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Editorial: crop diversification, a key pillar for the agroecological transition

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Editorial on the Research Topic
Crop Diversification: A Key Pillar for the Agroecological Transition

The spatial and temporal diversification of cropping systems is a way to reduce the dependency of agricultural systems on synthetic inputs and limit their environmental impacts by promoting the expression of ecosystem services (Kremen et al., 2012; Tamburini et al., 2020). The options to diversify cropping systems are numerous, going through the diversification of crop rotations with legumes and other crops, the association of species with intercropping (with annual or perennial crops), agroforestry, and the introduction of multiservice cover crops during fallow periods (Hufnagel et al., 2020). Diversified agricultural systems can contribute to increasing the stability and resilience of production in the face of climate change (Marini et al., 2020), while helping to mitigate its effects through increased carbon storage in soils and/or mitigation of greenhouse gas emission. They can also meet the needs of farmers who produce food, feed, and industrial products, while providing other ecosystem services and public goods.

After 50 years of intensification of agricultural production systems, which has been accompanied by a major simplification of these systems, their negative effects on natural resources (soil, water and air, loss of biodiversity, etc.) and their consequences on human health are now widely recognized. This indicates the strong need for a paradigm shift towards ecological intensification (Kleijn et al., 2019) and more diverse systems (Stein-Bachinger et al., 2022). Crop diversification with a high level of agrobiodiversity in cropping systems is seen as an essential pillar of agroecological transition, based on growing evidence of improved productive and environmental performance and resilience of cropping and farming systems. The contributions to this Research Topic provide relevant practical examples on crop diversification challenges and opportunities.

Emery et al. (2021) investigated the potential of achieving multifunctional crop protection benefits by intercropping oilseed rape with legumes in field experiments in southern Sweden. In particular, frost-sensitive legume intercrops provided evidence for a reduction in autumn pest damage in oilseed rape. While effects were not consistent, each legume intercrop had its own benefits and drawbacks in relation to pest, pathogen, and weed suppression. They suggest that the plant species selected for intercropping with oilseed rape should be based on the pests, pathogens, and weeds of greatest concern locally to achieve relevant multifunctional benefits of crop diversification.

Using the rapid ecosystem function assessment approach, Puliga et al. (2021) measured invertebrate predation, seed predation, and activity density of generalist predators in fields with various crop rotation histories in northern Germany. Interestingly, they found that temporal crop diversity did not benefit the activity and efficiency of generalist predators when diversification strategies involve crops of very similar functional traits. Hence, they suggest adding different resources and traits to the agroecosystems through a wider range of cultivated crops and the integration of semi-natural habitats when developing cropping systems aiming to provide a more efficient natural pest control.

Rodriguez et al. (2021) assessed the sustainability of diversified organic cropping systems beyond the ecological impacts. In a participatory approach with farmers in southern Sweden, they found a high sustainability for environmental dimensions due to restricted inputs of pesticides and mineral fertilizers and an efficient use of resources. On the other hand, they identified social and economic dimensions to be more variable, with challenges of lower sustainability in profitability and management complexity. Limited access to knowledge, technology, and markets for minor crops, and concerns about the consistency of policies were highlighted by farmers as barriers for crop diversification.

In a case study in the U.S. Midwest, Endres et al. (2022) explored factors likely to be limiting organic maize, aka corn seed quality and quantity using an approach including farmer focus groups, workshops, and interviews. They found that substantially higher costs of and challenges associated with organic seed production appear to be the most likely barriers to maize seed improvement for the organic sector.

To assess the barriers and opportunities for crop rotations in California rice systems, Rosenberg et al. (2022) interviewed farmers on their perceived benefits and challenges. While farmers found that weed control and reduced reliance on herbicides were benefits of rotations, they expressed many challenges from unsuitable soils to lack of markets and knowledge for growing other crops. The results indicate that soil condition is an important limitation, but other economic, social, and cultural barriers also strongly influence the potential for the diversification of rice systems.

To explore the ecosystem services derived from underutilized crops and their co-benefits for sustainable agricultural landscapes and resilient food systems in Africa, Mabhaudhi et al. (2022) reviewed the available literature. The results indicate that underutilized crops provide various provisioning, regulating, cultural, and supporting ecosystem services and several environmental and health co-benefits, dietary diversity, income, sustainable livelihood outcomes, and economic empowerment, especially for women. Thus, underutilized crops may support a transition to more sustainable, healthy, equitable, and resilient agricultural landscapes and food systems in Africa.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work, and approved it for publication.

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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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