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Editorial: Realizing livelihood and environmental benefits of forages in tropical crop-tree-livestock systems

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Editorial on the Research Topic
Realizing livelihood and environmental benefits of forages in tropical crop-tree-livestock systems

Ruminant livestock, such as cattle, can convert biomass into high-quality, nutrient-dense foods (Broderick, 2018). This ability enables livestock to play a critical role in increasing the productive utilization not only of fertile but also of marginal lands unsuitable for crop production (Wang et al., 2021). In the tropics, the sustainable intensification of livestock production systems plays a critical role in supporting rural livelihoods and meeting food security and environmental goals (Herrero et al., 2013; Rao et al., 2015). Despite its importance, less is known about the productivity and environmental impacts of tropical livestock systems compared to livestock production systems under other climatic regimes (i.e., temperate climate). This knowledge gap limits our ability to inform actions that lead to sustainable intensification in the tropics. However, it is unambiguous that the intensification of livestock systems in the tropics heavily depends on availability and access to quality feed since the limited previous studies have generally reported higher levels of animal production when feed supplements are included in livestock diets. Specifically, feed options such as cultivated forage legumes, crop residues and improved grasslands represent necessary feed resources, which can be accessible to tropical farmers with limited investments and better organization.

The papers in this collection, which explored livestock production systems in Latin America, Africa and Asia, all suggest the possibility of increasing livestock productivity by adopting innovative policies, technologies, and management practices.

The presented evidence suggests that the inclusion of legumes in grazed pastures has the potential to increase cattle production (Valencia et al.), reduce methane emissions (Quintero-Anzueta et al.) and increase the persistence of forage grasses (Valencia et al.). Including feed supplements such as Altoandina oat silage was reported to be an economically viable option for increasing the productivity of Colombia's High-Altitude Dairy Systems (Enciso, Castillo et al.). Management options that optimize rotational pasture grazing based on simple metrics such as sward height may increase livestock productivity and reduce enteric methane emissions from grazing cattle (Marín et al.). Besides the adoption of better pasture management systems, genetic innovations can be used to overcome challenges such as droughts (Carvajal-Tapia et al.), soil salinity (Liu et al.) and low biomass accumulation (Mwendia et al.).

An additional emerging use of tropical forages is their potential as a food source for edible insects (Bawa et al., 2020; Oonincx et al., 2020). Buitrago et al. share their perspectives on this aspect and suggest that integrating tropical forage-based diets in edible insect production systems represents low-cost feed sources for insects and supports transiting to circular economies. On the other hand, as Hernández et al. highlight, tropical forage production systems must be protected from harmful insects such as Spittlebugs. Narjes Sanchez et al. also provide critical insights into the possible role of tropical forage legumes in pollinator conservation efforts, income generation, and closing the forage legume seed bottleneck that still limits further advances in sustainable intensification efforts of the cattle sector as of today.

In addition to providing food, the livestock sector can generate ecosystem benefits such as increased on-farm agro-biodiversity, soil restoration, mitigation of GHG emissions and more efficient use of nutrients and water resources. Narjes Sanchez et al. showed that silvopastoral systems have the potential to support the provision of ecosystem services such as pollination. In a separate study, Notenbaert et al. used previous studies to demonstrate the multiple potential benefits of managed livestock production systems. They further demonstrate linkages between managed livestock production systems and agroecology and how the sustainable intensification of livestock production systems can contribute to the 13 principles of agroecology.

From this paper collection, it appears there is clarity on what needs to be done to sustainably intensify tropical livestock production systems to meet livelihood, food security and environmental goals. Nevertheless, the slow progress appears disproportionately attributable to non-technical aspects such as a disconnect between institutions and other actors along livestock value chains resulting in insufficient synchrony of efforts to support the adoption of critical innovations (Enciso, Triana et al.). While the need to sustainability intensify livestock production systems at the national and global levels is frequently well articulated, connections between policies and investments and, thus, actions on the ground largely remain weak (Lerma et al.). Chirinda et al. emphasize the need to create inclusive and creatively organized livestock value chains that improve stakeholder linkages, information flows and equity.

Author contributions

NC made the first draft of the Editorial. MP, SB, AN, and RV made edits and suggestions to improve the draft version. All authors contributed to the article and approved the submitted version.

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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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