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Editorial: Weed management in specialty crops

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Editorial on the Research Topic
Weed management in specialty crops

The unique challenge of specialty crop weed management

Specialty crops, which include fruits, vegetables, nuts, herbs, and ornamentals, are a vital part of United States (US) agriculture. Although they are typically grown on smaller acreages than grain or forage crops, they make significant contributions to the agricultural economy (USDA-NASS, 2025). Weeds pose major threats to specialty crops by competing for resources and indirectly interfering with hosting pests and diseases, increasing physical risks to workers, impeding field operations, and reducing harvest efficiency. Weed control in specialty crops is challenging due to a limited number of registered herbicides, increasing herbicide resistance, crop sensitivity to chemical treatments, narrow-spectrum weed control options, and the rising cost and decreasing availability of labor (Boyd et al., 2022; Fennimore and Doohan, 2008; Hanson et al., 2014; Kunkel et al., 2008). These combined challenges have created an urgent need for integrated, innovative, effective, and sustainable weed management solutions tailored to specialty crop systems (Brainard et al., 2023; Korres et al., 2019; Westwood et al., 2018). Recent research has begun to tackle these issues, offering several promising strategies that merit broader awareness and adoption.

Conventional and alternative mulching systems

Mulching is a key nonchemical weed control strategy in specialty crops, including ornamental container plant production where limited space can make crops especially vulnerable to weed competition. The review by Khamare and Marble examines the use of common mulches, such as rice hulls, pine needles and bark, wood chips, coconut fibers, and recycled paper products, for weed suppression. Innovative and unconventional approaches including weed discs, biodegradable sprays, herbicide-treated mulches, and substrate stratification are also discussed. Despite drawbacks like decomposition and potential phytotoxicity, proper mulching can reduce herbicide use and labor costs. The limited availability of suitable mulch materials for container plant production highlights the need for

research into novel options, such as allelopathic plants, invasive species, crop residues, and food processing byproducts, alongside innovative mulching techniques and economic analyses, to enhance weed suppression, reduce herbicide use, and improve the sustainability of nursery operations.

Under field production conditions, hydromulches offer a sustainable alternative to traditional polyethylene (PE) mulch. These biodegradable, liquid-applied mulches are made from shredded newspaper, water, and natural tackifiers like guar gum or psyllium husk. Research by Ahmad et al. in strawberry systems shows demonstrates that hydromulches (HM) with guar gum (GG) included as a tackifier can suppress weeds nearly as well as PE mulch, without contributing to plastic pollution. The degradation of GG HM varied across locations with season-long stability observed in North Dakota. In some trials, strawberry yields were higher under HM, highlighting its potential as a sustainable weed control option, although improvements in materials, equipment, and cost-effectiveness are needed for successful commercial adoption.

Harnessing allelopathic properties

Sidhu et al. describes research results highlighting the allelopathic properties of organic materials, including maple leaves (ML), pine bark (PB), and red hardwood (HW), among others, to suppress liverwort (*Marchantia polymorpha*) in container grown ornamental production. In laboratory trials, ML extract showed the strongest suppression of liverwort germination at two weeks after treatment. In greenhouse trials, all mulch extracts suppressed liverwort for the first two weeks. Over 10 weeks, PB and HW provided the most effective long-term control with the least liverwort biomass. Further research should explore additional organic mulches for allelochemical potential, assess their phytotoxicity on ornamentals, and identify the active compounds responsible. Understanding discrepancies between lab and greenhouse results and evaluating performance under different irrigation methods is also crucial. These efforts could enhance organic weed control strategies by leveraging natural chemical interactions in diverse specialty crop systems.

Strategic herbicide programs for resistance management

For some crops, carefully designed herbicide programs remain necessary components of integrated weed management. For instance, Miranda et al. demonstrated that sequential applications of very long-chain fatty acid (VLCFA)-inhibiting herbicides have shown promise for controlling acetolactate synthase (ALS)-resistant Palmer amaranth (*Amaranthus palmeri*) in dry edible beans. Programs incorporating pendimethalin plus either dimethenamid-P or *S*-metolachlor applied preemergence, followed by postemergence applications of the same VLCFA inhibitors, provided effective Palmer amaranth control while maintaining crop safety. Such strategic herbicide programs, when implemented within broader integrated approaches, can address resistance concerns while minimizing environmental impacts and protecting crop yields. For long-term control, integrated weed management strategies are essential. These may include reducing seedbank size, diversifying herbicide modes of action, and rotating with competitive crops like corn.

Understanding weed-crop interactions

Effective weed management requires understanding how weeds interact with crops and other pests. Research on lima beans by Sankula et al. has demonstrated that common cocklebur (*Xanthium strumarium*, jimsonweed (*Datura stramonium*), and ivyleaf morningglory (*Ipomoea hederacea*) at densities as low as 7 plants per 10 meters of row can reduce pod numbers by up to 40%. Lima beans also suppressed weed biomass and seed production by 40-60%, highlighting the complexities of crop-weed competition. These findings also emphasize that weed management decisions must consider on the impacts on weed seed banks, harvest efficiency, and interactions with diseases like *Rhizoctonia solani*. This research underscores the need for tailored, system-specific approaches to weed management rather than one-size-fits-all solutions.

The path forward

Effective weed management in specialty crops requires diverse, integrated strategies tailored to specific regions and crop systems. Priority areas include combining physical, biological, and selective chemical methods; adapting practices to local conditions; increasing funding for non-chemical and ecological research; and improving knowledge transfer through extension programs. With rising challenges like herbicide resistance, climate change, and labor shortages, innovative, research-driven solutions are critical to sustaining specialty crop production while protecting the environment and public health.

Author contributions

LS: Writing – original draft, Writing – review & editing. RL: Writing – review & editing.

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.

Generative AI statement

The author(s) declare that no Generative AI was used in the creation of this manuscript.

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