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Editorial: Reducing the susceptibility of agroecosystems to invasion through sustainable weed management

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Editorial on the Research Topic
Reducing the susceptibility of agroecosystems to invasion through sustainable weed management

Agroecosystems are major man-made ecosystems, representing approximately 40% of global land area. Present-day agroecosystems are highly vulnerable to global changes, namely weed invasion (Frost et al., 2019; Allen et al., 2022). Weeds are a major threat to agricultural production and are known to cause enormous losses to agricultural productivity (Chauhan, 2020). Several exotic invasive weeds have been reported to cause severe reductions in grain crop and vegetable yields globally. Continuous disturbance, greater resource availability, and reduced species diversity often enhance the susceptibility of agroecosystems to weeds (Harker et al., 2005). Management techniques are, therefore, needed to reduce the invasibility of agroecosystems, while maintaining their sustainability. The use of herbicides, which are considered to be the most effective method of weed control, may not be an option in certain farming systems. Alternative techniques, including the revival of traditional cultural practices with novel approaches, could be useful in reducing the indiscriminate use of synthetic herbicides where appropriate. A suitable manipulation of allelopathy in crop rotation, intercropping, and the use of cover, smother, and green manure crops can help in weed management and enhance crop productivity (Singh et al., 2003). In addition, an understanding of weed characteristics, their life cycle, physiology, and ecology, etc., could be useful for their management. To make these approaches viable and practical and to draw global attention, further research on this subject is required. The current Research Topic was initiated for this purpose and includes diverse research papers on eco-friendly approaches that could make agroecosystems less vulnerable to invasive noxious weeds.

The first manuscript in this collection explores the use of allelopathy, a plant-plant chemical interaction mediated through the release of chemicals known as

allelochemicals, to manage noxious weeds that invade our agroecosystems. Allelopathy alone can be inefficient for weed control but its integration with other known techniques of weed management can yield fruitful results. The manuscript "*Allelopathic Effects of Chrysanthemoides monilifera subsp. Monilifera on Lolium rigidum in Wheat Field: Implications on the Reduction of Chemical Loads in Agroecosystems*" by Harun et al. corroborates the above statements. This manuscript highlights that, when mixed with a one-fourth strength of herbicides, the leaf extracts of an allelopathic plant commonly known as boneweed (*Chrysanthemoides monilifera* subsp. *Monilifera*) have the potential to control post-emergent *Lolium rigidum* found in wheat fields. The study shows that adding extracts to herbicides can minimize their effective concentrations and reduce their detrimental effects on the environment and human health. There is, therefore, a pressing need to explore more allelopathic plants and to integrate them with other weed control techniques to enhance agroecosystem sustainability.

Another manuscript by Dar and Reshi highlights the importance of weed assessment. Assessing the taxonomic status, nativity, and association of weeds with Rabi and Kharif crops, and orchards of apple and other fruit trees can be helpful in their better management. The study reports on 198 weeds belonging to 47 families, with Poaceae and Asteraceae being the most predominant. Most of the identified weeds were non-native and as many as 51 were invasive. Most weeds were either annual or perennial herbs and the maximum number of weeds were recorded from orchards. The findings of this manuscript are relevant to the Kashmir Himalayas of India, but similar assessments can be undertaken in the agroecosystems of other geographic regions.

Understanding weed biology is also an important step that can strengthen our efforts to manage weeds, particularly parasitic ones. Knowledge of weed biology can be suitably integrated with other traditional techniques to achieve better results. The review article entitled "*Biological Characteristics, Impacts, and Management of Crenate Broomrape (Orobanche crenata) in Faba Bean (Vicia faba): A Review*" by Negewo et al. provides information on the biology, impact, and management of *Orobanche crenata* agroecosystems harboring food legume faba bean. This holoparasitic weed, with unique morphological traits and life cycles, causes serious impacts on legumes, including faba bean, and may even lead to 100% crop loss. The control of this weed is very difficult and requires suitably planned integrated approaches that may also rely on its biological traits. The review is, therefore, very useful for those dealing with the management of this troublesome agricultural weed.

The fourth article published in this Research Topic deals with the agroforestry weedy species *Leucaena leucocephala* (*Critical Insights into the Ecological and Invasive Attributes of Leucaena leucocephala, a Tropical Agroforestry Species*, by Sharma et al.). This agroforestry species is listed among the 100 worst invaders and is one of the world's top five terrestrial invasive species. This species has been promoted largely for its economic benefits, with disregard for its immense invasive potential. In addition to highlighting the ecological and invasive attributes of *Leucaena* species, the review article also includes some management approaches.

Author contributions

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

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.

Publisher's note

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