Westwind Field Trial Factsheet - WSARE WS20-912

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Research Objective: evaluate a surface-applied hull/shell mix amendment maintained over time with off-ground harvest. What are the effects on potassium (K) cycling, soil-plant water dynamics, and microbial community composition?

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

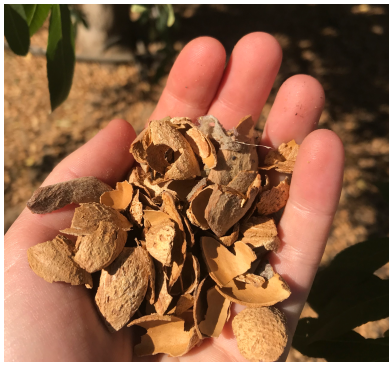
Treatments: (1) Control: no amendments, on-ground harvest
(2) Hull/shell mix removed annually by on-ground harvest
(3) Hull/shell mix maintained over time with off-ground harvest

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. • After 1.5 years, the original hull/shell layer had high actinomycetes, arbuscular mycorrhizae, and diversity while the newer layer had high total bacteria, protozoa, and undifferentiated microbial biomass.
Soil	Exchangeable K (XK), Fertility (pH, CEC, SOM, etc.), Microbial community (PLFA)	• Hulls/shells increased XK in top 0-10 cm, occasionally deeper depths. • High K from hulls/shells occasionally displaced soil sodium and magnesium but did not affect other soil fertility components. • After 1 year the amended catch frame soils had increased soil bacteria, then after 1.5 years higher bacteria, fungi, and beneficial subgroups such as saprophytes and arbuscular mycorrhizal fungi.
Water Dynamics	ERT, Soil probes, Stem Water Potential	• Amended catch frame soil had higher water infiltration rate and reduced soil surface evaporation compared to the control soil. • Upper 0-10 cm of amended catch frame soil tended to have higher average soil water and moderated temperatures than control soil. • In 2021, the amendment moderated tree water stress after 6 days without irrigation, but no effects in 2022 during pulse irrigation.
Tree	July leaf nutrient status, Yield & Trunk circumferences Root biomass	• Amendment significantly increased July leaf K especially when maintained with catch frame harvest. Leaf Mg decreased but was still sufficient. No differences in leaf N, P, Ca, S, B, Zn, Mn, Fe, Cu, Na. • No effects on yield or trunk circumferences. • Higher root biomass under hull/shell amendments in Spring 2022.

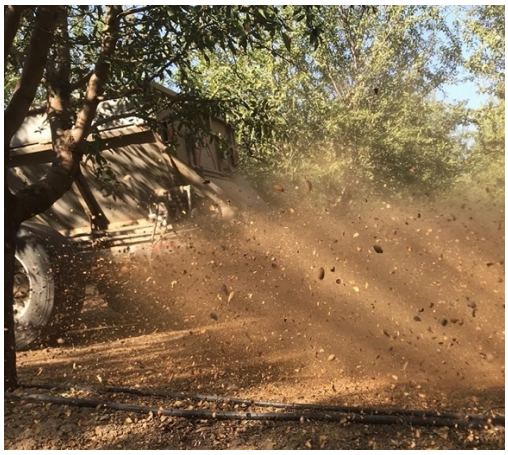
Conclusions & Practical Applications:

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.

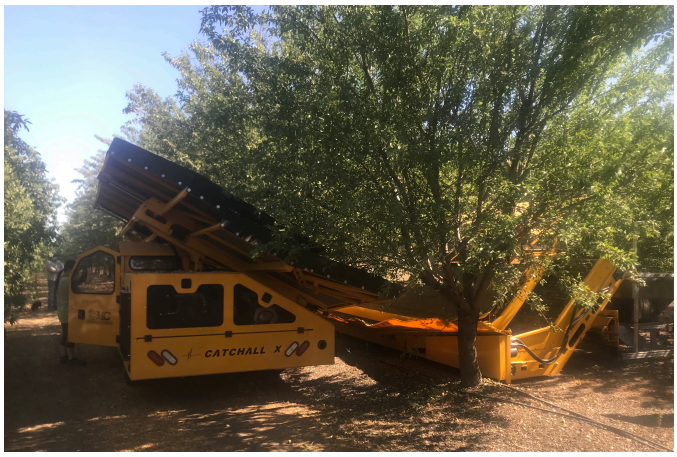
Pictures



Almond hull/shell amendment.



Hull/shell application.



Catch frame harvest equipment.

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