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Editorial: Crop modelling - underutilized crops for climate-smart agrifood systems

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Editorial on the Research Topic
Crop modelling - underutilized crops for climate-smart agrifood systems

Climate change is posing a significant threat to our food systems they are highly exposed to complex and unpredictable environmental changes and more susceptible to shocks, where climate change serves as a primary cause for the increasing vulnerability of these systems. Building climate-resilient food systems will enable us to deal with these shocks, complexity, and unpredictability, which ultimately contribute to food security and sustainable food systems. The limited range of crops supplying global food requirements makes food systems more vulnerable to climate hazards. Currently, over 50% of consumed calories come from just three staple crops (rice, maize, and wheat), leaving behind the extensive variety of nutrient-rich plants that have been historically utilized by humanity (Hunter et al., 2019).

Neglected and Underutilized Crop Species (NUS) emerge as a highly promising solution to fulfill the increasing food and nutritional needs of the growing global population (Chivenge et al., 2015). NUS are also recognized by FAO as Future Smart Food (FSF) have untapped potential to fight hunger and malnutrition. NUS are known to have important traits to enable resilience in harsher environments such as drought tolerance, adapted to marginal agricultural land, and ability to thrive with low-cost input use (Padulosi et al., 2012; Adhikari et al., 2017). Noteworthy, underutilized crop species offer diverse provisioning, regulating, cultural, and supporting ecosystem services, along with multiple environmental and health co-benefits. These contribute to outcomes such as enhanced dietary diversity, income generation, and sustainable livelihoods (Mabhaudhi et al., 2022). There is ample evidence from around the world underscoring the importance of incorporating neglected and underutilized crop species (NUS) into food systems as a strategy to enhance the resilience of agricultural systems in the face of climate change.

The promotion of NUS hinges mainly on research and development, post-harvest handling, new product development, value addition, and creating market access for farmers. In pursuit of enhancing the role of NUS in food systems, it is vital to develop

a framework for actions and partnerships required to scale up and improve NUS value chains. NUS value chains cover all actors and activities involved from food production to table enabling key actors and policymakers to identify feasible solutions to leverage NUS for improving food security and the environment. The value chain approach is a good strategy to transform NUS as food and commodity crops and enhance their role in climate-resilient food systems.

Gaining access to markets poses a challenge for NUS. The current market structures are designed to cater to the main crops, reflecting a paradigm that prioritizes a limited number of major food crops. Research on market analyses is essential to identify prospects for integrating NUS into existing markets, either by mainstreaming or disrupting the current systems. Additionally, there is a need to explore the feasibility of establishing new niche markets dedicated specifically to NUS. This alternative approach aligns with the creation of novel value chains for NUS. At present, there is a limited number of products developed from NUS. Research on new product development is key to accessing new markets. Value chain development for NTU should be given priority and more investments should be made toward exploiting these untapped opportunities to build climate-resilient food systems.

Underutilizing crops has the potential to become mainstream crops in many countries, therefore, detailed simulation modeling on various aspects of agriculture is essential (Jahanshiri et al., 2022). The actions taken over the next 10 years will be especially critical. A new research initiative is needed—one that integrates and applies the best and most promising approaches, tools and technologies. This Research Topic shows such modeling applications on climate smart agriculture (Mugo et al.), sustainable farming systems/precision agriculture (Lincoln et al.; El-Mehy et al.), and plant breeding and sensitivity analysis (Gunarathna et al.). As proven in the Research Topic titled "Crop Modelling - Underutilized Crops for Climate-Smart Agrifood Systems", using decision support tools, different management scenarios can be evaluated for both current and future climate scenarios that can provide crop production options for food and nutrition security at different levels.

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