Cover Crop Management for Weed Suppression:

testing intensified practices in nut tree orchards

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Cover crops can have many benefits, including weed suppression. What kind of management practices help create a competitive cover crop?

Cover crop essentials

Cover crops are non-crop plants that are used to add biodiversity to a cropping system. In California orchards, there is an **opportunity to add winter annual plants to the orchard floor**. These plants can capture winter precipitation, improve soil health, support pollinator health, and contribute to a number of additional ecosystem services.

Weed suppression is one of these potential ecosystem services. Winter cover crops could displace winter weeds by outcompeting the weeds for resources such as sunlight, space, and water. **By replacing unwanted winter weeds with domesticated cover crops, growers can create a more desirable orchard floor environment while using more diversified management practices**.

Competitive cover crops

Cover crops must access essential resources ahead of weeds, using germination and emergence strategies unique to each species in order to be competitive. Based on collaborative research at UC Davis with cover crop mixtures in almonds, the largest, most-abundant cover crop is the most competitive with weeds. Much of this cover crop abundance might be related to timely cover crop planting, which helps establish a cover crop before weeds emerge.

Achieving this ideal high-biomass cover crop can have tradeoffs with other management goals. Management factors like fall irrigation and uniformity of seedbed preparation affect both cover crops and weeds in their earliest life stages, which can have season-long impacts on plant competition. Specific recommendations are needed in order to balance the many demands of orchard management, cover crop management, and weed management.

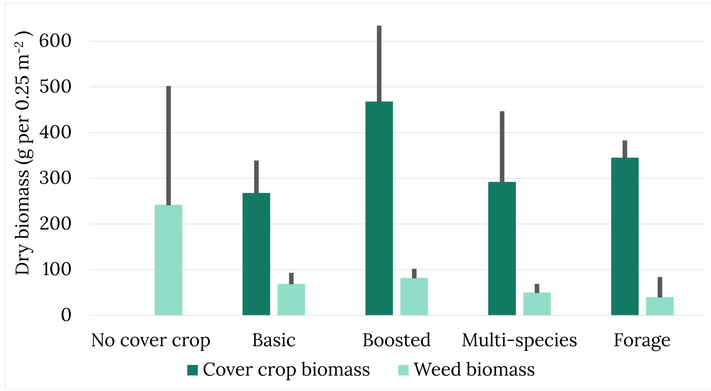
Searching for management solutions

In order to find which management practices support a competitive cover crop, we created an experiment to **compare different cover crop management programs**, which represented a range of management intensity from minimally-managed to a high-input forage intercrop. **We hypothesized that higher levels of management intensity would lead to a more abundant cover crop and, therefore, fewer weeds**.

Our four management programs, as well as a herbicide-based weed management program, were implemented in a small-plot, randomized complete block study in a walnut orchard in Davis, CA in November 2019. We harvested cover crops and weeds using a quadrat subsampling design immediately before cover crop termination in April 2020. Cover crop termination was done with a flail mower, except for the forage crop where residue was baled.

The cover crop systems

A **basic** cover crop had 50 lbs acre^{-1} rye with no other inputs. A **multi-species** cover crop had additional mustard, daikon radish, white clover, and vetch seed planted along with the basic rye cover crop. A **boosted** cover crop program had the basic rye planting with some starter irrigation and a 40 lb acre^{-1} nitrogen topdress in the spring. Finally, a **forage** crop was planted with 100 lbs acre^{-1} rye that received starter irrigation, a postemergent application of carfentrazone, 30 lbs acre^{-1} nitrogen and 50 lbs acre^{-1} monoammonium phosphate starter fertilizer, and a 40 lb acre^{-1} nitrogen topdress.



Lessons for weed management

As seen in the figure above, each of the cover crop systems reduced weed biomass compared to the herbicide-based treatment with no cover crop. However, the differences in weed and cover crop biomass between our management programs were not meaningful due to variability across our experiment.

Cover crops in this study demonstrated their potential for displacing weedy vegetation across several levels of management intensity. **While cover crops may not completely eliminate unwanted plants, they can likely be integrated into a variety of management systems**. These results are from the first year of this study, and continuation will help evaluate the cumulative effects of cover crops, such as impacts on the weed seedbank, weed community shifts, and persistence of cover crop residues.

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