

Ecological management of winter weeds in pea-wheat-corn rotations: the curious case of corn chamomile and cover crops

Cover crops are an important tool for improving soil, nutrient, and pest management, but can exacerbate weed problems if not managed carefully. In pea-wheat-corn crop rotations, the weed corn chamomile (*Anthemis arvensis*) can produce flower buds which are a problematic contaminant in processing peas. Other winter annuals—particularly those in the mustard family—are potential hosts of insects and diseases of vegetables commonly grown on organic vegetable farms. Field and growth chamber experiments were conducted to (i) assess seed production and seed characteristics of corn chamomile in peas and rotational crops, (ii) use this information to identify weak points in corn chamomile life-cycle that could be targeted for effective management, and (iii) evaluate the potential role of buckwheat cover crops for managing corn chamomile and other winter annual weeds. Corn chamomile seed production in winter wheat undersown with red clover was identified as a major source of seed inputs to the seedbank. Seeds produced by corn chamomile produced both small, non-dormant seeds and large, dormant seeds. The thick seed coat on these large seeds contributes to their persistence in the soil and ability to emerge in peas grown two years following wheat. Where red clover is undersown in wheat, control of corn chamomile following wheat harvest is challenging. Therefore, the best opportunity for avoiding buildup of the corn chamomile seedbank appears to be prevention of establishment of corn chamomile in wheat in the fall. Field and growth chamber studies examined the potential for residues from buckwheat planted following peas to suppress germination and growth of winter annual weeds in a subsequent wheat crop. In growth chamber studies, buckwheat residues suppressed several winter annual weeds including corn chamomile without suppressing wheat. In field studies, wheat emergence and early growth was inhibited by buckwheat residues, though no differences in final wheat yields were detected. Our results demonstrate the importance of understanding weed life-history for identifying optimal weed management and cover cropping strategies. Integration of cover cropping with other weed management practices including cultivation is critical for successfully improving soil health while avoiding future weed problems in organic production systems.