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Farmers’ and academia’s views”

## Insects as food and feed source in the tropics: opportunities and constraints of forage-based insect diets

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### Abstract

Farmed insects can provide an alternative protein source for humans, livestock, and fish, while supporting adaptation to climate change, generating income for smallholder farmers, and reducing the negative impacts of conventional food production, especially in the tropics. However, the quantity, nutritional quality, and safety of insects greatly relies on their feed intake. Tropical forages (grasses and legumes) can provide a valuable and yet untapped source of feed for several farmed insect species. In this literature review, we provide a perspective on how tropical forages can support edible insect production. We also highlight the potential of tropical forage-based diets over those using organic agricultural or urban by-product substrates, due to their versatility, low cost, and lower risk of microbial and chemical hazards. Our results show that insects are a viable option for supplying the growing demand for protein in the tropics, especially given the need to adapt to and mitigate climate change. The advantages of insect farming in the tropics include a greater biodiversity, production throughout the year under stable environmental conditions, and the contribution to at least 8 Sustainable Development Goals. This has led to the development of an emerging industry, e.g., through initiatives based on black soldier fly production for fisheries in Kenya and Colombia. Organic residues and substrates, commonly used for this purpose, may, however, represent a hazard for both fishery and human health. We thus propose a new approach for insect-based value chains by integrating tropical forage-based diets in edible insect production systems, given the yet untapped forage diversity in international gene banks and on farms. Compared to commercial diets, tropical forages are a low-cost feed source for insects, with high dietary versatility, that provide opportunities for the transition to sustainable, circular economies. The main bottlenecks are the lack of specific regulations, the dependence on few species for large-scale industrial insect production, and food safety. Our results will serve interested stakeholders in identifying urgent issues at the research, ethical, marketing, and policy levels that can prevent the emergence of new, insect-based value chains and business models, and the nutritional, economic, and environmental benefits they promise.

**Keywords:** Business models, edible insects, entomophagy policies, food security, sustainable development