period was 1702.5%, 824.5% and 699% of calculated MSY (266.96 tons) respectively. Mean fishing effort in the same period was 246.1%, 136.3% and 136% of calculated fmsy (1952.86 fishing days). Largescale fishers are extensively fishing beyond MSY and Fmsy which is very worrisome. Overexploitation of largescale fisheries resources beyond MSY and fmsy could as be as a result of increase in fishing effort by 436% between 1976 and 2022. This is a huge increase in a fisheries resources understanding that size Lake Malawi largescale fisheries resources are still limited and requires efficient management strategies in place. To ensure that largescale fisheries resources are not being exploited beyond MSY and that fishing effort is not beyond the fmsy, there is a need to employ output control measures. Although they are difficult to implement, high overexploitation leading to tragedy of commons necessitates their inclusion in the current fisheries management system in Malawi.

Keywords:

Abstract No: 012 -PP

Integrated MYCOROOT™ inoculation and biochar-compost mixture application enhances protein and secondary metabolites composition in cowpea grains under variable soil moisture conditions

Coka, S.Z., Maduna, M.K., Thosago, S.S. & Kutu, F.R.*

*School of Agricultural Sciences, Faculty of Agriculture and Natural Sciences, University of Mpumalanga, Riverside, Mbombela 1200
Corresponding Author: Funso.Kutu@ump.ac.za

Cowpea (*Vigna unguiculata* L.) is a protein-rich plant source containing numerous essential minerals and nutrients. However, its grains yield, and quality are limited by soil fertility and moisture constraints. The reported use of MycorootTM, a locally produced biofertilizer to enhance crop productivity under drought and low soil fertility, requires rigorous evaluation. We hypothesized that integrated use of mycoroot™ inoculation with variable biochar-compost mix ratios will positively affect cowpea protein and secondary metabolites' contents under moisture stress conditions. This study assessed the effect of

integrated Mycoroot™ inoculation and variable biochar-compost mix ratios on cowpea grain protein and secondary metabolites content under variable soil conditions. An agronomic trial comprising of 4 soil amendments, 2 Arbuscular Micorrhizae fungi (AMF) inoculum levels (inoculated and uninoculated), and 2 soil moisture regimes (non-stressed and stressed) as factors was evaluated on sandy loam and loamy sand soils. The soil amendments comprised of different mix ratios of 50:50, 75:25, 25:75 biochar (BC) and compost (C), and a control without amendment. The obtained treatment combinations were laid out in a factorial design with each replicated 4 times. Harvested cowpea grains were milled and used for the determination of total protein, anthocyanin, flavonoids, and total soluble sugars as secondary metabolites using standard procedures. Data generated were statistically analyzed and difference between means tested using Tukey's test at 5% probability level. MycorootTM inoculation produced quantitative higher anthocyanin and protein contents under moisture stress condition. Although mycorootTM inoculation had inconsequential effect on flavonoids content, a significant interaction effect with moisture levels were noticed with protein and anthocyanin contents. Soil amendment with 50:50 BC/C gave the highest flavonoids concentration while significant ($p<0.001$) correlation existed between macronutrients and zinc content of cowpea grains. Integrated use of mycoroot™ containing native AMF as inoculant with 50:50 biochar-compost mix ratio as soil amendment presents an appropriate agronomic approach to mitigate the negative effect of drought, soil fertility constraint, and increase cowpea yield, protein, and secondary metabolites contents.

Keywords: AMF, biochar, cowpea grains, compost, moisture stress, secondary metabolites, soil textural types

---

Abstract No: 013 -PP

Effect of plant spatial arrangement and population density on yield of *Neorautanenia brachypus* (Harms) C.A. Sm, a tuberous plant with potential to mitigate the effects of drought on livestock in semi-areas of Southern Africa

Kutamahufa, W.M.,[*a], Murungweni, C.,[b] Chikwambi, Z.,[c] & Mashingaidze, B.A.[a]

[a]Department of Crop Science and Postharvest Technology, School of Agricultural Sciences and Technology, Chinhoyi University of Technology, P. Bag 7724, Chinhoyi, Zimbabwe
[b]Department of Animal Production and Technology, School of Agricultural Sciences and Technology, Chinhoyi University of Technology, Chinhoyi, Zimbabwe.
[c]Department of Biotechnology, School of Healthy Sciences and Technology, Chinhoyi University of Technology, Chinhoyi, Zimbabwe
***Corresponding Author:** Marilyn W. Kutamahufa, mwkutamahufa@gmail.com

Adoption of a wild plant, Neorautanenia brachypus (Harms) C.A. Sm. as a drought survival feed for livestock is on increase in the southeastern lowveld of Zimbabwe. Currently, farmers harvest the tubers from natural veld. To facilitate with domestication and sustainable use of the plant, it's the agronomic requirements of the plant were evaluated in this research. This study determined the effect of plant spatial arrangement and plant population density on tuber yield at two sites with contrasting environments. The research was carried over two seasons using a 3 x 2 factorial experiment in a randomized complete block design at two sites; Zvimba, agro-ecological region IIb on arenosols and Chikombedzi, agro-ecological region V on eutric vertisols. The factors were inter-row spacing (0.45, 0.6 and 0.75 m) and in-row spacing (0.3 and 0.45 m) leading to six different plant population densities. At Zvimba site, averaged across in-row spacing, 0.6m inter-row spacing resulted in the longest tuber length (106mm), highest tuber diameter (19mm) and yield (1352kg ha^{-1}). There was a significant interaction between inter-row and in-row spacing ($P = 0.002$) on tuber yield with the highest yield (1856kg ha-1) recorded at 0.6 x 0.3 m spatial arrangement. Contrary, at high soil fertility (Chikombedzi), the narrow inter-row spacing (0.45m) resulted in the longest tuber length (121mm) and yield (2150kg ha^{-1}), averaged across

in-row spacing. Tuber yield in the medium (0.6m) and wide (0.75m) inter-row spacing was about a third (739kg ha-1) and two-fifths (847kg ha^{-1}) of the yield attained at the narrow row spacing (2150 kg ha^{-1}), however, there was no interaction between inter-row and in-row spacing on tuber yield. The effect of plant spatial arrangement and population density on tuber yield at two contrasting environments was significant on tuber yield. In arenosols, the 0.6 x 0.3 m spatial arrangement resulted in the highest tuber yield while in eutric vertisols the narrow row spacing (0.45m) resulted in the highest yield.

Keywords: Growth resources, inter-row spacing, intra-specific competition, tuber yield

Abstract No: 014 -PP

Effect of tannin deactivation methods on feed intake, dry matter digestibility and nitrogen balance in female Boer goats fed with Senegalia mellifera bush-based feeds

Andreas, E., John, M., Vonai, C. & Maria, D.

University of Namibia, P.O. Box 13301 Windhoek Namibia, Namibia
***Corresponding Author:** eandreas@unam.na

Bush encroachment/thickening by Senegalia mellifera (black thorn) has long been considered as an environmental and economic problem in the rangelands of Namibia and other southern African countries. Recently, harvesting bush thickets (encroacher bushes) and manufacturing various products from these woody plants has gained popularity. Among various products, bush-based feed production has gained special interest from farmers, as it has a potential to enhance livestock feed availability. The objective of this study was to determine the dry matter intake (DMI), apparent digestibility and nitrogen retention of Boer goats fed with Senegalia mellifera bush-based feeds treated with tannin deactivating methods. Eight female Boer goats, with an average initial body mass of 31.5 ± 2.5 kg were randomly assigned to a total mixed meal ration made of 40% of browse plant (Senegalia mellifera), 25% crushed yellow maize, 25% Marula cake press and 10% minerals and vitamins. The three treatments; Wood ash (WA), polyethylene glycol (PEG) and biochar (BIO) were evaluated against the control (CNT) diet as tannin deactivation treatment methods and were added in a powder form at a level of 5 g per day during feeding time. Goats were penned individually in metabolic cages where total faecal and urine outputs were determined. Goats were fed in a 4 Ã— 4 cross over Latin Square Design with two goats assigned per diet during the four experimental feeding periods. Each period lasted for 17 days (10 days of adaptation and 7 days of data collection). Goats were fed the meal diets twice daily at 09:00 h and 16:00 h. All diets had a protein content of 14% and neutral detergent fibre of 41%. The level of dry matter (DM) of feed offered was 4% of body weight. The study showed that the apparent digestibility coefficient of DM, organic matter and neutral detergent fibre were not significantly different ($P > 0.05$) among treatments and the control diet. Goats fed BIO treated diet had the highest ($P < 0.05$) nitrogen intake of 13.7 g/d, faecal nitrogen of 8.43 g/d and nitrogen retention of 5.11 g/d, while goats fed the control diet, PEG and WA were similar ($P > 0.05$). All treatments resulted in positive nitrogen retention ($P > 0.05$) with mean values ranging from 3.79 to 5.11 g/d. There were a lower DMI and nitrogen balance ($P < 0.05$) in Boer goats fed with S. mellifera feeds treated with Wood ash (WA), PEG and BIO compared with the control diet. The study concluded that the high protein content (14%) of the S. mellifera bush based feeds, if treated with WA, PEG or BIO and mixed with various agriculturalby-products such as Marula oil cake press can be considered as a suitable supplement for poor quality (low nitrogen content) natural pastures and crop residues such as grass hay, straw and stover. The study, therefore, recommends that each detannification method should be tested at different rates of inclusion in S. mellifera bush based feed resources.

Keywords: Bush-based feed, biochar, nitroget balance, tannins, wood ash feed intake

Abstract No: 015 -PP

Sustainable management of the yellow sugarcane Aphid (Sipha flava) using neem (Azadirachta indica) seed extract in the South East Lowveld of Zimbabwe

Manyangarirwa, W. M.

Africa University, Africa University, P.O. Box 1320, Mutare, Zimbabwe
Corresponding Author: manyangarirwaw@africau.edu

The study sought to determine the efficacy and best rate of application of neem seed solution in controlling Sipha flava. The study was conducted at Subdivision 07 Emanzini Farm, Triangle in Chiredzi district during the 2021-2022 cropping season. The variety N14 was used because it is widely grown in the South East Lowveld of Zimbabwe and has a history of yellow aphid attack. The Research Site has a sandy loamy soil classified as Lithosols. The Subdivision 07 Emanzini farm irrigates using the flood system and receives rainfall of 625mm per annum, falling predominantly in the hot summer months (October-March). Fifteen plots were randomly allocated in the field with each plot measuring 14m by 6m with inter row of 1.5m. The study involved 5 treatments namely; 100 ml neem seed solution per 15 l of water, 75 ml neem seed solution per 15 l of water, 50 ml neem seed solution per 15 l of water, dimethoate 1l0 ml per 100 l of water and untreated control. The neem seed solution used is traded as Fytogwanz 3% EC neem solution. The treatments were replicated three times and laid out in a Randomised complete block design (RCBD). The crop was planted using 2-3 eyed cane setts at an interrow spacing of 1.5 m. The depth of the furrows was 0.3m. Data was collected on number of aphid colonies per selected number of clusters every two weeks, the sucrose content (Pol%), the estimated recoverable crystal percent (ERC %), and the total cane yield. The results of the study point towards a positive outcome in the effort to reduce the use of synthetic insecticides in sugarcane production. Even though this work still needs further consolidation, there is evidence that neem seed extracts can be successfully used to control the yellow sugarcane aphid and this should serve as a starting point in the substitution of synthetic insecticides by eco-friendly products.

Keywords: Azadirachta indica extract, sugar production, yellow sugarcane aphid, Zimbabwe

---

Abstract No: 016 -PP

Exploring smallholder agriculture: Feeding Africa's growing population

Batizani, D.

Malawi University of Science and Technology. P.O. Box 5195 Limbe, Malawi
Corresponding Author: manyangarirwaw@africau.edu

Africa's burgeoning population and escalating market demands have prompted a critical examination of smallholder agriculture's potential to meet these challenges. This investigation delves into the feasibility and prospects of scaling up smallholder agriculture to address the needs of Africa's populace and markets. This study aims to scrutinize the evidence, roles, and opportunities linked with smallholder agriculture in Africa, with a particular focus on its productivity, resilience, and contributions to food security and rural development. gather evidence on smallholder productivity, socio-economic roles, and growth opportunities, a thorough review of scholarly literature, government reports, and developmental initiatives was conducted. The evidence indicates that smallholder agriculture exhibits resilience and adaptability, making significant contributions to food security, employment, and rural development in Africa. Opportunities for enhancing productivity and income emerge through empowering smallholder farmers with access to resources, technology, and markets. Smallholder agriculture accounts for approximately 70% of food production in sub-Saharan Africa, employing over 60% of the African population. Despite limited resources, smallholder farms contribute to approximately 90% of Africa's

agricultural output. However, only 10-20% of smallholder farmers in Africa have access to formal markets for their produce, and studies show that they typically earn less than $2 per day. The findings suggest that smallholder agriculture holds promise as a pivotal driver of agricultural development in Africa. Strategic investments in supportive policies, technology, and market access are essential for unlocking the full potential of smallholder farming to sustainably feed Africa's growing population and markets.

Keywords: Market demand, enhanced agricultural productivity, job creation

---

Abstract No: 017 -PP

University Mohamed VI Polytechnic contribution to the "Feed Africa" Agenda

Boulanouar, B.

Mohammed VI Polytechnic University Lot 660, Hay Moulay Rachid Ben Guerir, 43150, Morocco
Corresponding Author: bouchaib.boulanouar@um6p.ma

African agrifood systems face a mix of impeding gaps (technological, financial, policy and infrastructure) which all lead to their low overall performance. Low soil fertility, low water availability, poorly performing genetic resources and limited utilization of sustainable farming practices informed by science are the main causes of the productivity and production gaps. Furthermore, climate change and geopolitical instability put additional stress and urgency on producers, policy makers and researchers. Prompted by these impediments, the University Mohamed 6 Polytechnic (UM6P) embarked on the implementation of an Agriculture Water and Climate (AWC) strategy to supporting the African agrifood systems transformation. This strategy aims at contributing to transforming Africa agriculture through science, education, innovation and entrepreneurship. The AWC research, innovation, and education outputs contribute to agricultural productivity and production for food and nutrition security through sustainable intensification and diversification of staple crops in African food baskets, inclusive agri-food systems value chains for rural development, and natural resource management addressing soil degradation, water scarcity, and environmental sustainability and climate action. This comprehensive, integrated effort aims to harness innovation and its scaling to support agriculture, natural resource management, and rural development in Morocco and Africa and take part in the achievement of the SDGs and other Continental strategies and initiatives. The paper will highlight two structural changes that UM6P implemented concomitantly in order to enhance the implementation of the AWC Strategy: 1. The creation of the College of Agriculture and Environmental Sciences (CAES), and 2. The establishment of the Africa Initiative (AI) with a role to promote and advise on UMP6's positioning in terms of networking and , partnerships in R&D and Education in Agriculture among other sectors on the continent, on foresight and on benchmarking analyses. Finally, the paper will give the status of implementation and will make call for future thematic, and partnerships development.

Keywords: Africa initiative, agrifood systems, future thematic, nutrition security, Morocco

---

Abstract No: 018 -PP

Establishment of a livestock gene bank in Africa. Experiences from a University in Zimbabwe

Gororo, E.

Chinhoyi University of Technology, Private Bag 7724 Chinhoyi, Zimbabwe
Corresponding Author: gororoeddington@gmail.com

Zimbabwe is home to a diverse range of genotypes of livestock, poultry, fish and other domesticated and wild animal species. To protect this diversity, the government established a number of research centres where small isolated herds of native livestock breeds are conserved. In-situ conservation fails to capture enough genetic diversity for local and widely used breeds. Cryobanking is an effective complementary strategy for capturing this diversity and genetic management of valuable farm animal genetic resources (AnGR). It is an important step in ex-situ conservation and assisted reproduction programs. The Germplasm and Reproductive Technology Laboratory of Chinhoyi University of Technology (CUT) was set up to conserve diversity of the country's faunal heritage resources, including local and rare AnGR. The gene bank seeks to secure as much genetic diversity of poultry, fish and livestock that the country has ex-situ as possible. The cryobank was set up using a government grant, which the university matched. A semen laboratory, embryo unit, and bull centre were established. Currently, GRTL manages collections for a number of breeds of cattle in the form of frozen semen and embryos, as well as blood and hair samples. Future plans are there to widen the collections in terms of the type of genetic material collected as well as number of animal species in the collection. Commercial distribution of genetics in the form of semen and embryos keeps the gene bank running. A number of challenges have slowed down achievement of objectives. Because of the value of these genetic resources in the future, the gene bank is developing systems to ensure that enough diversity is captured and the material is reliably conserved, documented, fully accessible and tradable across borders. Long term sustainability of the gene bank hinges on securing the material in the collection, reducing costs, attracting funding and growing demand for services and products offered across the region.

Keywords: Gene bank, bull centre, ex-situ conservation, cryobank, Zimbabwe

Abstract No: 019 -PP

Promoting community-based cowpea production for improved nutrition and Agrarian transformation in South Africa: University of Mpumalanga Case Study

Kutu, F.R.

University of Limpopo, Private Bag X1106 Sovenga 0727, South Africa
Corresponding Author: Funso.Kutu@ump.ac.za

Cowpea (*Vigna unguiculata* L Walp) is a protein and nutrient-rich African pulse that possesses associated agroecological benefits accompanying its cultivation. Regrettably, it remains one of South Africa's neglected indigenous crops mostly grown by smallholder farmers (SHFs). Similarly, the return on its research investments over the years have remained unsatisfactory due to unavailability of improved seeds for planting, low yield under field conditions, limited whole dry seeds availability in the market, and limited to no availability of cowpea-based food product in South Africa food market. Transforming South Africa crop production and food systems through improved community-based small-scale cowpea production is critical for crop diversification and adoption of climate smart agricultural technologies and innovation. This paper highlights University of Mpumalanga interventions including processes at promoting community-based cowpea production among SHFs in Mpumalanga province, increase crop

diversification portfolios of SHFs, and provide alternative to the changing consumers' tastes and food preferences. The interventions were underpinned by participation, partnership, and commitment (2PC), training using ICT tool, and strong agricultural extension advisory support. Establishment of on-farm demonstration trials, training, and hosting of farmers' day programmes for reflection and information sharing represented key strategies for project success. Plans for new product development are underway through farmers-researchers-government partnership for value addition and greater market access by SHFs.

Keywords: Food systems, community based production, consumer's tastes, market access

---

Abstract No: 020 -PP

Effects of extraction method on antioxidant and antimicrobial activities of Lippia javanica leaf extracts

Nyoni, Q.

Chinhoyi Univesrity of Technology, Private Bag 7724, Chinhoyi, Zimbabwe
Corresponding Author: qnyoni@cut.ac.zw

Lippia javanica (Bum.f.) Spreng is a multipurpose medicinal plant with potential for use in food applications. Lippia javanica leaf extracts (LJLE) could possibly replace synthetic additives used to combat oxidative and microbial deterioration in foods. This study investigated the antioxidant and antimicrobial activities of LJLE, extracted by Hydro-Ethanol extraction (HEE), Aqueous Extraction (AE), and Natural Deep Eutectic Solvent (NADES). NADES have unique properties such as low toxicity, biodegradability and high solubility for a wide range of compounds. They offer a sustainable substitute for conventional organic solvents, in several applications, especially metabolite extraction. This study explored the effects of different extraction methods on in-vitro antioxidant and antimicrobial properties of Lippia javanica leaf extracts. Fresh Lippia javanica leaves were collected from Matobo district and shade dried. Proximate analysis was conducted on the dried leaf material. Hydro-ethanolic, aqueous and NADES extracts were prepared. The different LJLE were assayed for Total phenol content (TPC) by the Folin-Ciocalteu method, antioxidant activity by DPPH radical scavenging activity and antimicrobial activity by disc diffusion. Proximate analysis showed that the Lippia javanica dried leaves had values of 2.63±0.54%, 0.13±0.01%, 2.03±0.72% and 13±1.89 for crude protein, crude fat, ash and moisture respectively. Mineral content (in mg/100g) was 367.56±5.78, 245.35±6.38, 43.66±2.41, 1785.74±9.61, 514±12.54 and 5.67±1.64 for Ca, Mg, Fe, K, P and Zn. Extraction yield, TPC and antioxidant activity were highest in the NADES extract (NE) followed by the hydro-ethanolic extract (HEE) and least in the aqueous extract (AE). There was no significant difference in antimicrobial activity of NE and HEE. Antimicrobial activity was lowest in AE. NE exhibit appreciable antioxidant and antimicrobial activity. NADES can thus be used as a safer alternative to obtain extracts from Lippia javanica leaves.

Keywords: Ethnomedicinal applications, pharmacological activities, recreational tea, synthetic additives

---

Abstract No: 021 -PP

Internationalisation in emerging African Higher Education Institutions: Experiences from Gulu University in Uganda

Bagaya, J

Gulu University, P.O. Box 166, Laroo City, Uganda
Corresponding Author: ar@gu.ac.ug

In the 21st Century, internationalisation has become a central issue in the higher education landscape due to globalisation. Much as the rationale for internationalisation cannot be overemphasised, there are bottlenecks to internationalisation in African Higher Education Institutions (HEI). This paper, therefore, seeks to share experiences from Gulu University on the bottlenecks to internationalisation and suggest strategic approaches to overcoming them. In the context of Gulu University, a TAGDev 1.0 implementing Partner University, a project whose objectives included improving the international outlook of the University, the journey initially was not easy due to some bottlenecks such as rigid policies, procedures and processes, language of instruction, high tuition fee charges for international students, differences in education systems, and quality and relevance of curricula. Gulu University adopted approaches to overcome some of them. including flexible admission processes, English proficiency courses, rationalisation of fees for international students, automation of business processes, creation of an International students coordination office, and internationalisation in the university-wide strategic plan. In Uganda, internationalisation has been mainly the initiative of individual HEI. To overcome the bottlenecks to internationalisation, the Government through the Ministry of Education and Sports must support internationalisation efforts by developing a national policy and strategy on Internationalisation and increasing funding to HEI. The Uganda Vice Chancellors' Forum, whose membership is the Vice Chancellors and Academic Registrars, should play a big role in spearheading this strategic direction.

Keywords: Academic policies, international students, enrollment, student's credit transfer, Uganda

---

Abstract No: 022 -PP

Mathematical modeling of Foot and Mouth Disease (FMD) In cattle and buffaloes Using vaccination and culling

Shikumwifa, E.

University of Namibia, Rundu Campus, P/Bag 88, Rundu Namibia
Corresponding Author: eshikumwifa@gmail.com

Foot and mouth disease (FMD) is an acute, infectious viral disease for animals with cloven hooves, and it is one of the most rapidly spreading diseases worldwide. FMD virus can be found in excretions and secretions of infected animals, for instance saliva, milk, urine, semen and expired air. Clinical signs of FMD infection include high fever, and blisters called vesicles on the lips, tongue, in and around the mouth, on the mammary glands, and around the hooves, ruptured feed and small growth. Farmers with small and medium herds are the ones affected the most by FMD, as they experienced the most milk losses and suffered higher control costs. This subsequently affects countries whose economy depends more on export of livestock. In this study, a basic mathematical model was developed to simulate the dynamics of FMD with and without vaccination and transmission replicating the FMD infection in the interface setting of Namibia communal areas and National parks. The model was also used to assess the effect of control measures to the yearly cumulative FMD cases in Namibia. The results showed that when Vaccination rate reduced, the transmission rate increases and the infection multiplies while when vaccination rate increased then the transmission rate decreases and the disease reduces. The results from this study suggest that increasing vaccination rate reduces the transmission rate and has a positive

impact on reducing the spread of FMD. However, vaccination is not enough to protect both the cattle and buffaloes, therefore, more efforts from policy makers should be devoted to putting extra measures in place for buffaloes and cattle not to interact more often. Better results were observed when both vaccination rate and transmission rate increases hence it is advisable to Namibia to practice the increase of vaccination as one of the control measures.

Keywords: Vaccination model, FMD dynamics, FMD control measures, Namibia

---

Abstract No: 023 -PP

The effects of Quinoa (Chenopodium Quinoa) based feed on the growth performance of Nile Tilapia fish (*Oreochromis Niloticus*)

Chindomu, Y.A.

Women's University in Africa, P.O. Box, MP 1222, Mt Pleasant, Harare, Zimbabwe
Corresponding Author: yosherbellac@gmail.com

This study assessed the effects of quinoa based feed on the growth performance of Nile tilapia fish (*Oreochromis niloticus*) focusing on key parameters like weight gain, length of the fish from head to tail, width of the fish and then the circumference of the head. The research was carried out at Heliath Farm, which is located in Marondera along Ruzawi road, 4.5 km off Harare-Mutare highway. Nile tilapia fingerlings were randomly assigned to four experimental fish ponds and each fish pond consisting of about 825 fingerlings. The Nile tilapia were fed with various dietary formulations incorporating different inclusion levels of quinoa (100% quinoa plus additives, 50% quinoa: 50% maize plus some additives, 25% quinoa: 75% maize and lastly 25% quinoa: 75% maize plus some additives. The growth performance of the fish, including weight gain, length of fish from head to tail, width of the fish and then the circumference of the head were monitored throughout the trial period. The findings of this research align with the Sustainable Development Goals (SDG's), particularly SDG 2: Zero Hunger, which emphasizes the promotion of sustainable agriculture and food security and SDG 5: Gender Equality, by promoting the empowerment of women in the aquaculture sector through improved access to sustainable and cost effective feeding strategies.

Keywords: Aquaculture, cost benefit analysis, fish feed, tilapia growth, Zimbabwe

---

Abstract No: 024 -PP

Assess the efficacy of Quinoa (*Chenopodium Quinoa*) Saponins as a biopesticide in controlling Pests on spinach production (*Spinacia Oleracea* L)

Sekenya, F.

Marondera University of Agricultural Sciences and Technology, P.O Box 35, Marondera, Zimbabwe
Corresponding Author: farieseke87@gmail.com

The use of botanical biopesticides has gained attention as a sustainable alternative to synthetic pesticides in agriculture. This can help minimize potential negative impacts on human health and promote healthier food production practices, and lastly clean water and sanitation; application of quinoa saponins as biopesticides may help reduce chemical runoff and water pollution associated with synthetic pesticides. This study was to investigate the efficacy of quinoa saponins in controlling pests in spinach production. An experiment was conducted at the Marirangwe Farm, part of the Women's University in Africa (WUA) in Marondera, Zimbabwe. The experiment was laid out in a randomized complete block design (RCBD) with four treatments and three replicates as follows: T1 100% saponins (high concentration),

T2 a combination of 100% saponins, ashes, crushed garlic cloves, and cooking oil, and T3; 50% saponins and 50% water (medium concentration) and T4 being the control (nothing was used). Results demonstrated that T1 (100% saponins) showed the highest efficacy in controlling pests in spinach plants. Plant damage was significantly reduced compared to the Control group ($p < 0.05$). T2 and T3 also showed pest control potential, but their efficacy was lower than T1. In conclusion, quinoa saponins, particularly at a high concentration, demonstrated potential as an effective biopesticide for controlling pests in spinach. Further research should explore the feasibility of large-scale applications and potential phytotoxicity.

Keywords: Biopestcides, clean waterand sanitation, phytotoxicity, saponins

---

Abstract No: 025 -PP

Phytogenic impacts of garlic (*Allium Sativum*) powder and moringa (*Moringa Oleifera)* leaf meal as natural boosts for broiler production

Nyoni, Rebecca

Women's University in Africa, P.O. Box GD 32 Greendale Harare, Zimbabwe
Corresponding Author: rebbeca.nyoni9@gmail.com

This study i) examined the effects of garlic powder and moringa on growth, health, and performance of broiler chickens and ii) determined the optimal dosage for maximum benefits and potential synergistic effects between the two ingredients. The experimental design comprised of four treatments: T1 (control group with a commercial feed basal diet), T2 (basal diet + garlic at different percentages: 5%, 10%, and 20%), T3 (basal diet + moringa at different percentages: 5%, 10%, and 20%), and T4 (basal diet + combined garlic and moringa at different percentages: 5%, 10%, and 20%). To determine growth performance parameters, body weight was recorded weekly by selecting the smallest, medium, and largest birds from each pen, averaging their weights. Upon completing a 5-week growth period, during which the birds achieved their desired market weight, the results were gathered and examined. The results demonstrated enhanced growth performance in the groups receiving moringa leaf meal and garlic powder supplements, with the 5% combined garlic powder and moringa leaf meal group exhibiting the highest weight gain. Remarkably, garlic and moringa supplementation led to a substantial enhancement in the health and performance of broiler chickens, as evidenced by reduced mortality rate of 3% and improved immune responses. The inclusion of these natural phytogenics in the diet demonstrated a positive synergistic effect, indicating the potential to revolutionize Zimbabwe's poultry industry. These findings suggest that incorporating moringa leaf meal and garlic powder into broiler diets can effectively enhance growth performance, health, and productivity, with potential synergistic effects at a 5% inclusion level. The positive impacts of these phytogenic feed additives can contribute to reducing greenhouse emissions associated with livestock farming (SDG 13), promote animal health and reduce risks of antibacterial resistance (SDG 3), ensure sustainable and environmentally friendly agricultural practices (SDG 12), ultimately contributing to the nation's food security and economic development (SDG2).

Keywords: Additive, broiler, feed, garlic, natural phytogenic, nutrition

---

Abstract No: 026 -PP

Development of novel semen diluents for gamete preservation in African cattle breeds

Gororo, E., Makuza, S. M. & Chatiza, F. P.

Chinhoyi University of Technology, Department of Animal Production and Technology, P. Bag 7724 Chinhoyi, Zimbabwe
Corresponding Author: gororoeddington@gmail.com

Cryopreservation is an important tool for long-term storage of biological material, including semen and embryos. However, loss of gamete viability and fertilising capacity following freeze-thaw cycles is inevitable. The extent of loss has both genetic and biochemical basis, and may vary across species and breeds. This study aims to optimize bovine semen diluents enriched with local botanical extracts to improve cryosurvival and longevity of Sanga bull semen. The study began with an extensive literature review to identify potential botanical extracts known for their antioxidant properties. Four local botanicals were screened for their antioxidant and cryoprotective properties when included at graded levels in standard Tris-egg yolk semen extenders. Semen was collected three times from three bulls of each of Boran, Mashona and Brahman breeds. Split ejaculates were diluted in extenders containing graded inclusion levels of the extracts. Semen was evaluated pre-freeze and post-thaw for sperm motility and motion characteristics in a CASA system. Antioxidant activity was evaluated in post-thaw samples using 2.2 diphenyl-1-picrylhydrazyl (DPPH) and hydroxyl radical assays. Two of the botanical extracts, Ginger officinale (tuber) and Aloe barbadense (gel) demonstrated efficacy as candidate species for mitigating oxidative stress related cryodamage in African bovine semen. Local botanical extracts offer a promising avenue for enhancing cryosurvival and longevity of bull semen samples during and following cryopreservation. This may have favourable implications on costs of semen diluents; production related discards; as well as ex-situ conservation and assisted reproduction outcomes.

Keywords: Antioxidants, bull semen, cryosurvival, longevity, plant extracts

---

Abstract No: 027 -PP

Implementing Integrated soil fertility management for sustainable *Amaranthus* sp. production in Sub-Humid Zimbabwe

Kodzwa, J. J.,[1] Cronje N[2]., Swanepoel J.W.[2]

[1]National University of Lesotho, P.O Roma 180 Lesotho, Roma
[2]University of the Free State, P.O Box 339 Bloemfontein, 9300
Corresponding Author: kodzwajefline@gmail.com

In Zimbabwe, most African indigenous vegetables (AIVs) are grown in mixed cropping systems or grow on their own as weeds with no direct nutrient applications. AIVs are highly nutritious and are resilient to climate-induced moisture stress and drought. Very limited information is available on the fertilizer nutrient requirements (type, rate, timing and placement) of AIVs in Zimbabwe and the sub-region. This study explored the effects of mineral and organic fertilizer nutrient sources on the growth and nutritional quality of Amaranthus sp. A randomized complete block designed experiment with six fertilizer treatments replicated three times was established at MUAST Agro-Industrial Park for two seasons. The fertilizer treatments were 0kg Nha-1, cattle Manure (M) at 10t ha-1, and mineral fertilizer at 30kgN ha-1 (30N), 60kgN ha-1 (60N), M+30N and M+60N. Data was collected on plant growth parameters and nutrient concentration at maturity, and on selected soil properties. The preliminary data analysis showed that plant height was highest in the 60N treatment (108.6cm) during the first season and the M+60N (140.4cm) treatment during the second season. Number of branches per plant and number of leaves per branch were highest in the M+60N treatment in both seasons but these were not significantly

(p=0.831) different compared with the M+30N treatment. There were significant differences in fresh leaf yield between the treatments in season one (p=0.0016) and two (p=0.001). Treatments M+30N and M+60N had the highest fresh leaf yield of 2510 and 2600 kg ha-1 during the first season, and 2974 and 3120 kg ha-1 during the second season, respectively. There was a strong positive Pearson product moment correlation of 0.788 and 0.873 between plant height and number of leaves per branch with yield respectively. The highest yield in the combined organic and mineral fertilizer treatments demonstrates the complementarity of the two nutrient sources in sustaining production of Amaranthus sp. compared to one nutrient source.

Keywords: Commercialization of agriculture, dietary diversity score, good health and wellbeing, household food insecurity access scale

---

Abstract No: 028 -PP

Piloting Problem Based Learning (PBL) in the teaching of Agriculture at Bishop Stuart University, Uganda

Kalibwani, R.M., Kiguli, C., Tumwesigye W., Agaba, J., Tumusiime, B.,[1] Namara, E. & Rwecungura, I.

[1]Bishop Stuart University, P.O Box 9, Mbarara, Uganda
Corresponding Author: rmkalibwani@faest.bsu.ac.ug

Problem Based Learning (PBL) has gained worldwide acceptance as an effective instructional approach that helps students to acquire knowledge as well as develop desired professional skills and attitudes in higher education institutions. The key tenet of this approach is the belief that students learn better, when they are activated and motivated. The project entitled Innovative learning and co-creation of teaching methodology for scaling entrepreneurship in food and agribusiness in Sub-Saharan Africa (AgriSCALE) is a project that was implemented between 2020-2024 by a consortium of 9 universities; 3 in Europe and 6 in Sub-Saharan Africa, including Bishop Stuart University (BSU). The project aimed to create a new entrepreneurship-learning ecosystem, which is based on Problem Based Learning principles of student-centered and competence-based education, collaboration and networking with industry, societal partners and sharing knowledge through a community of practice. In order to pilot the PBL methodology in teaching and learning, the AgriSCALE project designed activities known as Student Challenges, for students to investigate a challenge proposed by a private sector/industry company, together with their teacher/lecturers as mentors. Each of the six partners in Sub-Saharan Africa hosted at least one student challenge activity, where the interested partners would participate with the host in piloting PBL using a challenge identified by a private company. BSU hosted two of such activities; the Bio-fertiliser Challenge and the Data Repository Challenge, and participated in three of them hosted in the partner institutions. The Student Challenges generated a lot of insights and lessons on the engagement of private sector in effective teaching and learning of Agriculture at the university. This paper shares lessons and experiences in piloting Problem Based Learning to scale entrepreneurship in African economies, and draws implications for the review of agriculture programs and curricula in High Education Institutions.

Keywords: AgriSCALE, problem based learning, student challenge, Uganda

---

Abstract No: 029 -PP

Effects of Marula (*Sclerocarya birrea*) oil cake as a partial replacement of soyabean meal on the production performance and egg quality of laying hens

Petrus, P.N.

University of Namibia, Private Bag 13301, Windhoek, Namibia
Corresponding Author: ppetrus@unam.na

Soyabean meal (SBM) is a widely used protein source in livestock diets worldwide. However, its limited distribution, the high cost of imported SBM, and the effects of climate change coupled with the escalating demand for animal protein have prompted the search for alternative locally available protein sources to decrease the dependency on imported SBM and to increase poultry production. Several studies have investigated the effects of replacing SBM with marula oil cake (MOC) on broiler chickens, however, there are limited studies on laying hens. This study evaluated the effects of partial replacement of SBM with MOC in laying hen diets on growth performance, egg production and egg quality. Sixty Hy-line chickens at point-of-lay were randomly assigned to three groups; T1: control (0% MOC), T2: diets with 10% MOC and T3: diets with 15% MOC and fed for 7 weeks, with 5 birds/cage. Diets were formulated to be isonitrogenous and isocaloric. Egg production and egg weight were measured daily, and feed intake and body weight were measured weekly. Eggshell characteristics and interior egg quality were measured. The result of this study shows that replacing SBM with MOC had no effect on feed intake, egg weight and shell thickness ($P<0.05$). The inclusion of MOC decreased egg production and the length of the albumen, however, the 10% inclusion of MOC significantly increased yolk colour. Birds fed 15% inclusion level of MOC were heavier compared to birds fed 10% MOC, but they did not differ from the control group. This study concluded that MOC can partially replace SBM in layer diets without adverse effects on intake, body weight, egg weight and shell thickness, however, it reduces egg production. The replacement of SBM with MOC in laying hens needs to be further studied to ascertain the effects of MOC on laying performance to maximum utilization of locally available protein sources in poultry diets.

Keywords: Anti-nutritional factors, bioavailability, bone mineralisation, poultry production, tibia, soybean meal

---

Abstract No: 030 -PP

Photosynthetic parameters as stress indicators in safflower

Kereilwe, D.

Botswana University of Agriculture and Natural Resources, Private Bag 0027 Gaborone, Botswana
Corresponding Author:dineophuduhudu@yahoo.com; dphuduhu@gmail.com

Safflower is a cold tolerant multipurpose crop suited to the semi-arid climatic condition. The cold tolerance of safflower diminishes as the plant approach maturity. Plants in bolling stage are susceptible to cold stress while the rosette plants are tolerant. To date, the physiological, biochemical and photosynthetic mechanisms underlying the differences have not yet been discovered. This study evaluated the photoprotective mechanisms involved in cold tolerance of safflower at those two developmental stages. To accomplish this, safflower plants were grown until the desired growth stages and later subjected to 0 and 4 °C for both 8 and 12 hours, control plants kept at 23.0 °C (room temperature). The study was carried out at Botswana University of Agriculture and Natural Resources (BUAN) netshade. Turkey genotype was selected and grown during 2022 and 2023 winter seasons. The plants were grown in stepwise manner in order to attain the two desired growth stages. Application

of cold stress in plants was performed following a 2 x 3 x 2 factorial design, replicated thrice. Treatments were safflower growth stages (rosette and bolling), temperature (0, 4^0C and 23^0C) and duration of exposure (8 and 12 hours). After cold stress induction leaf chlorophyls (a, b, a+ab) and carotenoids contents, stomatal conductance and chlorophyll fluorescence parameters were measured. Photosynthetic parameters such as photosynthetic pigments, chlorophyll fluorescence and stomatal conductance (gs) were analyzed. Cold stress significantly ($P < 0.05$) reduced the plants total chlorophyll (a+b) contents, carotenoids contents, stomatal conductance and fluorescence parameters in bolling stage. The overall results suggested that low photosynthetic pigment contents and improper thermal dissipation are contributing factors to the susceptibility of safflower to chilling injury in bolling stage.

Keywords: Semi-arid conditions, Turkey genotype, photosynthesis parameters, chilling injury

---

Abstract No: 031 -PP

Comparative genetic evaluation of Zimbabwean Red Dane and Jersey cattle breeds

Nyamushamba, G.B.

University of Fort Hare, Private Bag X1314, Alice 5700, South Africa
Corresponding Author: gbnyamushamba@gmail.com

Zimbabwean Red Dane and Jersey data for genetic and phenotypic parameters for milk, fat and protein yields were estimated. A total of 10 154 and 10 986 unedited Red Dane and Jersey 305-day lactation records respectively, were obtained from Livestock Identification Trust (LIT) containing 26 herds (1 Red Dane herd and 25 Jersey herds), with Red Dane calving in the period 2001 to 2021 (giving year of birth from 1999 to 2021) and Jersey cows calving in the period 2001 to 2021 (giving year of birth from 2001 to 2021). The General Linear Model (GLM) procedure of Henderson Type III sum of squares in Statistical Analysis Systems (SAS) was used to determine the environmental factors with the fixed effects model containing herd-year-season (HYS), calving interval and age at calving. All the factors significantly ($P<0.0001$) affected the milk, fat and protein yields. The month from June to July gave the highest milk production for the Red Dane breed and for the Jersey it was September and December. Genetic and phenotypic parameters were estimated using ASReml and the sire model. Heritability estimates for Red Dane cattle milk yield, fat yield, protein yield, fat percentage, protein percentage were 0.18, 0.14, 0.14, 0.24 and 0.24 respectively and for Jersey cattle milk yield, fat yield, protein yield, fat percentage, protein percentage were 0.25, 0.26, 0.26, 0.27 and 0.28 respectively. The corresponding repeatability estimates for Red Dane cattle were 0.36, 0.35, 0.36, 0.34, and 0.28 respectively and for Jersey cattle were 0.37, 0.36, 0.37, 0.38 and 0.40 respectively. Genetic and phenotypic correlations among milk production traits for both Red Dane cattle were high (0.75 to 0.96) and (0.39 to 0.81) respectively and for the Jersey cattle, the phenotypic correlations were (0.67 to 0.86). Herd-year-season, calving interval and linear and quadratic effects of age at calving are the major source of variation in 305-day yields of milk, fat and protein for Red Dane and Jersey cattle in Zimbabwe. It is thus necessary to pre-adjust data for these environmental factors when carrying out genetic evaluations of production traits in Zimbabwean Red Dane and Jersey cattle.

Keywords: Age at calving, calving interval, month of calving, non-genetic factors

---

Abstract No: 32 -PP

Gender based factors influencing farmer participation in the marketing of climbing beans in western Uganda

Kule, B. E.

Mountains of the Moon University, PO Box 837, Fort Portal, Western Region, Uganda
Corresponding Author: kule.eriya@mmu.ac.ug.com

Gender is considered as one of the most curtailing factors to agricultural production and productivity, especially in sub-Saharan Africa cultural norms and beliefs are strongly held. This study examines the gender participation in marketing climbing beans in Kabale District in South Western Uganda. More specifically, this study examined the; i) marketable climbing bean varieties that women and men produce, ii) strategies women and men use to market climbing beans; iii) proportions of total bean produce that women and men sell per harvest; and 4) gender relation in the marketing of climbing beans by women and men. The study used a cross-sectional survey research design to collect data from 155 women and men selected through stratified, purposive, and random strategies. The respondents were farmers that are actively engaged in the production of climbing bean varieties. The data were analyzed using descriptive and chi square statistics. The findings revealed that male farmers controlled the climbing bean marketing process through mobile traders, owned retail stores, and attained higher incomes than women farmers by travelling to distant markets. Women are mostly employed as casual laborers in the production of climbing beans to supplement the meagre income attained from the sale of low-priced climbing bean to meet household food and nutrition security, with the surplus sold at farm gate. Most men sold climbing bean, bought assets like land and invested in income generating businesses like motorcycle hiring for transport. Women farmers mostly used climbing bean to cater for family welfare, family needs such as; medical bills, buying scholastic materials and reserved part of their produce for family food and nutrition security. This study sheds light to the gender imbalances at household level and production activities that are generally skewed against women.

Keywords: bargaining power, inequality, labor saving technologies, Uganda, women employment

Abstract No: 033 -PP

Evaluating the potential of rabbit urine from Quiona fed rabbits as a sustainable alternative to commercial fertiliser for enhancing spinach (*Spinacia Oleracea*)

Chiguhune, M.

.Faculty of Agriculture, Women's University in Africa, P.O. Box, MP 1222, Mt Pleasant, Harare, Zimbabwe
Corresponding Author: chiguhunem@gmail.com

This study evaluated the efficacy of rabbit urine from quinoa-fed rabbits as a sustainable alternative to commercial fertilizer for enhancing spinach growth rate and yield. This study was conducted at the Farm of Women's 'University in Africa. The fresh weight of spinach plants treated with Spinach plants were cultivated in a Randomised Complete Block Design (RCBD) and subjected to four treatments: T1 quinoa-fed rabbit urine (RBFQ), T2 vegetable-fed rabbit urine (RBFV), T3 commercial fed rabbit urine (RBFC), and no fertilizer. Growth parameters, including plant height, number of leaves, leaf length, and fresh weight, were recorded at weekly intervals over six weeks. The quinoa-fed rabbit urine treatment demonstrated significantly higher growth rates in terms of plant height, number of leaves, and leaf length compared to the control rabbit. Rabbit urine from quinoa-fed rabbits has the potential to serve as a sustainable and effective alternative to commercial fertilizer for promoting spinach growth and increasing yield. Further research on nutrient composition and long-term effects is needed to validate these findings and explore the broader implications of utilizing quinoa-fed rabbit urine in sustainable agriculture.

Keywords: Rabbit urine, biopesticide, biofertilizer, quinoa-fed, plant nutrition

---

Abstract No: 034 -PP

Assessing the effects of applying different Quinoa Saponins (Chenopdium Quinoa) concentration on soil properties and spinach growth (Spinacia Oleracea L)

Matema, E.

Faculty of Agriculture, Women's University in Africa, P.O. Box, MP 1222, Mt Pleasant, Harare, Zimbabwe
Corresponding Author: matemaedith@gmail.com

This study assessed the effects of applying different quinoa saponins concentration on soil and spinach growth. Quinoa saponins are plant-derived natural compounds that possess various biological activities and potential applications in agriculture. The study was conducted at the Heliath Farm situated in Marirangwe along Ruzawi Road in Marondera, just 4.5 km off the Harare-Mutare Highway. Quinoa saponins were extracted from the first wash of untreated quinoa grains and diluted to create three treatments: 100% saponins (undiluted), 50% saponins, and 25% saponins. A control group without saponins was also included. Spinach plants were watered with the saponins treatments or plain water for the control group, and growth parameters, yield, and nutrient content were monitored. Results demonstrated that the undiluted saponins treatment (100% saponins) had the most significant positive effects on spinach growth, yield, and nutrient content compared to the diluted treatments and control group. These findings suggest that higher concentrations of quinoa saponins may improve spinach cultivation by enhancing nutrient availability, promoting plant growth, and deterring pests. This study provides valuable insights into the potential of undiluted quinoa saponins as an effective biofertilizer or natural pesticide for sustainable spinach cultivation. Future research could explore the specific mechanisms behind these benefits and evaluate the application of undiluted saponins in other crops.

Abstract No: 35 -PP

Enhancing youth entrepreneurship and employment through digital applications for smallholder farmers in South-Western Uganda

Kalibwani, R.M.

Bishop Stuart University, Buremba Kakoba Road P.O. Box 09, Mbarara, Uganda
Corresponding Author: rmkalibwani@faest.bsu.ac.ug

Smile Farm Save Technologies Ltd is a registered company that was formed by a team of three graduate entrepreneurs from Bishop Stuart University, after incubation in the Agribusiness Incubation Hub (AIH). The company, operating in south-western Uganda, has a vision to be the leading agri-tech company in Uganda that delivers long lasting agricultural solutions to small scale farmers. In 2022, SFS developed a state-of-the-art mobile application and web portal, offering swift, cost-effective, and collateral-free agricultural loans. However, SFS had a challenge to promote wide utilization of the technology by farmers, for the enhancement of entrepreneurship and employment of the youth. During a session to pilot Problem Based Learning as a pedagogical approach to teaching and learning, a multi-disciplinary group of students from partner universities of the AgriSCALE project set out to solve this challenge. Their investigation was done with a group of 75 farmers, members of Kiyega Farmers' SACCO, Ntungamo district, to understand the features that would enhance the appeal of the technology. They were interviewed using questionnaires and in focus group discussions to inquire into various aspects of farming, smart phone usage, and information that needed the app to provide. Data was also collected on any indigenous knowledge that the farmers use and was analysed quantitatively in statistical software and qualitatively in Excel. Impactful challenges were identified and potential solutions proposed for the development of prototypes. Paper mockups were created for the improvement of user-interface, which were subsequently transformed into functional digital prototypes.

Keywords: Indigenous knowledge, problem based learning, swift offers, youth entrepreneurs

---

Abstract No: 036 -PP

Acacia angustissima and Calliandra calothyrsus mixed with soya bean meal for supplementing protein to ruminants on native pasture hay basal diet

Murungweni, C.

Chinhoyi University of Technology, Private Bag 7724. Chinhoyi Zimbabwe
Corresponding Author: cmurungweni@cut.ac.zw

Acacia angustissima (AA) and Calliandra calothyrsus (CC) are browse legumes commonly used for ruminant livestock feeding, but limited by presence of phenolic hydroxyls (tannins). The objective was to determine the optimum level of browse legume in mixtures with soya bean meal (SBM) for beneficial synergies that can improve utilization of poor quality forages. Two experiments were designed with SBM mixtures containing 25% incremental levels of browse evaluated over 3 feeding levels, low, medium and high. The first experiment tested effects of AA/SBM and CC/SBM mixtures on total dry matter intake, while the second evaluated these mixtures through degradability and post-ruminal digestibility experiments. In the first experiment, thirty-six 18-month-old kapaters (castrated male goats) were divided into nine groups of four. Each group was randomly allocated to the nine treatments. Nutrient intake and nitrogen utilisation, observed values of mixtures was better than the expected values up to a level of 50% CC ($P < 0.05$). Mixtures involving AA did not show significant positive synergistic effects, however, mixtures with 25% and 50% AA protein were better utilised than mixtures at levels higher than 50% AA. In second experiment, optimum utilization of AA and CC in SBM mixtures was at

50% browse across the three feeding levels adopted in this trial. However, if maximum figures are being aimed at, then mixtures with AA showed highest response at 75 % ($P < 0.05$) for high feeding levels as in fattening stock and 25% for low ($P < 0.001$) feeding levels as just in maintenance. On the other hand, mixtures with CC showed highest responses at 50% level of inclusion for high level of feeding ($P < 0.001$) and 25% for medium to low level of feeding ($P < 0.001$). If aiming to maximize on post-ruminal digestibility, browse inclusion rate of 50% is optimum. Synergistic effects were possible between CC and SBM but absent between AA and SBM.

Keywords: Nitrogen intake, regressive digestive, Soyabean meal, Zimbabwe

---

Abstract No: 37 -PP

Assessing the contribution of mixed crop-livestock production systems to greenhouse gas emissions in sub-humid Zimbabwe

Nheya, L.

Marondera University of Agricultural Sciences and Technology, P. O. Box 35 Marondera, Zimbabwe
Corresponding Author: nheyalessy@gmail.com

There is a need to examine the environmental sustainability of mixed crop-livestock production systems in sub-Saharan Africa, particularly their impact on greenhouse gas (GHG) emissions. The objective of this study is to evaluate the drivers of and quantify GHG emissions in mixed crop-livestock production systems in sub-humid Zimbabwe. A randomized complete block design with four fertilizer treatments and four replicates with maize as the test crop was set up at two experimental sites (smallholder and commercial farm) on a sandy loam soil in Marondera District, Zimbabwe (18.29 31.51) in the 2023/24 rainfall season. The treatments were: control, fertilizer (NPK-basal: applied at 200kg ha-1 and 400kg ha-1, for smallholder and commercial respectively) + N top dressing), cattle manure only (smallholder: 8t ha-1 and commercial: 10t ha-1) and fertilizer + manure (smallholder: 180kg ha-1 NPK basal + 8t ha-1 manure and commercial: 400kg ha-1 NPK basal + 10t ha-1 manure). Two static gas chambers were installed in each plot for the purposes of collecting gas samples at fortnightly intervals. In addition, static gas chambers were installed in the cattle kraal, congregation point and grazing area at both farms. Samples for soil moisture, soil organic carbon and mineral N were also collected with the gas samples. Sampling and sample analyses are both work in progress. The gas samples collected will be analyzed for GHGs in relation to differences in fertilizer application rates and livestock intensities. It is anticipated that the data will show notable disparities in emissions between commercial and smallholder farming systems. This data will help policymakers make informed decisions about balancing agricultural productivity and environmental sustainability in the sub-region.

Keywords: Gas chambers, crop-livestock production, sub-humid tropics, Zimbabwe

---

Abstract No: 038 -PP

Reconfiguring University processes to serve rural smallholder farmers amidst commercially dominated production systems of Zimbabwe

Manyangarirwa, W.,[1] Nyakudya, E.,[2] Chikumba, N.[3] & Poshiwa, X.[4]

[1]Department of Agricultural Sciences, Africa University. P.O. Box 1320, Mutare, Zimbabwe
[2]Faculty of Agriculture, Environment and Food Systems, University of Zimbabwe. P.O. Box MP 167, Mt. Pleasant, Harare, Zimbabwe
[3]Faculty of Plant and Animal Sciences and Technology, Marondera University of Agricultural Sciences and Technology, P. O. Box 35 Marondera, Zimbabwe
[4]Gary Magadzire School of Agriculture and Engineering, Great Zimbabwe University, P.O Box 1235, Masvingo, Zimbabwe
Corresponding Author: : manyangarirwaw@africau.ac.zw

Agriculture is the backbone of Zimbabwe's economy and contributes some 11-14 % of GDP, provides employment for 70 % of the population, produces 60 % of raw materials for industry, and about 45 % of the country's exports. In the year 2000, Zimbabwe embarked on a land reform programme that resulted in increased participation of smallholder farmers in mainstream agriculture activities. This shift led to increased demand for skilled human resources to provide supportive services in extension, training and research. Universities with a mandate for Agriculture training are thus going through extensive curriculum review to integrate emerging issues such as climate change adaptation and mitigation, environmental management, entrepreneurship and business development skills, and innovation for increased livestock and crop productivity among others. Universities have adopted the Education 5.0 framework that encompasses innovation and industrialization in addition to teaching, research and community engagement. Universities have established Centers of Excellence in Agricultural technology development targeting smallholder needs. Such initiatives will go a long way in reducing the short- and long-term effects of climate change, building capacities of local communities to adapt, and increasing crop and livestock productivity in all agro-ecological regions of Zimbabwe. Universities have established Innovation Hubs to generate technologies and products that will benefit smallholder farmers. In order to increase commercial productivity and financial sustainability, Universities have established agro-Industrial parks focusing on increased crop and livestock production and value addition. Some of the agro-industrial parks are modelled along the hub-and spoke model where smallholder farmers supply produce to the hub for bulking and processing. These agro-industrial parks also serve in student training and industrial attachment to impart skills to the future workforce for the Agriculture industry. It is envisaged that these interventions will help Zimbabwe to achieve its set National Development goals which are anchored on increased agricultural productivity as one of the pillars of the economy.

Keywords: Education 5.0, crop-livestock value addition, innovation hubs, Zimbabwe

Abstract No: 039 -PP

Biochemical composition and nutritive value of safflower leafy vegetable under two agro-ecological zones in Kenya

Tautsagae, A.,[1,2*]Kavoo, A.K.,[1] Mwajita, M.R.[1] & Nyende, B.A[1]

[1]Department of Horticulture and Food Security, Jomo Kenyatta University of Agriculture and Technology, P.O Box 62000-00200, Nairobi, Kenya
[2]Department of Crop and Soil Sciences, Botswana University of Agriculture and Natural Resources, Private Bag 0027, Gaborone, Botswana
Corresponding Author: tautsagae.agisanyang@students.jkuat.ac.ke

Safflower (*Carthamus tinctorius* L.) is traditionally known for its oil-rich seeds, but recent interest has grown in its potential as a nutritious leafy vegetable. This study aims to explore the nutritional and biochemical properties of various safflower genotypes cultivated in different agroecological zones of Kenya. Two field experiments were carried out at the KARLO Embu and Katumani in the Eastern Coastal regions of Kenya. Six safflower genotypes (Kiama composite, Nyambura, and Wanjiru from Botswana; BJ1006, BJ803, and Mexican Dwarf from Kenya) were evaluated for their nutritional and biochemical composition for utilization as vegetables in a completely randomized design (CRD) with three replicates. Data were collected on iron, calcium, crude fiber, vitamin C, total polyphenols, total flavonoids, beta carotene, ash, crude protein, moisture content, zinc, calcium, and magnesium; and analyzed using R-software 4.4.0, and significant means were separated using LSD at 5%. Safflower leaves were harvested once during the rosette stage and freeze-dried into powder for analysis. Results showed that safflower genotypes significantly varied in crude protein (16.53%-32.54%) and crude fat (3.06%-3.84%), were not statistically different in moisture content, crude fiber, and ash in both Embu and Katumani. Katumani showed a statistical difference in crude protein and carbohydrate. The genotype 'BK001' had the highest crude fat, carbohydrates, and ash content compared to other genotypes. The average leaf mineral content significantly ($p < 0.05$) varied from 4.96-21.5 mg/100g zinc, 19.2-74.44 mg/100g iron, 441-1598 mg/100g calcium, and 27.2-329 mg/100g magnesium. All the safflower genotypes evaluated had sufficient nutritional content to be used as green leafy vegetables, thus contributing greatly to the nutritional requirements for human health, enhancing the income of safflower farmers, and improving food security in Kenya and the African region.

Keywords: Antioxidants, *Carthamus tinctorius* L., genotypes, green leafy vegetable, mineral, nutrition, proximate

---

Abstract No: 040 -PP

Potentials and challenges of beekeeping development in Rwanda

Kibogo, A., Monney, K.A. & Kwapong, K.P.

Department of Conservation Biology and Entomology School of Biological Sciences, College of Agriculture and Natural Sciences
University of Cape Coast, Ghana
Corresponding Author: andrew.kibogo@gmail.com

Beekeeping serves an important source of additional income for many beekeepers as well as playing a vital role in conserving natural resources and contributing globally to environmental protection. This study review paper specifically aimed at identifying potentials and challenges of beekeeping development in Rwanda. The article explores a quite number of beekeeping opportunities in Rwanda including many forest resources yet to be exploited for beekeeping production, good climatic condition across the country, government willingness to support the sub-sector through availing the public forests for beekeeping activities, job creation particularly for youth and women, government strong efforts to

support both local and foreign investors, high potential for apitherapy tourism, exporting other unique bee-hive products among others. On the side, it has revealed some major challenges hindering the sub-agricultural sector such as high pesticide use, gaps in existing bee species and diversity in the country, use of traditional beekeeping, low bee-hive products, bee-diseases and predation, sub-sector seems to be not a government priority, dominance of old aged male beekeepers with few youths and women in sub-sector, lack of training programs and limited access to finance. Despite some constraints there is potential yet to be exploited for sustainable beekeeping in Rwanda.

Keywords: Beekeeping, challenges, development, potentials

Abstract No: 041 -PP

Seroprevalences and risk factors of peste des petits ruminants (ppr) in eastern region of DR of Congo

Fabrice, B.,[1]* Tulinabo, E.,[1] Bagula, L.,[1] Barume, A.,[1] Basengere, A.,[1] Gitao, G.[2] & Bisimwa, N.[1]

[1]Université Evangélique en Afrique
[2]University of Nairobi
Corresponding Author:fabricebantuzek@gmail.com

Peste des Petits Ruminants (PPR) is a major constraint on the small ruminant population in Eastern of the DR Congo. This study determined the seroprevalence of the disease and the related risk factors in North and South Kivu. An epidemiological survey was carried out in Masisi and Rutshuru territories (North Kivu) and in Kabare (South Kivu) to collect 988 blood samples from goats and sheep on livestock. Detection of anti-PPR antibodies by the HPPR-bELISA test was carried out using the Kit of pre-coated microplates of inactivated PPRV antigen. The overall seroprevalence of PPR was found to be 31.5%, with a high average in Nyiragongo (37.00%), followed by Kabare (33.37%) and Masisi (26.92%). PPR seroprevalence is slightly higher in sheep (33.3%) than in goats (31.04%). Furthermore, the risk factors strongly associated with the seroprevalence of the disease were the sex of the animal (OR: 2.77, $p<0.000$), the age groups of the young (OR: 3.93, $p<0.05$) and adults (OR: 0.66, $p<0.05$), the breeds used (OR: 1.99, $p<0.05$) and the importation of animals (OR: 2.97, $p<0.01$). However, farmers in North and South Kivu were willing to pay for herd vaccination (56.25%). A small minority of farmers used secondary anti-PPR treatments, in particular sulphonamides (8.12%), multivitamins (3.75%), oxyvet (3.75%) and penistreptomycin (3.13%). In addition, the majority of farmers (81.25%) do not have recourse to laboratory confirmation of the presence of the PPR virus on their farms. Effort to control PPR are needed in the two provinces of DR Congo in order to enhance the population of small ruminants.

Keywords: bELISA, PPR, Risk factors, South and North Kivu, vaccination and Secondary treatment

---

Abstract No: 042 -PP

The digitalization of academic and pedagogical affairs at the National University of Agriculture in Benin Republic

Tchigossou, B.,* Okry, F. & Djossa, A.B.

National University of Agriculture, P.O. Box 43 Kétou, Benin
Corresponding Author: bentchig2009@gmail.com

Since its creation in 2013, UNA has conducted manually the admission and registrations processes, the development of courses agenda and the organization of exams, the monitoring of progress made by students and the mobility of students and academic staff. This has hampered the effectiveness of the department of academic affairs with high work load. The digitalization of academic affairs at higher education emerges as a priority to effectively respond to the rapid changes that occur within the education system and to meet the expectations of students to better fit into the requirements of the job market. The National University of Agriculture of Benin (UNA) has made the necessary changes to comply to this internationally felt need by moving from manual to digital management of academic affairs. UNA is a public university created in 2013. In 2023, 23.7% of the student population from UNA were female. UNA is made of nine vocational training schools and one doctoral school. For 10 years, UNA has manually conducted management of academic affairs. In 2023, UNA moved to a digital platform. This web platform is divided into three sub platforms: students and parents' platform, lecturers' platform and academic affairs platform. This web platform helps to better book courses, monitor progress made in the implementation of the course agenda, the publication of academic statistics, the management of students marks and the issuance of academic document like certificates and diplomas. This platform helps to reduce communication barriers and improve the effectiveness of academic affairs and the outreach of UNA. It also builds an effective educational partnership with students, alumni, lecturers, national and international partners, companies and professionals, and students' parents who can visit dedicated platforms and directly communicate with the appropriate sections of the university. The digital tool is an effective way to manage academic affairs and should be promoted in most higher education institution in Africa.

Keywords: Academic affairs, Benin, digital Platform, higher education, National University of Agriculture

Abstract No: 043-PP

Bioactivity and safety of selected medicinal plants used in the management of Candidiasis in Pader District, Northern Uganda

Akwongo, B.,[1,2*] Kakudidi, E.K.,[1] Nsubuga, N.A.,[1] Morgan Andama, M.,[2] Namaganda, M.,[1] Tugume, P.,[1] Savina Asiimwe, S.,[1] Anywar, G.[1] & Katuura, E.[1]

[1]Department of Plant Science, Microbiology and Biotechnology, School of Biosciences, College of Natural Sciences, Makerere University, P. O. Box 7062, Kampala, Uganda
[2]Department of Biology, Faculty of Science, Muni University, P.O. Box 725, Arua, Uganda
Corresponding Author: b.akwongo@muni.ac.ug; bakwongobetty2014@gmail.com

This study i) documented medicinal plants used for treatment of candidiasis in Pader district, ii) assessed antifungal activities of five commonly used antifungal plants against eight susceptible and resistant strains of candida albicans and non albicans species, and iii) evaluated safety of Khaya anthotheca, since it demonstrated the highest anti-candida activity. Ethnobotanical data of potential anti-candida plants was collected from 63 herbalists using a snowball approach. Four focus group discussions (FGDs) were used to ascertain community's perspective on use of anti-candida plants. The anti-candida activity of five commonly used medicinal plants (Sansevieria dawei, Momordica foetida, Distimake

dissectus, Khaya anthotheca and Hallea rubrostipulata), extracts were tested on 2 candida species viz; Candida albicans (ATCC 90028, ATCC 10231, 0796 and 0770a), and candida non albicans (C. glabrata ATCC 2950 and VVc 004; and C. tropicalis ATCC 750 and 0210). Toxicity assessment of methanolic stem bark extracts of K. anthotheca was done according to OECD guidelines. Results show 32 potential anti-candida plant species belonging to 18 families were identified; Fabaceae (9 species) and Asteraceae (5 species) dominated. Five most cited plants were Momordica foetida (26), Sansevieria dawei (20), Khaya anthotheca (15), Distimake dissectus (05), and Hallea rubrostipulata (05). For antifungal efficacy, aqueous extract at 24.4oC of M. rubrostipulata (ZOI: 18.00±1.00 - 38.33±0.17; MIC: 3.13±0.00 - 20.83±4.17), methanol extract of K. anthotheca (10.11±0.31 -15.11±0.65; 1.04±0.26-12.50±0.00), and combination of aqueous extract at 60oC of D. dissectus + methanol extract of K. anthotheca (7.89±0.26 - 19.67±0.37; 0.78±0.00- 50.00±0.00) were effective against all tested organisms, unlike the conventional drugs used. For toxicity evaluation, long term administration of high extract doses presented with at least one organ specific toxicity of the liver, kidney or stomach. Methanol extract of K. anthotheca, aqueous extract at 24.4oC of M. rubrostipulata, and combination of aqueous extract at 60oC of D. dissectus + methanol extract of K. anthotheca demonstrated broad spectrum antifungal activity against all candida species tested. The most efficacious plant, K. anthotheca was generally safe at low doses, though its long term present may be toxic to the liver, kidney or stomach.

Keywords: Antifungal activities, candidiasis, medicinal plants, resistant candida species

---

Abstract No: 044 -PP

Heavy Metals contamination in Oilfield area of Thar-Jath, South Sudan

Bior James Akoi., Cheo Emmanuel Suh & Fozao Kennedy Folepai

University of Bamenda, P.O. Box 277 North West Region Cameroon
Corresponding Author: juniorbior25@gmail.com

The study i) quantified the levels of heavy metals in soil and water from the study areas. Eight soil and water samples were collected from mining site and main town of Thar-Jath. The heavy metal quantification of Lead (Pb2+), Mercury (Hg2+), Cadmium (Cd2+), Arsenic (As2+), Iron (Fe2+), Chromium (Cr6+), and Zinc (Zn2+) was carried out using an energy dispersive x-ray fluorescence spectrometer. The contamination level of the heavy metals was assessed using the Geo-Accumulation Index (Igeo), Contamination factor, Pollution load index (PLI), Enrichment Factor (EF), and Potential Ecological Risk Assessment (PER) models. Result shows that there was no significant difference ($p<0.05$) in the mean values of heavy metal concentrations in all the sampled water resources. The heavy metals Pb, Cd, Fe, Hg, As, Zn and Cr concentrations in soil samples exceeded the standard permissible limits. High concentration of heavy metals was observed in the mining compared to the control. The variations of the determined heavy metals concentrations (ppm) at the depth of (10-60cm) obtained are 0.001-0.182, 0.001-0.005, 0.001-0.008, 0.220.241, 0.43-0.432, for Pb, Hg, As, Fe, and Zn respectively. PLI analysis confirms that the concentration of heavy metals sites declined with depth. ER values for Cd, Cr, Cu, Hg showed severe enrichment due to contributions of anthropogenic sources with higher values in subsurface. There is a potential for heavy metal pollution in soil and water in Thar-Jath Oil production site and its environs if not properly managed. There is need for remediation measures and sensitization of the population on the dangers of different activities on the soils.

Keywords: Oilfield, Pollution loadings, geo-accumulation, restoration, soil and water contamination risk

---

Abstract No: 045 -PP

Molecular diversity of fungal community in the maize rhizosphere under rainfed agroecologies in Eastern DRC

Ndeko, A.B.,[1,2,3]* Diedhiou, A.G.,[2,3,] Ndour, P.M.S.,[4] Fall, S.,[3] Hassna Founoune-Mboup, H.,[3] Diouf, D.,[3] Mushagalusa, G.N.[1] & Kane, A.[2,3]

[1]Université Evangélique en Afrique, Faculty of Agriculture and Environmental Sciences,
[2]Département de Biologie Végétale, Université Cheikh Anta Diop de Dakar,
[3]Laboratoire Commun de Microbiologie,
[4]UCEIV-ULCO, IRD, P.O. Box 62228, Calais, France
Corresponding Author: ndeko.byam@gmail.com; ndekobyamungu@uea.ac.cd

Rhizosphere fungi are pivotal in maintaining soil health and enhancing crop productivity. However, there is still limited knowledge regarding the diversity and population structure of rhizosphere fungi in maize fields across various agroecological zones (AEZs) is still limited. This study aimed to characterize the diversity and composition of fungal populations in the maize rhizosphere in South Kivu. Alpha and beta diversity, species richness, and fungal community composition were analysed based on AEZs and sites (territories). Rhizosphere soil from maize plants at 32 different sites across two AEZs was examined using Illumina's MiSeq platform. The results indicated low alpha diversity across all sites (Shannon-Weaver index 2) and a significant decline in species richness from high altitude to low altitude. Ascomycota and Basidiomycota were the dominant fungal phyla detected at all sites and in all AEZs. Conversely, Ascomycota were more abundant in the lowland sites of Uvira compared to highland sites. Among the prominent groups identified, the phylum Glomeromycota is notable for its role in promoting maize growth and exhibiting antagonistic effects against various pathogens. These findings could provide new opportunities to harness the potential of fungi for maize disease control and biofertilization.

Keywords: Fungal communities, next-generation sequencing, Rhizosphere microbiome, Soil microbiology, *Zea mays* L

Abstract No: 046 -PP

Assessment of knowledge, attitude and practice of mothers/caregivers towards mycotoxins contamination of infants and young children porridge in the Democratic Republic of Congo

***Miderho., C.C.,[1,2] Njue, L.G.,[2] Abong, G.O.,[2] Sylvok, M.[3] & Mubagwa, K.[4]**

[1]Department of Food Science,Nutrition and Technology,Faculty of Agriculture,University of Nairobi, Nairobi, Kenya
[2] Faculty of Agriculture, Université Catholique de Bukavu, Bukavu, Democratic Republic of Congo
[3] Department of Agrobiotechnology IFATulln, Institute of Bioanalytics and Agro-Metabolomics, A3430 Tulln, University of Natural Resources and Life Sciences, Vienna, Austria
[4] Department of Basic Sciences, Faculty of Medicine, Université Catholique de Bukavu, Bukavu, Democratic Republic of Congo
Corresponding Author: cito.miderho@ucbukavu.ac.cd

Lack of information on knowledge and attitude concerning mycotoxin contamination of Infants and Young Children(IYC) maize-based foods, as well as the practices of mothers/caregivers who handle porridge ingredients including maize flour for their under-five children, are generally associated with a high risk of non-communicable disease exposure. Mycotoxicosis affects vulnerable groups such as infants and young children and it is currently recognized as a major public health concern worldwide. This study assessed the public's knowledge, awareness, and practices adopted by mothers/caregivers towards mycotoxin contamination of infants and young children's porridge in the Democratic Republic of the Congo (DRC) and to help mitigate the occurrence of mycotoxins in IYC foods. A cross-sectional

study design was carried out. The Fischer's formula was used and 428 mothers/caregivers were targeted for the study. Eight health zones were selected through a multistage sampling method. Data was collected using questionnaires and analyzed using descriptive and inference statistics. Data was descriptively and inferentially analysed using a statistical package for social science version 26 (SPSS) and R. Mothers' /caregivers' knowledge of mycotoxin contamination in maize-based IYC foods (porridge and maize flour) was significantly linked to the location [OR=4.195 (95% CI: 2.535-6.94), $p < 0.000$]. Furthermore, household size was associated with mothers'/caregivers' knowledge level of mycotoxins contamination [OR =1.106 (95% CI: 1.006-1.22), $p = 0.036$]. Both locations were significantly associated with attitudes towards mycotoxin contamination in maize-based food for infants and young children [OR=0.591 (95% CI: 0.369-0.967), p=0.036]. In terms of practices, maize grain/flour was stored under both favourable and poor ventilation conditions (90.3 and 9.7%, respectively) and 93.3% of mothers/caregivers said they shelled maize by hand; 89.31% of women/caregivers pre-treat maize flour before using it. Despite mothers/caregivers having a good knowledge and positive attitude, their practice of treating IYC maize based food at household level was quite low quantities. Knowledge of mycotoxins was slightly low, and mothers/caregivers showed a negative attitude towards mycotoxins contamination of IYC maize based porridge. A strategy for nutritional education and IYC food handling for effective mitigation of mycotoxins contamination of IYC should be developed and implemented.

Keywords: IYC, KAP, maize, Mycotoxins, porridge

Abstract No: 047 -PP

Sustainable farming practice: a case of farmer's participation in agroforestry in Kgalamela-odolu, Kogi state, Nigeria

Attamah, C.O. & Ukwueze, E.R.

Department of Agricultural Extension, University of Nigeria, Nsukka, Enugu, Nigeria; Corresponding
Corresponding Author: clement.attamah@unn.edu.ng

The study ascertained farmers' participation in agroforestry in Igalamela-Odolu Local Government Area of Kogi State, Nigeria. Specifically, the socioeconomic characteristics of agroforestry farmers were described; farmers' agroforestry activities were determined, and their perceptions of the benefits of agroforestry were identified. Eighty agroforestry farmers were purposively selected and data was collected using a structured interview schedule. The findings showed that the majority (78.8%) were male with an average age of 54 years, while a greater proportion (95%) were married with an average household size of 7 persons. The major crops cultivated in the area were maize (71.3%), cocoyam (60%) and cassava (57.5%), while the tree integrated with crops was majorly oil palm (71.3%). The result revealed that a greater percentage (85%) practised silvoarable systems of agroforestry. Farmers mentioned household nutritional enhancement ($\bar{x}$=3.58), income boost ($\bar{x}$=3.53), and medicinal advantage of trees ($\bar{x}$=3.65) as their perceived benefits of participation. Farmers' participation in agroforestry was limited, as farmers were found to have only engaged majorly in one out of the eight practices considered. Local governments and agricultural extension agents should vigorously drive the campaign for agroforestry, clearly highlighting the huge benefits, especially that of climate change mitigation and sustainable food systems.

Keywords: Agroforestry in Nigeria, participation in agroforestry, sustainable farming

---

Abstract No: 048-PP

Evaluation of upland rice response to water stress using polyethylene glycol (PEG -6000) at germination and early seedling stage

Momolu, P. E.

Department of Seed, Crop and Horticultural Sciences, School of Agriculture and Biotechnology, University of Eldoret, Kenya
Corresponding Author:momolupope@gmail.com

Water stress is one of the most important crop growth limiting factors which leads to low crop productivity and yield instability. Water stress affects crop growth and development, especially during the germination and seedling period. The experiment was conducted in the growth chamber at the seed physiology laboratory of the Department of Seed, Crop and Horticultural Sciences, University of Eldoret to evaluate sixteen upland rice varieties to water stress tolerance at germination and early seedling growth stage. These varieties were tested against four levels of water stress imposed by Polyethylene glycol 6000 (PEG - 6000) at 0%, 5%,10% and 15% concentration using a complete randomized design (CRD) with three replications. Osmotic stress induced by PEG levels significantly reduced plant growth parameters. The result showed that the germination percentage, germination index, Relative seedling height (%), seedling dry weight, Seedling fresh weight, Seedling length, seedling vigor index and mean germination time of all tested rice varieties were found decreasing trends with increasing the levels of PEG from 0 to 15% concentration levels. Among all the sixteen varieties, NERICA rice varieties followed by MWUR, White rice, Kpatawee, and Komboka had an outstanding performed in terms of germination percentage, germination index, seedling height, seedling dry weight, root length and relative dry weight under water induced stress by using PEG compared to other varieties. Therefore, these varieties could be useful in breeding programs and can be cultivated in arid and semi-arid environment or where water shortage is a regular constraint.

Keywords: Germination and early seedling stage, polyethylene glycol 6000, upland rice response, water stress

Abstract No: 049 -PP

Effects of agroforestry tree species on soil micro-nutrients content in Western Kenya

Nyuma, H.T[1, 2]*, Mumoe, J.[2] Machote, B.[3] & Wesonga

[1]University of Liberia P.O.Box 9020 1000 Monrovia, 10 Liberia
[2] University of Eldoret P.O.Box 1125-30100 Eldoret, Kenya
[3] Kenya Forest Research Institute Manseno, Kisumu County Kenya
Corresponding Author:tnyuma@gmail.com

Agroforestry trees have multipurpose uses including but not limited to replenishment of plant nutrients in agricultural soils. Despite the deficiency of micronutrients in agricultural soils contributing to low crop production, there is limited information on the role of agroforestry trees in their replenishment. Thus, this study aimed at evaluating the effects of selected agroforestry trees (Leuceana, sesbania and Calliandra) on the contents of Mn, Zn and Cu content in agricultural soil across two agro-ecological zones in Busia and Kakamega Counties. A cross-sectional design was deployed and 15 farms that had adopted agroforestry trees purposefully sampled. Soil samples were analyzed for pH, soil organic carbon, manganese, zinc and copper. Leuceana, sesbania and calliandra significantly increased the contents of soil Mn and Cu. Leuceana and Sesbania increased the contents of Mn by about 7 mg kg-1 at Kakamega site, translating to approximately 27 kg Mn ha^{-1}. On average, agro-forestry trees increased Mn content by between 26 and 51% above the control. This study confirms agroforestry trees as crucial natural “fertilizers” and hence could be targeted to replenish soils deficient in micronutrients.

Keywords: Agroecology, micronutrient deficiency, nutrient cycling, soil degradation

Abstract No: 050 -PP

Determinants of adoption of soil and water conservation measures in Kalehe territory Democratic Republic of Congo

Nteranya, J.N.,[1,2]*Kiplagat,A.,[1] Ucakuwun, E.K.[3] & Nzabandora, C.K.[4]

[1]Department of Environmental Planning, Sustainability and Geoinformatics, School of Environmental Sciences and Natural Resources Management, University of Eldoret, Kenya
[2]Department of Geology, Faculty of Sciences, Université Officielle de Bukavu, DR Congo
[3]Department of Environmental Sciences, School of Environmental Sciences and Natural Resources Management, University of Eldoret, Kenya
[4]Department of Biology, Faculty of Sciences, Université Officielle de Bukavu, DR Congo
ORCID: https://orcid.org/0000-0003-4954-5450
Corresponding Author:j.nacishali@gmail.com

The implementation of soil and water conservation measures (SWCM) constitutes a strategy to address the land degradation problem. However, the adoption of these measures is not a straightforward process, as it is influenced by various factors that affect the farmers' perception, motivation, and capacity to implement them. This study analyzed the determinants and constraints of adopting SWCM to cope with erosion in Kalehe territory, a highland area in the eastern region of the Democratic Republic of Congo. A multi-stage cluster sampling method was used to select 384 households from four health zones. A semi-structured questionnaire was administered to assess the social, institutional, physical, economic, and attitudinal factors influencing the adoption of SWCM. Basic descriptive statistics, chi-square test, and binary logistic regression model were applied to analyze the data. The results showed that fallow, mulching, intercropping, agroforestry, trenches, and drainage ditches were the main SWCM adopted by the respondents. However, the rate of adoption was low due to different constraints such as the lack of training, technical and financial support among others. Moreover, the farmer's decision to adopt the SWCM was positively influenced ($P<.05$) by the education level, household size, farming seniority, access to extension services, and slope of farmland but negatively influenced by the age, distance to farmland, and residency period in the locality. These results implied that conservation planning and interventions should be tailored to the socioeconomic characteristics of farmers and the structural characteristics of their farmland. Thus, this study suggested some policy recommendations such as using educated people as focal points for demonstration plots, increasing the number of extension workers and centers, promoting experience-sharing and community actions, and raising awareness about the benefits of SWCM to enhance their adoption.

Keywords: Conservation practices, conservation planning, erosion, land degradation

Abstract No: 051 -PP

Selected antinutritional factors and minerals of raw morama bean (*tylosema escululetum* (burch.)), and their interaction effect on mineral bioavailability

Gwamba, J.,[1,2*] Imathiu, S.,[1] Kinyuru, J.[1,3] & Onyango, A.[1]

[1]Department of Food Science and Technology, School of Food and Nutrition Sciences, Jomo Kenyatta University of Agriculture and Technology, P.O Box 62000-00200, Nairobi, Kenya
[2]Department of Food Science and Technology, Botswana University of Agriculture and Natural Resources, Private Bag 0027, Gaborone, Botswana
[3]African Institute for Capacity Development, P.O. Box 46179-00100, Nairobi, Kenya
Corresponding Author:

Morama bean (Tylosema escululetum (Burch.) has the potential to contribute micronutrients such as iron, zinc and calcium to meet the daily human dietary needs. However, minerals such as calcium, zinc and iron are predominantly found bound with antinutritional factors such as phytate and oxalate which may limit their bioavailability in the lumen. Oxalate has acrid or bitter taste which may lead to unpalatability, and it is responsible for formation of calcium oxalate kidney stones. This study assessed the effect of geographical sourcing of morama bean on selected minerals and antinutrients, and their interaction on mineral bioavailability. Morama bean samples were collected from eight locations in four districts of Botswana to determine oxalate, phytate, calcium, iron and zinc contents. Mineral molar ratios were calculated to evaluate the potential mineral bioavailability of raw morama bean. Iron, zinc and calcium levels ranged between 1.06-2.60, 1.77-2.79 and 90.4-105.4 mg/100 g across the districts, respectively. Phytate levels differed significantly p=0.001 between the districts ranging between 84.9 to 149.0 mg/100 g. Oxalate levels also differed significantly p=0.001 between the districts ranging between 37.5 to 119.4 mg/100 g. Across the four districts the molar ratios of phytate: zinc, phytate calcium/zinc, phytate: calcium and oxalate: calcium, were lower than critical limits of <15, <200, <0.24, <1, respectively, indicating good bioavailability of zinc and calcium in raw morama beans. However, the phytate: iron molar ratios ranged between 3.4 and 8.0, which are above the recommended critical limit of one indicating the possibility of affecting iron bioavailability. Since raw morama beans are not consumed raw due to bitter taste, known heat processing techniques of the bean such as roasting and boiling and potential processing technique such as fermentation may further reduce antinutrient contents thus improving palatability and mineral bioavailability particularly iron. This may subsequently address micronutrients deficiencies commonly referred as hidden hunger where morama bean is consumed in rural communities.

Keywords: Antinutrients, Botswana, micronutrient deficiencies, minerals, mineral bioavailability, morama bean, palatability

Abstract No: 052 -PP

A Survey on consumption patterns, harvesting, post-harvest practices and safety concerns of mopane caterpillar in Matebeleland South, Zimbabwe

Murefu, T. R. [1,2] **Muriithi, A.N.**[3] **& Musundire, R.**[4,5]

[1]Department of Plant, Animal and Food Sciences, Jaramogi Oginga Odinga University of Science and Technology (JOOUST), P.O. Box 210-40601 Bondo, Kenya
[2] Department of Food Science and Technology, Chinhoyi University of Technology (CUT), Private Bag 7724, Chinhoyi, Zimbabwe
[3] Department of Plant, Animal and Food Sciences, Jaramogi Oginga Odinga University of Science and Technology (JOOUST), P.O. Box 210-40601 Bondo, Kenya
[4] Department of Crop Science and Postharvest Technology, Chinhoyi University of Technology (CUT), Private Bag 7724, Chinhoyi, Zimbabwe
[5] Directorate of Research and Graduate Studies, Chinhoyi University of Technology (CUT), Private Bag 7724, Chinhoyi, Zimbabwe
Corresponding Author: taterue@gmail.com

Mopane caterpillars are high in proteins and other vital minerals, making them a nutritious food supply that gives impoverished households food security. Limited studies have explored how age, gender, and localities affect mopane caterpillar consumption, harvesting, and post-harvest practices. There is insufficient data on contamination risks during harvesting, processing, and storage, including microbial, chemical, and environmental contaminants and the health implications of consuming mopane caterpillars. To determine how mopane caterpillars are harvested, processed, packaged, stored, marketed, and cooked, a study was conducted in the Gwanda Rural District of Matebeleland South Province, Zimbabwe. Using a semi-structured questionnaire, 138 value chain actors (collectors, processors, and traders) from three wards were interviewed about value chain operations, and 182 respondents were interviewed for the consumption survey. Most respondents were female and between the ages of 31 and 40 years, and 83.52% consumed the mopane caterpillar. The most popular techniques for harvesting mopane caterpillars were the use of the knockdown method (40.3%) and hand-picking the ground (44.0%). Charcoal roasting or heating was determined to be the most widely used processing method (93%), while polypropylene bags were the most used storage option (53.1%). The majority of respondents indicated they consumed mopane caterpillars one to two times a week, averaging 45 grams per person, with 100g dry mopane caterpillars serving three to four people. Based on the responses, the majority of people consumed mopane caterpillars fried (69.8%), with a further 21.4% turning them into a relish. A proportion of 74.7% of the respondents attributed health benefits as reasons for consuming mopane caterpillars while 25.3% indicated negative health effects associated with consuming mopane caterpillars. The responses showed that 19.7% of respondents experienced gastrointestinal problems, and only 5.5% attributed the health issues to allergic reactions. The findings indicate significant regional and demographic variations in consumption patterns, harvesting practices, post-harvest handling, and safety concerns associated with mopane caterpillars. Safety concerns, particularly regarding contamination during harvesting and processing, are critical issues that need addressing through improved practices and stricter regulations.

Keywords: Consumption patterns, edible insects, harvesting practices, indigenous knowledge, mopane caterpillar food safety, post-harvest processing, vendors

Abstract No: 053 -PP

Occurrence, causes and management of poor responsive soils in western Kenya: Case studies

Otinga, A. N*., Njoroge, R., Rono, E., Njogo, S., Munini, B., Oluoch V. and Kimaiyo, E.

University of Eldoret, Department of Soil Science, P.O. Box 1125-30100 Eldoret, Kenya
Corresponding author: abigaelno@uoeld.ac.ke

Poorly responsive soils are defined as those that exhibit an insignificant increase in crop yields when recommended amounts of mineral fertilizers are applied. These poorly responsive soils have been documented as the cause of the widening yield gaps recently observed in various parts of sub-Saharan Africa (SSA). It has also become increasingly evident that, while crops respond favourably to the commonly applied nitrogen (N), phosphorus (P) and potassium (K) fertilisers in some soils (the so-called responsive soils), they do not respond to fertilizer application in any significant manner in some soils (thus the so-called poorly responsive soils). In some cases, e.g. where land is newly opened, or where farms are close to homesteads (e.g., in kitchen gardens that receive large amounts of organic inputs continuously), a third class of soil may exist where crops barely respond to fertilizer. These soils are already fertile, and, therefore, require only maintenance fertilizer doses of and can be termed as 'fertile, less responsive soils. Little knowledge is available about the actual coverage of poor soil responsiveness in SSA, and they could be as high as 40% in some places. The causes of such soils and the dynamics may vary in each context at even farm level. This paper examines some of the studies carried out in western Kenya to document the occurrence of poorly responsive soils, their causes and some of the practices that have been recommended for their management. In some instances, poor soil responsiveness depends on inherent physicochemical characteristics of soil, landscape position, and soil management history. The management of these soils is very context specific and varies from application of organic fertilizers to soil conservation practices such as minimum- tillage. A promising agroecosystem approach that aligns with climate-smart agriculture, 'agroecology' may be a sustainable technique that may improve soil responsiveness to fertilizer use and thus improved crop production. Therefore, studies are needed to unravel mechanisms of the agroecology approach in improving soil physicochemical and biological quality.

Keywords: Agroecology, climate smart management of soils, crop response, degraded soils, fertilizer use efficiency, soil conservation

Abstract No: 052 -PP

Effect of soaking and extrusion on functional and pasting properties of cowpeas flour

Kesselly, S.R.,[a,b] Mugabi, R.[b] & Byaruhanga, Y.B. [ba]

[a]Department of Home Science and Community Development, College of Agriculture and Forestry, University of Liberia, P.O. Box 9020, Monrovia, Liberia
[b] Department of Food Technology and Nutrition, School of Food Technology, Nutrition and Bio-Engineering, Makerere University, P. O. Box 7062, Kampala, Uganda
Corresponding Author:

Cowpea (*Vigna anguiculata*) is a leguminous crop that is widely grown and consumed in Asia and Africa as a major source of dietary protein. This study investigated the effect of varying extrusion conditions (temperature and moisture content) on the functional and pasting properties of cowpea flour. Particle size distribution, functional and pasting properties of cowpeas flour were determined. Moisture content had a significant effect on the functional and pasting properties of cowpeas flour followed by temperature. Increasing moisture content from 10% to 15%, increased the bulk density from 0.4 to 0.5, Oil Absorption Capacity 149 to 238, Water Absorption Capacity 407 to 422, Swelling Power 4.6 to 4.9, Water Absorption Index 3.9 to 4.2, as well as Peak and Breakdown viscosities. On the other hand, reducing the moisture content decreased Water Solubility Index (WSI) from 31 to 21. Lower extrusion temperature increased all the functional properties except WSI along with pasting properties namely Peak, Final and setback viscosities. Higher extrusion temperature increased WSI, breakdown, peak time, and pasting temperature. The results suggest that variation of extrusion conditions can be used to modify the functional and pasting properties of cowpea flour to suit different applications.

Keywords: Cowpeas, flour extrusion modification, functional properties

---

Abstract No: 053 -PP

Transformative institutional management and development

Cheruiyot, T. K.,[1] Totona, E.[2] & Ochuodho, J.O.[3]

1* University of Eldoret, Office of the Vice Chancellor, P.O. Box, 1125 - 30100, Eldoret, Kenya.
2 University of Eldoret, Finance Office, P.O. Box, 1125 - 30100, Eldoret, Kenya.
3University of Eldoret, School of Agriculture & Biotechnology, P.O. Box, 1125 - 30100, Eldoret, Kenya
Corresponding author email: cherutho@uoeld.ac.ke

Proper management of an institution influences the direction of development it experiences. Leadership and management of HEIs have been brought into disrepute lately due to many challenges both internally and externally. A quick systematic review of literature was performed to demonstrate the gap available in institutional management. A short survey was conducted within the university targeting the management and experiences expressed collated in a few areas. Observations were made on how to transform the university and reposition it for better development. The quantitative data collected were subjected to descriptive and inferential analysis and results presented in bar graphs with standard error bars. The teaching and non-teaching staffs were found to be overly ageing and a succession plan needed. Due to ever increasing number of students in the face of dwindling public funding there is need for staff rationalization and improvement of infrastructure to minimize operational cost and increase efficiency in the university management systems.

Keywords: Age bracket, ICT, institutional management, staff, strategic planning

---

Abstract No: 054 -PP

Higher education nodes in Africa: Harnessing the collective Power for Accelerating Human Capital Development and Transitions

Egeru, A.[1]* & Adipala, E.[2]

[1]Regional Universities Forum for Capacity Building in Agriculture (RUFORUM), P.O. Box 16811 Wandegeya, Kampala
[2]Research and Education Agency (RAE), Kampala Uganda
Corresponding Author: a.egeru@ruforum.org

In the last decade, higher education has returned into the development discourse in Africa, partly owing to the investments that were made in secondary education that have shifted the demographics in higher education space. This has created a pent-up demand on higher education leading to the expansion of higher education enrollment that has in turn created an appetite for more enrollment. Accordingly, an estimated 10 million young Africans attend higher education institutions at present presenting a surmounting pressure on the constrained job market in the continent. The discourse on higher education relevance and skills development for suitability to the employment market and/or for job creation through innovation, entrepreneurship and enterprise development has become critical at a time the continent is facing unprecedented transition to work challenges. Higher education institutions have attempted to respond to the public demand through deliberate interventions aimed at bridging the skills gap. These responses overtime have led to the creation of centres of excellence and higher education nodes within the continent at sub-regional level. These nodes are diverse tackling various education and innovation ecosystem components including: health, biotechnology, agriculture, agribusiness and commerce, and the broader Science, Technology Engineering and Mathematics (STEM). Notable countries in these various fields include: Morocco, Tunisia and Egypt (North Africa), Kenya, Mauritius, Uganda, Sudan and Ethiopia (Eastern Africa), Nigeria, Senegal, Benin and Ghana (West Africa), and Malawi, Namibia, South Africa and Zimbabwe (Southern Africa). Interventions at continental level have not been uniform and synchronized among the various agencies financing higher education, largely due to policy differences and national goals and objectives of education as well as variations in human capacity to handle required adjustments. The African Union Commission (AUC) Agenda 2063: the Africa We Want raises fundamental issues that higher education nodes ought to realign to support their achievement on a continental level whilst meeting the national goals. It is vital to note that the nodes present in Africa provide a platform for reforming higher education whilst working with other global partners as technical and learning partners. These higher education nodes are cost effective, are relevant to the demands of Africa, and provide opportunity for skills transfer to a larger pool of young and dynamic fellows yearning for critical skills required in the labour market. Scalability of the initiatives and interventions can be enhanced through utilizing regional networks and consortia within Africa with a well-established continental traction and delivery mechanisms.

Keywords: Africa, Agenda 2063, excellence, innovation, labour

Abstract No: 055 -PP

Accelerating Agri-Food systems transformation in Africa through training new generation of scientists

Rogério Marcos Chiulele

Edouardo Mondlane University, Av. 25 de Junho, Maputo, Mozambique
Corresponding Author: ...

Africa has enormous potential for agri-food systems transformation. Achieving this goal will require amongst others, highly qualified human resources to lead the development of technologies, innovation and appropriate policies for such transformation. The Centre of Excellence in Agri-Food Systems and Nutrition at Eduardo Mondlane was established with the vision to contribute to this goal through training highly qualified human resources at post-graduate level and delivering high quality research outputs in agri-food systems and nutrition, agricultural policy analysis and agricultural risk management and climate change. The Centre is contributing to that goal through training about 200 scientists from 20 African countries at Masters and Doctorate levels in the different agri-food thematic areas, delivering short courses in key areas of the agri-food systems and entrepreneurship incubation . It is expected that in near future, this generation of scientists will lead the generation of knowledge, innovation and design of appropriate policies that will guide agri-food systems transformation in African countries.

Regional Univesities Forum for Capacity Building in Agriculture
P. O. Box 16811, Kampala, Uganda
Website: www.ruforum.org | **Email:** secretariat@ruforum.org