Westwind Field Trial Factsheet - WSARE GW23-249

By Sydney Cho

1/8/2024

Research Objective: Evaluate a surface-applied hull/shell mix amendment maintained over time with off-ground harvest and a winter cover crop. What are the effects on soil aggregate stability, soil-plant water dynamics, and microbial community composition?

Experimental Design: Randomized complete block design. Treatments applied to entire rows.

Treatments:
(1) Control: no amendments, on-ground harvest
(2) Cover crop, with off-ground harvest
(3) Hull/shell mix, removed annually with on-ground harvest
(4) Hull/shell mix, maintained over time with off-ground harvest

Reponses	Methods	Results
Hull/shell amendments	Nutrients, Decomposition, Microbial community (PLFA)	• Hull/shell layer released K rapidly as water was applied, briefly retaining K additions from fertilizer and compost before re-releasing. • Hulls/shells decomposed by ~half after 1 year, ~90% after 2 years. • The C:N ratio, estimated C, and net dry mass steadily declined. • The hull/shell organic layer maintained with off ground supported beneficial microbial groups and high levels of microbial biomass.
Soil	Aggregate stability, POM/MAOM, Fertility (pH, CEC, SOM, etc.), Microbial community (PLFA)	• Hulls/shells increased XK in top 0-10 cm, occasionally deeper depths. • Increased C and N in micro and macroaggregate fractions. • Significantly high % TN in MAOM fraction compared to POM fraction. • After 2 years the amended catch frame soils had increased soil bacteria, then after 2.5 years higher bacteria, fungi, and beneficial subgroups such as saprophytes and arbuscular mycorrhizal fungi.
Water Dynamics	Soil probes	• Upper 0-10 cm of amended catch frame soil tended to have higher average soil water and moderated temperatures than control soil. • In 2022, the amendment moderated tree water stress after 6 days without irrigation, but no effects in 2023 during pulse irrigation.
Cover Crops	Biomass, Decomposition, Nutrients	• Mix of 60% pea, 35% oat, 5% mustard with overall average biomass highest in oat species. • 70% decomposition over 3-month period with cover crop litter bags • % N in peas were significantly greatest across all species, while %N in oats and weeds were significantly greater than mustard. • Average C:N ratio was significantly higher in mustard compared to oats, peas, and weeds.

Conclusions & Practical Applications:

The hull/shell amendment increased K cycling, decomposed rapidly, improved water dynamics during dry periods by acting as a mulch, and increased root biomass. Maintaining the amendment with off-ground harvest maximized K benefits, established a microbially-rich organic layer on the soil surface and increased microbial biomass in the soil beneath it. Beneficial microbial functional groups included saprophytes and arbuscular mycorrhizae.

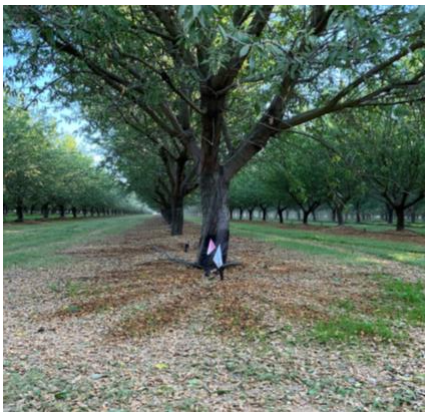
Link to Sacramento Valley Orchard Blogpost (Ellie Andrews): https://www.sacvalleyorchards.com/blog/almonds-blog/applying-amendments/.

Pictures by Sydney Cho and Ellie Andrews

Hull and shell application Fall 2022.

Catch frame harvest equipment.

Pea, oat, mustard cover crop mix in February 2023.



Hull and shell applied Fall 2022.

Undisturbed hull/shell organic layers on Fall 2020 (left) and Fall 2022 (right).