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EDITED AND REVIEWED BY
David L. Harmon,
University of Kentucky, United States

*CORRESPONDENCE
Geoffrey E. Dahl
✉ gdahl@ufl.edu

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Editorial: Interventions for improving livestock productivity in developing countries

Mulubrhan Balehegn, Adegbola T. Adesogan
and Geoffrey E. Dahl*

Feed the Future Innovation Lab for Livestock Systems, Institute of Food and Agricultural Sciences (IFAS), University of Florida, Gainesville, FL, United States

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Editorial on the Research Topic

Interventions for improving livestock productivity in developing countries

Livestock systems are foundational to developing economies, contributing significantly to economic stability, food security, and rural livelihoods. An estimated one billion people in Africa, Asia and Latin America depend on livestock for livelihoods, with smallholder systems providing critical income, nutrition, and resilience against economic shocks in developing countries. Animal-derived foods contribute approximately 37% of the global protein supply, and their role is particularly significant in arid and semi-arid regions, where limited rainfall and poor soils constrain crop production, making livestock a critical source of food and income (Smith et al., 2024). In most of sub-Saharan Africa, livestock contributes 20–40% of agricultural GDP, with some countries reporting figures as high as 80% depending on the structure of their agricultural sector and economy (Erdaw, 2023). Beyond direct outputs, livestock in developing countries supports crop productivity through draft power-utilized on approximately 250 million hectares for soil tillage, transport, and post-harvest activities (Harrigan, 2022), and through manure, which supplies about 12–23% of nitrogen inputs in mixed crop-livestock systems, thereby reducing the need for synthetic fertilizers (FAO, 2018). These diverse contributions demonstrate how livestock not only generates food and income but also underpins sustainable crop production and rural livelihoods in developing regions.

Livestock productivity in developing countries remains constrained by interconnected challenges. Limited supplies of feed are exacerbated by seasonal variability and low-quality forage (Balehegn et al., 2020; Baltenweck et al., 2020). Disease prevalence, compounded by fragmented veterinary services and limited vaccine access cause a significant reduction in livestock productivity in developing countries, in some cases causing a GDP reduction of up to 4% (Countryman et al., 2024). Socioeconomic barriers—such as limited access to credit (Yang et al., 2022), low rates of technology adoption, and underinvestment in livestock research and development continue to constrain productivity growth in developing countries (Rosegrant et al., 2022).

Given the complexity and context-dependent challenges in livestock systems, sustainable productivity improvements demand context-specific integration of technological, managerial, and policy interventions (Kazanski et al., 2025). In this

Research Topic, the 14 studies collectively advance actionable insights across three critical domains: (1) optimizing feed resources through circular, locally adaptable strategies, (2) enhancing genetic potential via participatory and genomic approaches, and (3) dismantling institutional barriers through gender-responsive policies and inclusive market systems.

1 Feed innovation and optimization

Chronic feed shortages and reliance on resource-intensive grains are tackled through circular and locally adaptable solutions. [Chisoro et al.](#) demonstrated that substituting 30–40% of conventional maize/soy with wild fruit byproducts (WFBP) in ruminant diets reduces methane emissions by 12–18% while maintaining productivity, offering a sustainable alternative for smallholders in arid regions. Similarly, [Somporn et al.](#) validated black soldier fly larvae oil (BSFLO) as a replacement for rice bran oil in broiler diets, preserving growth performance and reducing dependence on imported feed ingredients in Southeast Asia. In Ethiopia, [Kebede et al.](#) identified high-yielding forage crops like oats and vetch, which increase dry matter yields by 40–60% compared to traditional grasses, addressing feed scarcity in mixed crop-livestock systems. In an experiment by [Mengistu et al.](#) aimed at evaluating forage cultivars with potential for improving yields, Maralfalfa grass, tested in Ethiopia's highlands, showed optimal productivity at 50 cm intra-row spacing, enhancing forage availability for dairy systems. [Ashagrie et al.](#) further highlighted the economic viability of nutrient-rich feed interventions, boosting milk yields by 33% in smallholder dairy farms. Similarly, [Sanfo et al.](#) investigated the performance of improved food-feed maize and cowpea cultivars under monoculture and intercropping systems among smallholder crop-livestock farmers in southern Burkina Faso, and found out that intercropping improved maize (Barka) and cowpea (KVx745-11P) cultivars significantly increases both grain and fodder yields, enhancing land-use efficiency, and providing higher quality fodder, offering a practical solution to seasonal feed shortages and supporting sustainable crop-livestock integration in the region.

2 Genetic and breeding improvements

Mismatched breeding programs and low genetic potential are addressed through participatory and genomic approaches. [Zorobouragui et al.](#) documented farmer-led selection of heat-tolerant Gudali cattle in Benin, prioritizing coat color and milk yield, which improved lactation performance by 17% in semi-arid agroecologies. [Chafai et al.](#) quantified negative genetic correlations (−0.89) between milk yield and fertility traits in Moroccan Holsteins, advocating for balanced breeding strategies to reduce culling rates. Epigenetic research by [Rodrigues et al.](#) revealed that creep-feeding in crossbred beef cattle alters methylation patterns in genes like IGF2, enhancing post-weaning growth by 15% in resource-limited systems. Moreover, [Samuel et al.](#) investigated the effect of the DGAT1 K232A gene mutation and breed differences on

milk yield and composition in five Ethiopian cattle populations. They found that the DGAT1 K232A marker significantly influences daily milk yield, fat, and lactose content, suggesting its potential use in marker-assisted selection to improve milk production and quality traits in Ethiopian cattle after further validation in larger populations.

3 Socio-institutional and policy interventions

Gender disparities, market inefficiencies, and fragmented extension services are mitigated through inclusive and integrated strategies. [Njiru et al.](#) investigates the gender dynamics influencing the adoption and commercialization of *Brachiaria* forage among smallholder dairy farmers in Kenya, revealing that while both men and women benefit from *Brachiaria*'s high productivity and drought tolerance, women face greater barriers to adoption due to limited access to land, extension services, and cooperative membership. [Ayantunde et al.](#) mapped feed market dynamics in Burkina Faso, showing that transhumant pastoralists in the Sahel pay 40% more for crop residues during dry seasons, underscoring the role of decentralized feed networks. [Hatew et al.](#) demonstrated synergies in Ethiopia where combined feed, management training, and genetics increased milk yields by 25%, highlighting the importance of holistic interventions.

The studies in this Research Topic show that improving livestock productivity in developing countries depends on integrated, context-specific strategies that combine technical, genetic, and institutional innovations. Specific lessons include the use of alternative feeds and intercropping to boost yields and sustainability, the alignment of breeding programs with local environmental needs, and the removal of social and market barriers through inclusive policies. The significance of these results lies in demonstrating that only by blending practical, locally adapted solutions across multiple domains can livestock systems achieve lasting productivity gains, resilience, and equitable benefits for smallholders.

Key lessons from this Research Topic include the need to reinforce and expand context-specific interventions that address the diverse challenges facing livestock productivity in developing countries ([Kazanski et al., 2025](#)). Future efforts should prioritize bolstering feed improvement strategies, as inadequate and low-quality feed remains the most significant bottleneck for smallholder systems across regions ([Tran et al., 2023](#); [FAO, 2018](#)). Integrating livestock productivity goals with climate change mitigation and adaptation is essential, not only to reduce emissions and build resilience but also to unlock climate finance opportunities that can support sustainable intensification and innovation ([Bashiru and Oseni, 2025](#)). Policy frameworks must encourage sustainable intensification and commercialization, which have been shown to stimulate investment and the adoption of improved inputs and technologies ([Abay and Jensen, 2020](#)). Finally, there is a need for focused research to close persistent gaps in feed resources, genetics, and socioeconomic constraints, and to ensure that new technologies

and management practices are effectively transferred and adopted at scale. Only through a coordinated, evidence-based approach that combines technical, policy, and institutional innovations can livestock systems in developing countries achieve sustainable productivity, climate resilience, and inclusive growth.

Author contributions

MB: Writing – original draft, Writing – review & editing. AA: Writing – original draft, Writing – review & editing. GD: Writing – original draft, Writing – review & editing.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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