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BOTSWANA UNIVERSITY OF
AGRICULTURE AND NATURAL RESOURCES
Inspiring Sustainable Growth

21st Annual General Meeting
01-05 December 2025
Botswana

RUFORUM
Capacity Building in Agriculture

Republic of Botswana

PRE-AGM EVENTS- SCIENTIFIC FORUM

17th-21st NOVEMBER 2025

PROGRAMME FOR ONLINE PRESENTATION

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FORUM I

RESILIENT AGRIFOOD SYSTEMS TRANSFORMATION

Monday 17th to Friday 21st November 2025 from 8:30 to 17:00

DAY TWO

Tuesday, 18th November 2025

Session Chair: Dr. Joseph Semakula
Rapporteurs: Dr. Sarah Akello, Dr. Geofrey Gabiri

08:00-08:05	Welcome Remarks from the Chair: Dr. Joseph Semakula	
08:05-08:20	Agroforestry and Household Food Security: Evidence from Tephrosia improved fallow adoption at Chulu and Kaluluma Extension Planning Areas in Malawi	Maureen Phiri
08:20-08:35	Where is the missing food? Characterizing food loss and waste along the urban, peri-urban, and rural settlement continuum: Implications for accelerated food system transformation in Zambia	Blessing Masamha
08:35-08:50	Benchmarking improved food security, rural incomes and agricultural development among countries: Kenya's lessons from other East African Countries	Francis Mwaura
08:50-09:05	Reconfiguring Food Systems and Primitive Capital Accumulation under Neoliberalism in Africa	Toendepi Shonhe
09:05-09:20	Physicochemical, nutritional and sensory characterisation of seven promising accessions of aromatic rice resilient to climate shocks in Benin	Valere Dansou
09:20-09:35	Wonder multistorey gardens: strengthening urban food systems and advancing nutrition security in Nairobi, Kenya	Andrew Abiya
09:35-09:50	Coastal Preferences for Mangrove Forest Utilization in Ambanja District, Madagascar	Clifford William Fety
09:50-10:05	Seedling survival and plantation success in the drylands of Northern Ethiopia	Daniel Hagos Berhe
10:05-10:20	Enhancing forage production and mitigating greenhouse gas emissions through bioslurry fertilization	Akiber Chufo Wachemo
10:20-10:35	Modifying aspects of ruminal fermentation to mitigate enteric methane generation in goats through the use of saponin- and tannin- rich plant sources - A meta-analysis	Emmanuel Malematja
10:35-10:50	Effect of biochar, canola oil and garlic on in-vitro digestibility, volatile fatty acids and total gas production in selected dairy cattle feeds	Rachel Mutore
10:50-11:05	Phytochemical profiling, antioxidant, and androgenic effects of multi-solvent extracts of Ziziphus mucronata on mouse testicular TM3 Leydig cells	Nelisiwe Prenate Masuku
11:05-11:20	Sero-epidemiology and Risk factors of Foot and Mouth Disease (FMD) in the Eastern regions of DR Congo	Bantuzeko Kwankanaba Fabrice
11:30-11:40	Health Break	

11:40-11:55	New approaches in the development of diluents for gamete preservation in African cattle breeds	Eddington Gororo
11:55-12:10	Artificial Intelligence for Farm-Level Decision Support: A Synthesis of Emerging Innovations, Challenges, and Policy Imperatives in Kenya	Brigid K. Gesami
12:10-12:25	Sustainable Fish Farming Through old Jerrycan Pond Innovation: A Youth-Led Model for fish farming in Uganda	Ojuka Ambrose Abraham
12:25-12:40	Vulnerability of small-scale fishers' livelihoods to climate change in Binga, Zimbabwe	Tendai Maparara
12:40-12:55	Rainwater harvesting simulation models and their implications for GW resources in Africa: A systematic review	Thomas Sahinkuye
12:55-13:10	Ivermectin Use in Livestock: Environmental Persistence, Impacts on Dung Beetles and Ecosystem Services, and Pathways Toward Sustainable Alternatives.	Mactildah Kadivirire
13:10-13:25	Characterization and evaluation of cicadas (Platypleura haglundi) as a feed protein source for commercial broiler chicken production under small scale production	Makaza H. E
13:25-13:55	Health Break	
13:55-14:10	Genome-wide association study of seropositivity to Babesia bigemina, Babesia bovis and Erhlichia ruminantium in cattle	Malatji Dikeledi
14:10-14:25	Morphometric traits and structural indices of the small east african zebu and its crosses with tyrolean grey cattle under on-station conditions in aswa ranch and lusenke stock farm of Uganda	Mary Goretti Acila
14:25-14:40	Nixtamalization of White and Yellow Maize: Effects on Nutrition and Acceptability of Traditional Staples	Alba du Toit
14:40-14:55	Kowledge, attitude and practice regarding antibiotic use and residues among smallholder dairy producers in mbala and kasama, Zambia	Goliath Eneya Zulu
14:55-15:10	Plant Microbiomes as Unexplored African Heritages: Endophytic Bacteria from Brachiaria Grass as Tools for Climate-Resilient Agriculture	Goshu Misganaw
15:10-15:25	Assessment of small stock management practices and farmers' willingness to adopt new feed innovations	Nonofo Gotcha
15:25-15:40	Safflower (Carthamus tinctorius) Seeds as a Natural Feed Additive for Improving Poultry Semen Quality and Reproductive Performance: A Review and Future Research Directions	Onalenna Kereilwe
15:40-15:55	Bovine cysticercosis in Botswana: A call for a One Health Approach	Pfukenyi DM
15:55-15:10	Building Veterinary Capacity in Botswana: A proposal to establish a school of Veterinary Medicine in Botswana	Solomon S Ramabu

15:10-16:25	Analysis of the Effects of Rainfall Variability on Natural Forage Resources and the Corresponding Livestock Production: Climate Variability and Livestock Dynamics in Botswana	Thabo S. Nketsang
16:25-16:40	Effect of feed form on performance and blood profiles of Ross 308 broiler chickens fed algae-based diets	Tlou Grace Manyelo
16:40-16:55	The influence of nutrient addition under different moisture levels on vegetation dynamics in a mesic grassland, South Africa	Yonela Maziko
16:55: 17:00	Closing Remaks from the Chair and RUFORUM Representative	

Building Resilient and Inclusive Agri-Food Systems in the Face of Climate and Economic Shocks

Abstract No: 012 -OP

Agroforestry and household food security: Evidence from Tephrosia Improved fallow adoption at Chulu and Kaluluma extension planning areas in Malawi

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ABSTRACT

Smallholder farming systems in Malawi face chronic food and nutrition insecurity driven by soil degradation, declining fertility, erratic rainfall, and limited access to mineral fertilisers. The Agroforestry Food Security Programme (AFSP) promoted climate-smart options, including Tephrosia improved fallows, in which portions of land are planted to Tephrosia shrubs for several seasons to replenish soil nitrogen and organic matter. Tephrosia (fish poison bean; fumbi lanyama/mtetezga) is a multipurpose nitrogen-fixing legume that supplies biomass for mulch or green manure, fodder, botanical pesticide, and income from seed sales. This study conducted a retrospective assessment of the long-term effects of Tephrosia-improved fallow adoption on household food security in Chulu and Kaluluma Extension Planning Areas, Kasungu District, Malawi. A cross-sectional survey of 336 randomly selected households stratified by adopters (practising Tephrosia improved fallow for 3–4 years and still integrating shrubs with crops) and non-adopters was implemented using a semi-structured questionnaire in KoboCollect. Household food security was measured with the Household Food Insecurity Access Scale (HFIAS) and data were analysed in SPSS using chi-square tests for individual HFIAS items and Mann–Whitney U tests for total scores. Only 2.8% of adopters, compared with 60.8% of non-adopters, often worried about food, and none of the adopters, versus 81.7% of non-adopters, often failed to eat preferred foods. Adopters reported markedly lower frequencies of going to bed hungry. Overall, 28% of adopter households were food secure (HFIAS = 0), whereas 35.7% of non-adopters were severely food insecure (HFIAS 20–25). Mean HFIAS ranks differed strongly between adopters and non-adopters (W = 23 436; p < 0.001), confirming that Tephrosia improved fallows significantly enhance household food security. The study recommends integrating legume-based improved fallows into national soil fertility strategies, strengthening land tenure security and extension support, and embedding long-term impact evaluation in future agroforestry programmes.

Keywords: Agroforestry Food Security Programme, biomass, fertiliser, household food insecurity (access) score, soil fertility, Tephrosia

Where is the missing food? Characterizing food loss and waste along the urban, peri-urban and rural settlement continuum in Zambia

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ABSTRACT

Climate change and rapid urbanisation are reshaping food systems in Zambia, contributing to reduced crop and livestock output, increased in-field losses, rising food waste and deteriorating food safety, particularly among small-scale actors. This study profiled the structure and functioning of the food system along an urban–peri-urban–rural settlement continuum, focusing on Lusaka city and the Chikankata and Chirundu districts of Southern Province. A cross-sectional qualitative design was employed, combining a two-day multi-stakeholder consultative workshop in Lusaka with in-depth interviews of 134 purposively selected food system actors, including producers, transporters, processors, traders and regulators. The food system was found to be dominated by small-scale subsistence producers, distributors and traders, alongside a rapidly expanding network of supermarkets and fast-food outlets in urban and peri-urban areas. This duality has driven a nutritional transition towards ultra-processed, energy-dense, salty and oily foods and high consumption of maize meal (tshima) at the expense of fruits, vegetables and animal-source foods, increasing the risk of non-communicable diseases. Massive food losses and waste were observed at Soweto Market and other hubs for tomatoes, vegetables and fruits due to oversupply, poor handling and limited cold storage or processing capacity. Policy instruments such as FISPI remain heavily maize-focused and do not adequately promote dietary diversity or reduction of loss and waste. Emerging policy directions emphasise agroecology, organic farming, biodiversity conservation, nutrition-sensitive agriculture, biofortified crops and local processing, but implementation is nascent. The study underscores the need for integrated policies that simultaneously address food loss and waste, nutrition, and livelihoods to accelerate food system transformation in Zambia.

Keywords: Food systems, food loss, food waste, Zambia, urban–rural continuum, nutrition, small-scale actors

Benchmarking improved food security, rural incomes and agricultural development among countries: Kenya's lessons from other East African countries

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ABSTRACT

Despite commitments to the Comprehensive Africa Agriculture Development Programme (CAADP), many sub-Saharan African countries, including Kenya, continue to experience severe food and income insecurity. This study benchmarked Kenya's agricultural performance against selected East African neighbours to identify strategies for improving food security, rural incomes, and regional trade. Forty years of FAO data (1980–2020) on production, area, and yield of nine key food crops were analysed for Kenya, Tanzania, Uganda, and other countries, and triangulated with data on agriculture's contribution to GDP. Annual fluctuations in production, area, and yields were primarily driven by weather variability, land availability in suitable agro-ecological zones, and policy-driven enterprise promotion. Production, area, and yields of maize, rice, beans, and potatoes generally increased across countries, while wheat, sorghum, millet, cassava, and cooking banana showed mixed trends. Kenya's average maize production was 3.6 million tonnes, with Tanzania and Uganda reaching 175% and 89% of this level, respectively. Kenya lagged behind its neighbours in rice, cassava, millet, sorghum, beans, and cooking banana, despite higher fertiliser use. Rapid population growth reduced per capita food availability for most crops, except maize and rice in Tanzania and Uganda, and beans. High food imports in Kenya reflected both low domestic production and relatively higher disposable incomes. Similarities in agro-ecology and socio-economic conditions support policy learning: Kenya needs to diversify crop production and diets, strengthen productivity of underutilised staples, and leverage regional integration to enhance food security and rural incomes.

Keywords: Agricultural development, benchmarking, East Africa, Food security, Kenya

Reconfiguring Food Systems and Primitive Capital Accumulation under Neoliberalism in Africa

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ABSTRACT

Africa hosts the highest proportion of hungry people globally, and projections suggest that by 2030 more than half of the world's hungry will reside on the continent. Contemporary drivers of this crisis—climate change, global economic shocks, conflict, and volatile commodity markets—interact with enduring legacies of colonial capitalism, primitive accumulation, and neoliberal restructuring to shape unequal food systems. This study applies an agrarian political economy lens to analyse how historical and current power relations reconfigure production, circulation and consumption within African food systems. A multi-method approach combines historical analysis of land and agrarian change, critical review of policy and trade documents, quantitative analysis of hunger, production, and rural employment using FAO and World Bank datasets, and GIS mapping of spatial inequalities. Case studies from Kenya and Bolivia highlight that agroecological and localised food systems outperform conventional models on environmental sustainability, food security, and social-ecological resilience, particularly when underpinned by participatory governance. The results show that unequal access to land, credit, technology, and markets, especially for women and smallholders, continues to entrench structural inequities despite technological innovations. Food sovereignty and food democracy emerge as transformative paradigms that prioritise local control over food systems, ecological sustainability, and justice-based distribution. The study argues that systemic transformation—not incremental reform—is required, linking agroecological transitions with policies that secure land rights, regulate corporate power, strengthen cooperatives, and institutionalise multi-stakeholder food policy councils. Such a shift is essential for building inclusive, climate-resilient agrarian and food systems in Africa.

Keywords: Africa, agroecology, food sovereignty, food systems, neoliberalism, primitive accumulation

Physicochemical, nutritional and sensory characterisation of seven promising aromatic rice accessions resilient to climate shocks in Benin

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ABSTRACT

The Rice Research Programme of INRAB and AfricaRice has identified seven aromatic rice accessions with promising yield, disease resistance and climate resilience, yet their grain quality attributes remain insufficiently documented for varietal promotion. This study evaluated the physicochemical, nutritional and sensory characteristics of seven aromatic accessions (WAC 11, ARICA 1, ARICA 8, ARA8, ARA9, ABA20, ARA22) compared with a widely grown aromatic control (IR 841). Standard methods were used to determine ash, protein and other physicochemical parameters on white and parboiled rice. A panel of rice farmers assessed sensory quality. Ash content of white rice varied significantly ($P < 0.05$), with ARA22 (0.80%) and ARICA 8 (0.71%) showing the highest values and WAC 11 (0.48%) and IR 841 (0.57%) the lowest. For parboiled rice, ARA22 (0.85%) and WAC 11 (0.89%) had the highest ash contents, while WAC 11 (0.58%) and IR 841 (0.63%) had the lowest. Protein content ranged from 8.10 to 8.88% in white rice and 9.7 to 11.1% in parboiled samples. Several parboiled accessions exhibited high gelatinisation temperatures (74–76°C), similar to IR 841. All accessions showed high homogeneity (>86%) and low uniformity (0.1–10%) in starch distribution, and swelling rates did not differ significantly between white and parboiled samples. Sensory evaluation indicated that cooked white rice of ARA8, ARA9, ARICA 1 and ARICA 8 was preferred by 75% of panelists over IR 841 due to stronger aroma, attractive colour, non-sticky texture and pleasant taste. These accessions can therefore be promoted as climate-resilient aromatic varieties with favourable post-harvest quality.

Keywords: Aromatic rice, climate resilience, grain quality, sensory evaluation, Benin

Wonder multistorey gardens: Strengthening urban food systems and advancing nutrition security in Nairobi, Kenya

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ABSTRACT

Rapid urbanisation in sub-Saharan Africa is intensifying pressure on food systems and heightening risks of food and nutrition insecurity, particularly for low-income households that depend on purchased food. In Nairobi, Kenya, fruit and vegetable consumption remains far below World Health Organization recommendations, contributing to micronutrient deficiencies and diet-related non-communicable diseases. Conventional urban farming is constrained by land scarcity, tenure insecurity and high input costs. Wonder Multistorey Gardens (WMSGs) are low-cost vertical gardens constructed from stacked rings filled with soil, each accommodating 100–130 plants and yielding up to 9 kg of vegetables per week on very small plots. This study analysed determinants of WMSG adoption and associated welfare and food security effects in Nairobi. A reconnaissance survey identified 424 urban farming households, from which 147 (116 adopters and 31 non-adopters) were sampled using Nassiuma's formula. Data were collected between October 2021 and December 2022 through structured questionnaires, key informant interviews, field observations and online surveys. Food security was assessed using the Household Food Insecurity Access Scale, and logistic regression and treatment-effects models were applied to identify adoption drivers and welfare impacts. Adopters were typically younger, better educated and more entrepreneurial, farmed on plots <0.25 acres, and were more likely to have accessed agricultural information. Land tenure, land size and use, monthly income and information access significantly influenced adoption. WMSG adoption substantially reduced food insecurity, improved dietary diversity and generated modest income from surplus sales; 97% of adopters reported improved household welfare. These results support scaling WMSGs as a scalable, nutrition-sensitive technology for building resilient, space-efficient urban food systems.

Keywords: Farming, household welfare, nutrition security, space-efficient, Urban agriculture, vertical gardens

Coastal preferences for mangrove forest utilization in Ambanja District, Madagascar

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ABSTRACT

Mangrove forests provide critical ecosystem services, including biodiversity conservation, coastal protection, carbon sequestration and support to fisheries-based livelihoods. Madagascar hosts Africa's fourth-largest mangrove area, yet these ecosystems are rapidly degrading under pressure from charcoal production, wood extraction and agricultural expansion. In Ambanja District, overexploitation has generated conflicts between charcoal producers and fishers and threatens both biodiversity and food security. This study analysed coastal communities' preferences for mangrove forest utilisation to inform more sustainable management strategies. Data were collected from 384 coastal residents using structured, face-to-face questionnaires. A discrete choice experiment captured preferences for mangrove attributes: biodiversity, natural landscape coverage, tree-use patterns, ecological security and an ecosystem conservation trust fund. Responses were analysed using descriptive statistics and a conditional logit model in R. All attributes significantly influenced individual choices. Biodiversity conservation emerged as the most preferred attribute, followed closely by maintenance of natural landscape coverage, while more intensive tree-use patterns and lower ecological security levels were negatively valued. As expected, the trust fund contribution had a negative coefficient, implying that higher payment levels reduced programme attractiveness. The findings indicate strong local support for conservation-oriented schemes that prioritise biodiversity and landscape protection, provided that financing mechanisms reflect the population's limited ability to pay and involve communities in decision-making. The study recommends that public policies promote participatory mangrove management, strengthen local institutions and design incentive-compatible financing tools to curb unsustainable exploitation while sustaining coastal livelihoods.

Keywords: Coastal communities, discrete choice experiment, ecosystem services, Madagascar, Mangrove forests

Seedling Survival and Plantation Success in the Drylands of Northern Ethiopia

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ABSTRACT

Large-scale tree planting under Ethiopia's Growth and Transformation Plan I (GTP I; 2011–2015) has been widely promoted as a dryland restoration strategy, yet plantation success and seedling survival remain poorly quantified. This study assessed survival rates of planted seedlings and the effectiveness of plantation interventions in the drylands of Northern Ethiopia. Six districts in Tigray representing highland, midland and lowland agro-ecologies were randomly selected, and biophysical surveys were conducted across multiple plantation sites. Primary data on seedling survival, species composition, site conditions and management practices were complemented with secondary data on plantation targets and implementation. Seedling survival varied significantly (P < 0.05) among plantations within villages, between villages and across districts, with a regional mean survival rate of only 53%. Low success was attributed to moisture stress, poor soil and site conditions, limited watering, lack of pre- and post-planting management, planting unmanageable numbers of seedlings, weak law enforcement and inadequate monitoring and evaluation. Four ownership types were identified: private, communal, state and youth groups. Private plantations exhibited the highest survival rates, whereas communal plantations performed worst, reflecting differences in responsibility and incentive structures. The results highlight that simply increasing planting targets is insufficient; success depends on careful site selection, realistic stocking rates, sustained management and clear ownership arrangements. Strengthening watering regimes, employing guards, and improving community-based management and accountability are essential to sustain dryland plantation development and achieve intended restoration benefits.

Keywords: Drylands, Ethiopia, manageent, ownership, plantation success, seedling survival

Enhancing Forage Production and Mitigating Greenhouse Gas Emissions through Bioslurry Fertilisation

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ABSTRACT

Low forage productivity and poor feed quality constrain livestock production in sub-Saharan Africa, while synthetic fertiliser use and manure mismanagement contribute to greenhouse gas (GHG) emissions. Bioslurry, a co-product of anaerobic digestion, offers a circular-economy alternative to mineral fertiliser and farmyard manure (FYM), yet field-based evidence from tropical livestock systems remains limited. This study evaluated the effects of bioslurry fertilisation on Napier grass yield, forage quality and soil GHG emissions. A field experiment was conducted at ILRI, Nairobi, in a randomised complete block design with six treatments: bioslurry (BS), FYM, NPK, 50% BS + 50% NPK, 50% FYM + 50% NPK and an unfertilised control, all applied at 100 kg N ha^{-1} (total N basis) and replicated four times. Biomass yield, forage quality traits, soil moisture and GHG fluxes (CO_2, CH_4, N_2O) were monitored from April to October 2024. Dry matter yields ranged from 2.27 t ha$^-$ (control) to 3.84 t ha^{-1} (BS + NPK), with BS and FYM yielding 3.38 and 2.95 t ha$^-$, respectively. The BS + NPK treatment increased yields by 52% at the second harvest despite below-average rainfall and improved soil moisture, crude protein (16.95%) and C:N ratio (14.71). Sole BS produced the highest N_2O (4.84 kg N ha^{-1}) and CH_4 emissions and the greatest global warming potential, whereas BS + NPK lowered N_2O (1.96 kg N ha^{-1}), acted as a CH_4 sink and reduced yield-scaled GWP. Combining bioslurry with NPK thus optimises forage yield and quality while mitigating GHG emissions, providing a more sustainable fertilisation strategy than sole bioslurry in smallholder systems.

Keywords: Bioslurry, circular economy, forage production, greenhouse gas emissions, Napier grass

Modifying Ruminal Fermentation to Mitigate Enteric Methane Generation in Goats Using Saponin- and Tannin-Rich Plant Sources: A Meta-Analysis

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ABSTRACT

Saponin- and tannin-rich plant sources are increasingly investigated as natural strategies to modulate rumen fermentation and reduce enteric methane (CH_4) emissions in small ruminants, yet evidence is scattered and sometimes conflicting. This meta-analysis synthesised data from 32 studies on goats to quantify the effects of such plants on dry matter intake, fermentation characteristics, rumen microbial populations and CH_4 production. Standardised mean differences (SMD) and 95% confidence intervals (CI) were estimated using a random-effects model in OpenMEE. Supplementation with saponin- and tannin-rich plants significantly increased propionate (SMD = 0.71; CI 0.21–1.21) and decreased the acetate:propionate ratio (SMD = 0.98; CI 1.57 to 0.38), indicating a shift toward more glucogenic fermentation. Pooled results showed significant reductions in rumen ammonia-N (SMD = 1.34; CI 1.86 to 0.83), protozoa populations (SMD = 1.08; CI 1.95 to 0.22) and enteric CH_4 emissions (SMD = 0.84; CI 1.16 to 0.51), without adverse effects on dry matter intake. Subgroup analyses revealed that higher inclusion levels (>30%) increased acetate and bacterial populations while further reducing ammonia-N and protozoa, and that feeding duration, animal sex and specific phytochemical profiles were important moderators of response. Meta-regression confirmed linear relationships between inclusion level and total volatile fatty acids, ammonia-N, bacterial counts and CH_4 output. Overall, saponin- and tannin-rich plant supplements can improve rumen fermentation efficiency and substantially mitigate enteric CH_4 in goats, provided that inclusion levels and feeding strategies are carefully managed.

Keywords: Goats, methane mitigation, phytochemicals, rumen fermentation, saponins, tannins

Effect of biochar, canola oil, and garlic on in vitro digestibility, volatile fatty acids, and total gas production in selected dairy cattle feeds

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ABSTRACT

Biochar, canola oil, and garlic are natural feed additives with the potential to enhance rumen fermentation and feed efficiency in dairy systems, offering low-cost alternatives to synthetic rumen modifiers that are often inaccessible to smallholder farmers in sub-Saharan Africa. This study evaluated the effects of these additives on in vitro digestibility, volatile fatty acids, and total gas production of hay, commercial dairy meal, and a total mixed ration (TMR). Each feed type was ground and mixed with biochar, canola oil, or garlic at 0, 1, and 2% of dry matter, and incubated using the in vitro gas production technique. Cumulative gas production at 24 and 48 h, organic matter digestibility (OMD), and short-chain fatty acid (SCFA) production were measured and compared with the 0% controls. Garlic at 2% was the most consistent additive across feeds. In TMR, 2% garlic slightly reduced gas production at 24 and 48 h but increased OMD and SCFA concentration. In dairy meal, 2% garlic yielded the highest OMD (98%) and SCFA production compared with the control, whereas effects in hay were modest, with low OMD but increased gas production. Biochar and canola oil also improved digestibility and influenced SCFA profiles, although their responses were less consistent than those of garlic. Overall, strategic inclusion of garlic, canola oil or biochar can improve in vitro feed utilisation, indicating promise for sustainable, natural feed additives in smallholder dairy production.

Keywords: Feed efficiency, in vitro digestibility, Natural feed additives, sustainable livestock production, volatile fatty acids

Phytochemical Profiling, Antioxidant and Androgenic Effects of Multi-Solvent Extracts of Ziziphus mucronata on Mouse TM3 Leydig Cells

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ABSTRACT

Male infertility is an increasing health concern in many low and middle income countries, yet affordable, effective therapies remain limited. Ziziphus mucronata is a widely used medicinal plant in southern Africa, but its androgenic potential has not been fully characterised. This study evaluated the phytochemical composition, antioxidant capacity and androgenic activity of Z. mucronata leaf extracts prepared with different solvents using mouse TM3 Leydig cells as an in vitro model. Quantitative assays were used to determine total phenolic, flavonoid and proanthocyanidin contents, while antioxidant activity was assessed by DPPH, ABTS and ferric reducing antioxidant power (FRAP) assays. UPLC Q TOF MS was employed to profile bioactive metabolites. Cytotoxicity was evaluated using the CellTiter Blue assay, and testosterone production was quantified by ELISA in the presence of human chorionic gonadotropin (hCG). Methanolic extracts exhibited the highest total phenolic content (173.04 ± 2.23 mg GAE g^{-1}) and strongest antioxidant activity (ABTS 0.48 ± 0.00 µmol TE g^{-1}; DPPH 1293.87 ± 2.02 µmol TE g^{-1}; FRAP 0.49 ± 0.00 µmol TE g^{-1}), while ethanolic and acetone extracts were richest in flavonoids (245.52 ± 5.87 mg QE g^{-1}) and proanthocyanidins (173.02 ± 0.50 mg CE g^{-1}), respectively. Ten bioactive compounds were identified in the methanolic extract. Aqueous extracts were non cytotoxic and, together with organic extracts, enhanced testosterone secretion by TM3 cells in the presence of hCG. These findings indicate that Z. mucronata leaf extracts possess strong antioxidant and androgenic properties, supporting their potential as a natural remedy for male reproductive dysfunction, pending further in vivo efficacy and safety studies.

Keywords: Androgenic properties, antioxidant activity, medicinal plants, phytochemicals, TM3 Leydig cells, Ziziphus mucronata

Sero-Epidemiology and Risk Factors of Foot and Mouth Disease in the Eastern Regions of the Democratic Republic of the Congo

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ABSTRACT

The eastern Democratic Republic of the Congo (DRC) supports an important pastoral economy in heterogeneous agro ecological zones, yet cattle productivity is severely constrained by endemic foot and mouth disease (FMD). This study characterised FMD sero epidemiology, spatial patterns and risk factors in South Kivu and Tanganyika provinces. A total of 406 cattle keepers were surveyed using a structured questionnaire administered via KoboCollect, and clinical observations were recorded while animal samples were collected for laboratory analyses. Herds graze predominantly on communal pastures near forests and scrubland, and herd sizes are declining, with 61% of losses attributable to mortality, largely from infectious diseases. FMD outbreaks peak in July–August across most sites and in October in mountainous Kivu. Seroprevalence was highest in the Ruzizi plain (80%) and Lwanika (70%), followed by Fizi and Malia (60%), and lower in mountainous Kivu (50%), Kichanga (40%) and Kisondja (27%). Serotyping revealed predominance of serotype A in the Fizi region and Ruzizi plain in South Kivu and SAT 2 in the Kichanga–Tabac axis of Tanganyika. Multivariate analysis identified introduction of animals from other herds and frequent contact with neighbouring livestock as primary risk factors, compounded by seasonal transhumance toward forested rangelands and cross border animal movements. These findings confirm that FMD remains endemic in eastern DRC and underscore the need for regionally coordinated control strategies focused on movement management, targeted vaccination and strengthened surveillance at communal grazing areas and transboundary corridors.

Keywords: Cattle, seroprevalence, serotyping, foot and mouth disease, risk factors, DR Congo

New approaches in the development of diluents for gamete preservation in African cattle breeds

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ABSTRACT

Conventional bovine semen extenders are typically developed through empirical, trial and error optimisation, a process that is resource intensive and poorly suited to exploring complex interactions among medium components. This study evaluated the potential of combining experimental approaches with computational modelling to design bovine semen diluents with improved cryoprotective capacity for African cattle breeds. A dataset of extender compositions and corresponding post thaw sperm quality parameters was compiled from published literature and internal experimental records. Response surface methodology was used to identify key diluent components and concentration ranges most strongly associated with post thaw motility. Artificial neural network models were then trained to predict formulations that maximise cryosurvival while minimising component redundancy. Five top candidate formulations were selected and validated against a commercial egg yolk–based control using semen from three Tuli bulls (n = 12 ejaculates). Feature analysis highlighted buffers, sugars, cryoprotectants, membrane stabilisers and antioxidants as the most influential ingredient classes. Predicted total motility of the optimised extenders ($45.4 \pm 5.29\%$) exceeded experimentally observed post thaw motility ($34.7 \pm 3.52\%$), although, in validation trials, post thaw performance of the new formulations was statistically comparable to the commercial control. These findings demonstrate the feasibility of integrating machine learning with targeted experimentation to accelerate development of semen extenders, reduce experimental runs and improve the efficiency of cryopreservation protocols for African cattle genetic resources.

Keywords: Cattle, cryopreservation, machine learning, media design, semen diluents

Artificial intelligence for farm-level decision support: A synthesis of emerging innovations, challenges and policy imperatives in Kenya

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ABSTRACT

Agriculture remains central to Kenya's economy, contributing about one-third of GDP and over 40% of national employment, yet smallholder production is increasingly challenged by climate variability, pest and disease outbreaks and limited extension support. This study synthesises emerging applications of artificial intelligence (AI) for farm level decision support in Kenya, examining their impacts, enabling conditions and policy implications. A structured qualitative synthesis was conducted of project reports, scholarly articles, policy briefs and case studies from government programmes and agri tech start ups. Thematic analysis grouped evidence on AI-enabled predictive tools, computer vision diagnostics, digital financial services, market platforms and advisory chatbots. The review reveals a dynamic ecosystem of AI applications: platforms such as the Kenya Agricultural Observatory Platform (KAOP) and Uliza WI provide location specific weather and climate risk advisories; PlantVillage/Nuru uses smartphone based image recognition for pest and disease diagnosis; Apollo Agriculture and Pula Advisors apply machine learning and remote sensing for credit scoring and index insurance; M shamba and related tools link farmers to markets and post harvest services, while chatbots such as Shamba Salama and Farmer Chat deliver tailored agronomic advice in local languages. Reported outcomes include yield increases of up to 40%, reduced losses, improved risk management and enhanced incomes for early adopters. Kenya's enabling environment—national AI strategy, digital public infrastructure and supportive policy initiatives—has been critical, as have participatory, human centred design approaches that embed technologies in existing social networks. Key challenges include the digital divide, data governance and privacy concerns, algorithmic bias and risks of techno solutionism. The study outlines a policy roadmap prioritising robust data governance, targeted digital literacy, inclusive co design and balanced public–private partnerships to ensure that AI becomes a tool for inclusive, climate resilient agricultural transformation rather than a driver of new inequalities.

Keywords: Artificial intelligence, decision support, digital technologies, Kenya smallholder agriculture

Sustainable Fish Farming through Old Jerrycan Pond Innovation: A Youth-Led Model for Aquaculture in Uganda

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ABSTRACT

Plastic waste accumulation, limited access to conventional aquaculture infrastructure and high youth unemployment constrain the expansion of small scale fish farming in Uganda. This youth led initiative developed an innovative, low cost model that repurposes discarded plastic jerrycans into modular fish ponds, thereby simultaneously addressing environmental pollution, livelihood creation and local food security. Old jerrycans are cleaned, cut and assembled into reinforced tank structures capable of holding water and rearing tilapia and catfish at household or micro enterprise scale. The system is highly space efficient and can be installed in backyards or dense urban settings, enabling entry into aquaculture for land and capital constrained youth and low income households. Start up costs are substantially lower than for conventional earthen ponds or lined tanks, and the modular design allows incremental scaling as skills and resources grow. Early implementation by "Farm with Mr. Ojuka" in Gulu has generated strong interest from community members and local farmers and has created opportunities for peer to peer training in basic aquaculture, water quality management and entrepreneurship. The model contributes to climate resilience by diverting plastic from open dumping and burning, enhancing local fish supply and offering diversified income sources for unemployed youth. The initiative calls for partnerships with research institutions and development agencies to refine technical aspects, assess productivity and biosecurity, and support replication of jerrycan based fish farming as a scalable, youth driven innovation within Uganda's evolving food system.

Keywords: Aquaculture, circular economy, food security, jerrycan ponds, youth innovation

Vulnerability of Small-Scale Fishers' Livelihoods to Climate Change in Binga, Zimbabwe

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ABSTRACT

Climate change is intensifying risks in inland fisheries through increasingly erratic weather, rising temperatures and more frequent extreme events, threatening both livelihoods and food security. This study assessed the livelihood vulnerability of small-scale fishers to climate change in Binga District, Zimbabwe, and identified key determinants of vulnerability to inform adaptation strategies. Simple random sampling was used to select 104 fishers, and structured household interviews were conducted using Kobo Toolbox. The Livelihood Vulnerability Index (LVI) was computed to integrate exposure, sensitivity and adaptive capacity indicators, while Ordinary Least Squares regression and Principal Component Analysis were applied to identify drivers of vulnerability. Results showed that fishers exhibit low adaptive capacity combined with high exposure and sensitivity, with limited access to productive resources, health services and secure food supplies emerging as major risk factors. Socio demographic characteristics, food availability and livelihood diversification indicators significantly influenced LVI scores, underscoring the central role of both household attributes and resource endowments. Overall, Binga's small-scale fishers were found to be extremely vulnerable to climate change because of constrained opportunities to diversify income, weak access to finance and health care, and high dependence on the Zambezi fishery. The study recommends improving access to resources and financial services, promoting diversified livelihood portfolios, strengthening technical and extension support and fostering multi stakeholder partnerships to co design locally relevant adaptation pathways for climate resilient small-scale fisheries.

Keywords: Climate change, fisheries, livelihoods, small-scale fishers, vulnerability

Rainwater Harvesting Simulation Models and Their Implications for Groundwater Resources in Africa: A Systematic Review

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ABSTRACT

Nearly 75% of Africa's population relies on groundwater for domestic and agricultural use, yet increasing climate variability and rising water demand threaten long term groundwater security. Rainwater harvesting (RWH) can reduce pressure on conventional sources and enhance groundwater recharge, but the performance and suitability of available simulation models for African contexts are poorly synthesised. This systematic review, following PRISMA guidelines, analysed 30 studies (2009–2025) from 16 African countries that applied RWH models with explicit implications for groundwater. Models were classified by scale, category, data requirements, computational demand and reporting of groundwater outcomes. Approaches included knowledge driven GIS–multi criteria decision analysis, conceptual rainfall–runoff models (e.g. Australian Water Balance Model), physically based and semi distributed models (HEC HMS, HEC RAS, WetSpass M, SEAWAT), process based models (SWAT, MODFLOW, ModelMuse, GMS, Hydrognomon), event based models (HyfranPlus, EPA SWMM) and empirical tools (ArcSDM, statistical regressions, CROPWAT, Hazen). Around 70% of studies performed calibration and validation and produced quantitative groundwater estimates, demonstrating applicability in data scarce settings, but none reported formal uncertainty or sensitivity analyses, limiting cross study comparability. Data needs ranged from low to high, and computational demand from low to moderate, reflecting heterogeneity in transferability and resource requirements. Overall, RWH simulation models show strong potential to inform groundwater recharge interventions under climate stress, but future work should harmonise performance metrics, standardise calibration datasets, incorporate uncertainty analysis and better integrate socio economic and environmental drivers to support robust, context specific groundwater planning.

Keywords: Africa, groundwater, modelling, PRISMA, rainwater harvesting

Ivermectin Use in Livestock: Environmental Persistence, Impacts on Dung Beetles and Ecosystem Services, and Pathways toward Sustainable Alternatives

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ABSTRACT

Livestock enterprises provide critical livelihood buffers in climate vulnerable mixed farming systems, but intensifying parasite pressure has driven heavy reliance on anthelmintics such as ivermectin. While highly effective against gastrointestinal parasites, ivermectin is environmentally persistent and excreted largely unmetabolised, adversely affecting non target dung dwelling organisms and associated ecosystem services. This systematic review synthesised evidence on ivermectin persistence, its impacts on dung beetles and other soil biota, and implications for ecosystem functioning. Over 300 publications were screened and 200 studies retained based on predefined inclusion criteria. Ivermectin was consistently more efficacious (>90%) than most alternative anthelmintics and has been widely adopted since its commercialisation in 1981, with 46 countries adopting within five years. Measured residue concentrations reached 0.81 mg kg^{-1} in dung, 0.085 mg kg^{-1} (dry weight) in soil and 1.24 ng L^{-1} in aquatic systems. Lethal effects on dung beetles varied by species, with mortality up to 94.1% in Copris acutidens, while sublethal effects included impaired reproduction, altered life-history traits and population declines. These changes translate into reduced dung removal, nutrient cycling and secondary seed dispersal, with potential cascading effects on pasture productivity and biodiversity. The review highlights the need to transition toward more sustainable, plant based parasite control integrated within One Health approaches, and calls for further research on cumulative impacts, interactions with co stressors and context appropriate mitigation strategies to safeguard dung beetle diversity and ecosystem services.

Keywords: Dung beetles, ecological services, gastrointestinal parasites, Ivermectin, persistence, one Health

Characterization and evaluation of Platypleura haglundi Cicadas as a feed protein source for commercial broiler chicken production under smallholder conditions

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ABSTRACT

Conventional protein ingredients for broiler diets, particularly soybean meal, are increasingly expensive and inaccessible to smallholder farmers, constraining poultry productivity. This study characterised sun dried cicadas (Platypleura haglundi) and evaluated their suitability as an alternative protein source in broiler diets under smallholder conditions in Mudzi District, Zimbabwe. Cicada meal was analysed for proximate composition and amino acid profile, while white maize and white sorghum provided dietary energy. Soybeans were roasted at 110 C for 15 min and cicadas at 85 C for 12 min to reduce anti-nutritional factors and microbial load, before milling and diet formulation. Four diets containing 0% (control), 5%, 15% and 20% cicada meal were fed to 120 day-old Cobb500 chicks randomly allocated to treatments (three replicates) for six weeks. Growth performance, weekly body weight, feed intake and feed conversion ratio (FCR) were recorded and analysed using ANOVA (GenStat 18) with Fisher's LSD at 5% significance. Cicada meal was nutrient-dense (57.0% crude protein, 14.3% fat) and rich in essential amino acids such as lysine (3.17 g/100 g) and methionine (1.42 g/100 g). Final live weights at day 42 were 1473, 1249, 1636 and 1804 g for the 0%, 5%, 15% and 20% diets, respectively, with significantly improved FCR at 20% inclusion (1.98). Results demonstrate that cicada meal can partially substitute soybean meal at 15–20% inclusion without compromising performance, offering a viable, local protein option for smallholder broiler systems.

Keywords: Alternative protein, broiler production, feed efficiency, insects, smallholder farming

Genome-Wide Association Study of Seropositivity to Babesia bigemina, Babesia bovis and Ehrlichia ruminantium in Cattle

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ABSTRACT

Tick-borne pathogens are a major constraint to cattle productivity and welfare in communal production systems, yet host genetic resistance remains underexploited. This study identified genomic regions associated with seropositivity to Babesia bovis, Babesia bigemina and Ehrlichia ruminantium in apparently healthy cattle from six villages in the Bela-Bela Municipality, South Africa. A total of 145 animals were sampled at communal dip tanks, and sera were screened for antibodies using the indirect immunofluorescence assay. Genomic DNA was extracted from whole blood and genotyped with the Illumina Bovine 1000K SNP BeadChip. Population structure was assessed by principal component analysis, and runs of homozygosity were used to infer inbreeding. Genome-wide association analyses were performed to detect SNPs and candidate genes associated with seropositivity to each pathogen. PCA revealed no marked genetic stratification among local breeds, except for the Simmental, which formed a distinct cluster. Extensive runs of homozygosity indicated relatively high inbreeding and shared ancestry in the sampled population. Several genes showed significant associations with seropositivity, including PFKL, SERP1, RAC2, SIRT3, CHST11, MARCHF1, DDX56, SHPRH, PLXNA1, IFNGR2, LRRIQ1 and MARF1. These genes are involved in immune response, stress adaptation and key cellular pathways such as glycolysis, apoptosis regulation, cytoskeleton organisation, oxidative stress mitigation, antiviral defence and DNA repair. The findings highlight the potential for genomic selection and targeted breeding to enhance resistance to tick-borne pathogens and improve cattle productivity in smallholder systems.

Keywords: Genes, GWAS, serology, tick-borne pathogens

Morphometric Traits and structural indices of small East African Zebu and its crosses with tyrolean grey cattle under on station conditions in Uganda

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ABSTRACT

The Tyrolean Grey (TG) cattle breed from Austria was introduced into Uganda in 2009 for crossbreeding with the indigenous Small East African Zebu (SEAZ) to improve productivity while retaining adaptation to local conditions. This study characterised SEAZ and TG SEAZ crossbreds (TGZ) using linear body measurements and derived structural indices under on station conditions at Aswa Ranch and Lusenke Stock Farm, with the aim of informing breeding and production strategies. Morphometric data were collected from 214 randomly sampled animals. Associations between location and traits were examined using tests; genotype comparisons used independent samples t tests for normally distributed traits and Mann–Whitney U tests otherwise. TGZ cattle had significantly greater chest girth (p = 0.012), head length (p = 0.004), height at withers (p = 0.017) and body length (p = 0.023) than SEAZ, indicating a larger skeletal frame and enhanced thoracic development favourable for meat production and metabolic efficiency. In contrast, SEAZ exhibited a higher Height Index (65.41 ± 1.77 vs 53.55 ± 1.67; Z = 3.974, p < 0.001) and Balance Index (0.64 ± 0.026 vs 0.54 ± 0.022; Z = 3.475, p = 0.001), reflecting more proportionate body conformation and greater relative leg length, traits advantageous for mobility and endurance in extensive systems. Structural variation between locations suggested influence of environmental conditions, feed resources and management practices. Animals at Lusenke, with superior chest and body dimensions, appear well suited to commercial beef production, feedlot finishing and genetic improvement programmes targeting growth traits, whereas Aswa Ranch animals, being taller and more balanced with longer rumps, are better adapted to long distance grazing in harsher environments. These results highlight the importance of matching genotype–phenotype combinations to production environments when designing crossbreeding and selection programmes.

Keywords: Characterisation, genotype, morphometrics, structural indices, Tyrolean Grey, Zube

Nixtamalization of white and yellow maize: Effects on nutrition and acceptability of traditional staples

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ABSTRACT

Maize, particularly white maize, is a staple in Southern Africa, where pap prepared from refined commercial meal is consumed daily. However, reliance on unfortified pap contributes to protein and micronutrient deficiencies, exacerbated by phytic acid induced mineral malabsorption and limited safe grain to meal processing at household level. Nixtamalization—a traditional alkaline processing technique widely used in Latin America—can enhance mineral availability, improve digestibility and flavour, and reduce aflatoxins, yet remains largely unfamiliar in sub Saharan Africa. This study evaluated the effects of nixtamalization on the nutritional composition of white and yellow maize flour and the sensory acceptability of three traditional wheat based products—vetkoek, dumplings and steamed bread—partially substituted with nixtamalized maize. Composite flours containing 0, 15 and 25% nixtamalized white or yellow maize were formulated. Proximate and mineral analyses showed that nixtamalization increased calcium content approximately fivefold and significantly raised magnesium and potassium levels ($p < 0.05$). Yellow maize flour had higher crude protein, neutral detergent fibre and acid detergent fibre than white maize. Consumer acceptability was assessed with a 100 member panel (18–65 years) using a 5 point Just About Right (JAR) scale. Products with 25% nixtamalized yellow maize were preferred over 15% and white maize analogues; vetkoek with 25% yellow flour achieved the highest acceptance. Its aroma and exterior appearance were rated JAR by >75% of panellists, though taste was perceived as slightly too bland (mean JAR drop >1); overall liking was 6.86 ("slight liking"). Nixtamalization thus offers a practical, kitchen scale processing method to improve mineral density and diversify maize based foods, with potential to support household nutrition, micro enterprise development and inclusive, climate smart agri food value chains.

Keywords: Agri-food systems, food and nutrition security, nixtamalization, staple food innovation, sensory acceptability

Knowledge, Attitudes and Practices Regarding Antibiotic Use and Residues among Smallholder Dairy Producers in Mbala and Kasama Districts, Zambia

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ABSTRACT

Smallholder dairy producers supply at least half of Zambia's milk, yet indiscriminate antimicrobial use may contribute to antibiotic residues in milk and antimicrobial resistance (AMR). This cross sectional study assessed knowledge, attitudes and practices (KAP) regarding antibiotic use and residues among smallholder dairy farmers in Mbala and Kasama districts, Northern Province. From a sampling frame of 109 farmers, 101 were randomly selected (59 Kasama, 42 Mbala). A semi structured questionnaire, administered via KoboToolbox in English, Bemba and Mambwe, captured socio demographics, antibiotic use, awareness of withdrawal periods and residue risks. Data were analysed in Stata using descriptive statistics, KAP scoring (70% = "good"), χ^2 tests, Pearson correlations and multivariable linear regression. Overall, farmers exhibited poor knowledge, negative attitudes and poor practices regarding antibiotic use and residues in both districts, with all composite scores below 70% and no significant differences between sites. Approximately 36.6% of respondents did not know what antibiotics are, 60.6% were unaware of withdrawal periods and only 49.5% knew how to determine them. In Mbala, strong positive correlations were observed between knowledge and attitude, knowledge and practice, and attitude and practice, indicating that improved knowledge could leverage behaviour change. Lower education level (none/primary) and age 30–50 years were significantly associated with poorer KAP. Risky practices were widespread: 100% never screened milk for residues; 79.2% kept no treatment records; 68.3% self administered antimicrobials; 30.1% used antibiotics prophylactically; 21.8% ignored withdrawal periods; and 17.8% used antibiotics to boost production. Commonly used drugs included oxytetracycline, sulphonamides and β lactams sourced from agro vets, veterinary staff, fellow farmers and pharmacies. Despite 85.2% attending disease control trainings, key messages on prudent use appear poorly translated into practice. The study highlights urgent needs for stronger regulation, residue monitoring, farmer centred stewardship programmes and cost effective rapid residue tests to protect public health within a One Health framework.

Keywords: Antibiotic residues, antimicrobials, knowledge–attitude–practice, milk, One Health

Knowledge, attitudes and practices regarding antibiotic use and residues among smallholder dairy producers in Mbala and Kasama Districts, Zambia

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ABSTRACT

Smallholder dairy producers supply at least half of Zambia's milk, yet indiscriminate antimicrobial use may contribute to antibiotic residues in milk and antimicrobial resistance (AMR). This cross sectional study assessed knowledge, attitudes and practices (KAP) regarding antibiotic use and residues among smallholder dairy farmers in Mbala and Kasama districts, Northern Province. From a sampling frame of 109 farmers, 101 were randomly selected (59 Kasama, 42 Mbala). A semi structured questionnaire, administered via KoboToolbox in English, Bemba and Mambwe, captured socio demographics, antibiotic use, awareness of withdrawal periods and residue risks. Data were analysed in Stata using descriptive statistics, KAP scoring (70% = "good"), χ^2 tests, Pearson correlations and multivariable linear regression. Overall, farmers exhibited poor knowledge, negative attitudes and poor practices regarding antibiotic use and residues in both districts, with all composite scores below 70% and no significant differences between sites. Approximately 36.6% of respondents did not know what antibiotics are, 60.6% were unaware of withdrawal periods and only 49.5% knew how to determine them. In Mbala, strong positive correlations were observed between knowledge and attitude, knowledge and practice, and attitude and practice, indicating that improved knowledge could leverage behaviour change. Lower education level (none/primary) and age 30–50 years were significantly associated with poorer KAP. Risky practices were widespread: 100% never screened milk for residues; 79.2% kept no treatment records; 68.3% self administered antimicrobials; 30.1% used antibiotics prophylactically; 21.8% ignored withdrawal periods; and 17.8% used antibiotics to boost production. Commonly used drugs included oxytetracycline, sulphonamides and β lactams sourced from agro vets, veterinary staff, fellow farmers and pharmacies. Despite 85.2% attending disease control trainings, key messages on prudent use appear poorly translated into practice. The study highlights urgent needs for stronger regulation, residue monitoring, farmer centred stewardship programmes and cost effective rapid residue tests to protect public health within a One Health framework.

Keywords: Antibiotic residues, antimicrobials, knowledge–attitude–practice, milk, One Health

Plant Microbiomes as unexplored African heritages: Endophytic Bacteria from Brachiaria Grass as tools for Climate Resilient Agriculture

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ABSTRACT

Endophytes—microorganisms that inhabit plant tissues without causing disease—are increasingly recognised as key allies for sustainable, climate resilient agriculture. Brachiaria (syn. Urochloa), a tropical C_4 forage widely promoted in Africa for its drought tolerance and soil restoring capacity, hosts diverse bacterial endophytes that remain largely unexplored. This study characterised culturable endophytic bacteria associated with Brachiaria ecotypes and germplasm collections from diverse Ethiopian agro ecologies processed at the BecA–ILRI Hub, and evaluated their plant growth promoting traits. From 56 samples (seeds, roots, stems and leaves), 215 bacterial isolates were obtained and assigned to three phyla, five classes, 13 families and 34 genera. Dominant genera included Pseudomonas, Pantoea and Rahnella, with additional taxa such as Brevibacterium, Paenibacillus, Serratia and Curtobacterium reflecting ecological specialisation across tissues and ecotypes. Functional screening revealed that 56% of isolates produced indole 3 acetic acid, 38% solubilised inorganic phosphate, 64% produced siderophores and 33.5% expressed ACC deaminase activity. Several isolates suppressed Aspergillus flavus, indicating potential to reduce aflatoxin risk. Notably, 55 isolates combined at least four growth promoting and protective traits, highlighting their multifunctionality. The coexistence of ubiquitous "core" genera and ecotype specific taxa supports a holobiont view of Brachiaria, in which plant performance emerges from plant–microbe interactions. These endophytes constitute an important microbial heritage with direct applications as biofertilisers and bioprotectants to reduce reliance on synthetic agrochemicals, improve nutrient cycling and enhance stress tolerance in forage based systems. Establishing regional culture collections, advancing consortia development and integrating endophyte based inoculants into climate smart forage programmes could transform Brachiaria into a platform for microbial innovation in African agri food systems.

Keywords: Bacterial endophytes, biofertilisers, Brachiaria grass, climate-smart agriculture, Plant microbiomes

Assessment of Small stock management practices and farmers' willingness to adopt new feed innovations in Central District, Botswana

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ABSTRACT

Small stock (goats and sheep) are critical to rural livelihoods, food security and climate resilience in Botswana, yet production is constrained by dry season feed shortages and limited adoption of improved feeding strategies. This study characterised current small stock management and supplementary feeding practices and assessed farmers' willingness to adopt novel feed innovations, including insect based proteins, in Central District, Botswana. A structured survey was administered to small stock farmers, capturing herd sizes, management systems, feed resources, fodder production and interest in training. Herd size ranged from 14 to 80 goats per household, with an average of 36. All respondents (100%) practiced free range systems and reported providing dry season supplements, primarily Lablab purpureus, maize residues and melons. Fodder production was universal, yet highly specialised: all farmers grew lablab, and only 1% additionally cultivated forage sorghum, indicating low diversification of fodder species. Although farmers recognised the importance of supplementation, resource constraints, limited knowledge and weak extension services hindered adoption of more intensive or innovative feeds. Respondents expressed strong interest in capacity building on fodder cultivation and insect based feed production, and indicated willingness to adopt new practices if training, technical backstopping and start up support were available. The findings underscore the need for targeted, locally adapted feed innovations, strengthened advisory services and participatory training that align with smallholders' resource realities. Integrating climate smart fodder systems and alternative proteins into small stock value chains could substantially improve productivity, household incomes and resilience of Botswana's smallholder livestock systems.

Keywords: Climate-smart farming, fodder production, insect-based proteins, small stock, supplementary feeding

Safflower (*Carthamus tinctorius*) seeds as a natural feed additive for improving poultry semen quality and reproductive performance: A review and future research directions

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ABSTRACT

Semen quality is central to reproductive efficiency and genetic progress in poultry, yet poor semen traits in roosters often limit fertility and hatchability. Natural feed additives rich in bioactive compounds are increasingly explored as sustainable alternatives to synthetic fertility enhancers. Safflower (Carthamus tinctorius), an oilseed crop adapted to semi-arid regions, contains high levels of polyunsaturated fatty acids, proteins, tocopherols and phytosterols with recognised roles in membrane fluidity, steroidogenesis and oxidative stress mitigation. This narrative review synthesised peer reviewed literature (2007–2025) on safflower seed composition, bioactive constituents and their effects on male reproductive physiology across livestock species, and extrapolated implications for poultry. Evidence indicates that dietary safflower can improve semen volume, sperm concentration, motility and morphology in mammals, likely via enhanced spermatogenesis, antioxidant protection of sperm membranes and modulation of reproductive hormones. Studies on flaxseed and related oilseeds in roosters demonstrate that enrichment of n 3/n 6 fatty acids in sperm membranes improves semen quality and cryotolerance, suggesting analogous benefits for safflower. However, direct trials in poultry are scarce, and optimal inclusion levels, processing methods and interactions with basal diet composition remain unknown. The review concludes that safflower seeds have strong potential as a locally available, dual purpose feed and cash crop to enhance poultry reproduction and diversify farmer income. Rigorous dose–response studies in roosters are urgently needed to quantify effects on semen traits, fertility, hatchability and oxidative status, and to integrate safflower into climate resilient, nutritionally sensitive feed strategies aligned with RUFORUM's Theme 2.

Keywords:Antioxidants, poultry reproduction, Safflower, semen quality, sustainable feed

Bovine Cysticercosis in Botswana: A call for a one health approach

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ABSTRACT

Bovine cysticercosis (BCC), caused by the larval stage (Cysticercus bovis) of the human tapeworm Taenia saginata, is an important parasitic disease of cattle with significant zoonotic and economic consequences. This paper reviews the occurrence and impacts of BCC in Botswana over the past five decades and advocates for a coordinated One Health response. Existing data from abattoir inspections and national reports were collated to determine temporal trends in prevalence and associated financial losses. BCC has been recognised in Botswana since 1958, and despite increased awareness and control efforts, abattoir prevalence has risen from 12% in 1974 to 17.2% in 2020. Over this period, BCC has caused substantial economic losses through carcass condemnation and downgrading, with annual reductions in beef export earnings ranging from approximately one million pula in 1978 to 100 million pula in 2010. While the cattle level and trade impacts are well documented, information on the burden of human taeniasis and its public health implications remains limited. Persistently high prevalence despite available preventive measures underscores gaps in sanitation, meat inspection, public awareness and intersectoral coordination. The paper argues that effective prevention and control of BCC require an integrated One Health strategy that links human, animal and environmental health sectors to improve surveillance, risk assessment, community education, sanitation, meat inspection and safe disposal of infected carcasses. Such a collaborative approach is essential to break the transmission cycle, safeguard public health and protect the economic viability of Botswana's beef industry.

Keywords: Botswana, Bovine cysticercosis, economic losses, one Health, prevalence, Taenia saginata

Building veterinary capacity in Botswana: A proposal to establish a school of veterinary medicine

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ABSTRACT

Botswana relies heavily on livestock for national income, exports and rural livelihoods, yet veterinary capacity has historically depended on training veterinarians abroad, a costly and increasingly unsustainable model. In the past decade, fewer than three veterinarians have been trained per year, while the existing workforce is shrinking through attrition and retirement, creating critical gaps in animal health services, food safety and One Health surveillance. To address this deficit, the Department of Veterinary Sciences at the Botswana University of Agriculture and Natural Resources (BUAN) spearheaded development of a proposal to establish a national School of Veterinary Medicine. Following approval at departmental, faculty, senate and council levels, a multi stakeholder working group designed a five year Doctor of Veterinary Medicine (DVM) programme. The proposal, informed by demand analyses, benchmarking with the University of Botswana's Faculty of Medicine, stakeholder consultations and technical support from a Fulbright consultant, systematically addressed infrastructure and facilities, curriculum and pedagogy, human resources, governance, admissions and academic regulations, partnerships, financing and long term sustainability. The proposed School, to be established as a publicly funded Faculty of Veterinary Medicine embedded in Botswana's National Development Plan, is expected to strengthen the veterinary workforce, support a competitive livestock industry, expand regional veterinary training opportunities and position Botswana as a hub for veterinary education, research and One Health service delivery in Southern Africa.

Keywords: Botswana; livestock industry; One Health, veterinary education; veterinary workforce

Analysis of the Effects of rainfall variability on natural forage resources and livestock production in Botswana

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ABSTRACT

Arid and semi arid ecosystems are characterised by highly variable and unpredictable rainfall, with profound implications for forage dynamics and livestock productivity. This study developed and analysed a non autonomous plant–herbivore model to quantify the effects of rainfall variability on natural forage biomass and livestock populations in Botswana, where traditional livestock farming remains a key pillar of food security and the rural economy. The model incorporates real climate data to capture temporal variability in rainfall timing and intensity and its influence on forage growth, carrying capacity and herbivore dynamics. Stability and bifurcation analyses were used to identify critical threshold values for ecosystem sustainability and to evaluate how departures from historical rainfall regimes affect long term coexistence of forage and livestock. Simulations showed that early onset and higher intensity rainfall events enhance forage biomass and support higher, more stable livestock populations, whereas delayed onset or reduced rainfall lead to forage depletion and livestock decline, consistent with observed historical trends. The model further demonstrated that adaptive livestock harvesting strategies—such as dynamic destocking in drought years—can mitigate climate induced risks and maintain system resilience. By combining theoretical modelling with empirical climate records, the study provides a predictive framework for assessing grazing system responses to climate variability and designing sustainable livestock management strategies for Botswana's rangelands.

Keywords: Botswana,climate risk, Livestock production,natural forage, plant herbivore model, rainfall variability

Effect of feed form on performance and blood profiles of ross 308 broiler chickens fed algae-based diets

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ABSTRACT

Algae are promising functional feed ingredients for poultry, but their interaction with feed form on broiler performance and health is not well understood. This study evaluated the effects of feed form (mash versus pellet) and algae inclusion level on growth performance and haematological profiles of Ross 308 broiler chickens. A total of 144 male broilers (22 days old) were allocated to a 2×4 factorial experiment in a completely randomised design, with two feed forms and four algae inclusion levels (0, 10, 15 and 20 g kg^{-1} diet dry matter), replicated three times with six birds per replicate. Experimental diets were isoenergetic and isonitrogenous and formulated to meet Ross 308 nutrient requirements. Body weight gain, feed intake and feed conversion ratio (FCR) were recorded, and blood samples were analysed for packed cell volume and differential leukocyte counts. Data were subjected to ANOVA using SAS 9.3.1. Pelleted diets significantly increased feed intake and growth rate compared with mash ($p < 0.05$), but birds fed mash achieved superior FCR, indicating more efficient feed utilisation. Diets containing 10 and 15 g algae kg^{-1} supported similar growth rates, suggesting that moderate algae inclusion can maintain performance. Feed form had no significant effects on white blood cell counts or leukocyte differentials, and algae inclusion levels did not alter packed cell volume or leukocyte profiles ($p > 0.05$), indicating no adverse effects on haematological status. Overall, algae can be included up to 15–20 g kg^{-1} in mash or pelleted diets without compromising health, while the choice of feed form involves a trade off between growth rate and FCR.

Keywords: Blood profile, broiler chickens, feed conversion ratio, feed form, algae inclusion, growth performance

The influence of nutrient addition under different moisture levels on vegetation dynamics in a Mesic Grassland, South Africa

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ABSTRACT

Grasslands underpin livestock production and ecological stability in southern Africa, yet their structure and functioning are increasingly altered by climate variability and nutrient enrichment. This study examined how nutrient addition interacts with variable moisture regimes to influence species composition, diversity and aboveground biomass in a mesic grassland at Ukulinga Research Farm, South Africa. A rainfall manipulation experiment (2020–2022), embedded in the International Drought Network, imposed three moisture levels—drought (53% of long term mean rainfall), ambient and above average rainfall—using passive shelters and water redistribution in a randomised block design. Within nine 3×5 m plots, fertiliser subplots received annual applications of nitrogen, phosphorus, potassium and micronutrients during the growing season. Species composition was surveyed and aboveground biomass harvested annually. Rainfall strongly regulated biomass and diversity: above average rainfall substantially increased productivity, whereas drought suppressed biomass without immediate declines in species richness. Nutrient addition effects emerged gradually, significantly shifting species composition and enhancing diversity in wetter years, while unfertilised plots exhibited more stable diversity across years. Fertilised plots showed increased species abundance but also greater inter annual variability, indicating that moisture availability constrains the benefits of nutrient inputs. Overall, the grassland community appeared resistant to short term drought but highly responsive to longer term nutrient enrichment when coupled with higher rainfall. These findings highlight the need for climate smart soil fertility strategies that integrate rainfall variability into grassland management to sustain productivity, biodiversity and grazing livelihoods under climate and economic shocks.

Keywords: Grassland biomass, nutrient addition, rainfall manipulation, species composition, ecosystem resilience