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DEVELOPING NUTRIENT REQUIREMENTS FOR YOUNG WALNUT ORCHARDS AFTER WHOLE ORCHARD RECYCLING

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Project status in 2024: Year 1 of 3

PROJECT OBJECTIVES:

1. Develop nutrient requirements for orchard establishment and early years of whole orchard recycling in walnut.
2. Evaluate effects of whole orchard recycling in walnut on physical, chemical, and biological properties of soil.

BACKGROUND

Whole orchard recycling (WOR) is the practice of removing and chipping old orchards and reincorporating tree biomass into the soil before planting a new orchard. It was developed in part to reduce air pollution in the San Joaquin Valley, where the traditional method of clearing orchards was to knock down and burn trees in the field.

Extensive WOR research in almond has demonstrated increased carbon sequestration, increased soil health, increased water-use and nutrient-use efficiency, and reduced nitrogen leaching potential relative to conventional orchards. As a result, WOR has been included as a practice that can receive incentives through the Ag Burn Alternatives Grant Program as agricultural managed burning in the San Joaquin Valley is being phased out. Since the Ag Burn Alternatives Grant Program was launched in 2021, alternative practices have been implemented for 269,534 acres (7,291,353 tons of material) of orchards and vineyards. Of the crops that participated in the program, 67% of this material was almond, followed far behind by grapes at 11% and walnut at 9%.

Developing recommendations for how to implement WOR in walnut will enable the California walnut industry to reap the benefits of WOR and improve overall resilience of our product. Especially as growers remove non-bearing walnut orchards amid a decline in crop prices, there is an opportunity to establish new orchards with WOR.

WOR requires different management than conventionally planted orchards because nutrients are broken down and released into the soil at a different rate. Almond research has shown additional

nitrogen application is required in the early years of orchard establishment to supplement nitrogen that is initially immobilized by microbial communities as they break down carbon in the applied chips. However, fertilization guidelines for walnut must be developed due to crop-specific nutrient requirements and the significantly greater amount of biomass that is recycled from walnut (80-120 tons/acre) compared to almond (30-60 tons/acre). It is imperative to define the rate of nitrogen necessary to prevent stunted trees in walnut orchards with WOR while avoiding overapplication of nitrogen that can lead to leaching and groundwater contamination.

KEY FINDINGS

In 2021, a demonstration plot in Sutter County was developed with WOR to observe general effects on walnut orchard growth. Survival, growth of trees, and fourth-leaf yields have proved comparable in soil with and without WOR chips thus far.

More recently in 2024, two walnut orchards in Sutter and San Joaquin counties were established with WOR and various fertilizer treatments of additional nitrogen and phosphorous to 1) focus on developing nutrient guidelines for orchard establishment and early years of WOR and 2) evaluate effects of WOR in walnut on physical, chemical, and biological properties of soil. Data will be collected annually as these orchards establish to evaluate tree survival and growth, physical and microbiological soil properties, nitrogen mobilization and immobilization, nematode populations, and eventually yield.

After this first season, the Sutter County plot demonstrated greater tree growth in soil without chips over all fertilizer treatments, indicating that rates of the fertilizer treatments at this site may need to be increased to accommodate 80 tons/acre of chips in the WOR treatment. Meanwhile, the San Joaquin County plot demonstrated greater tree growth in soil with chips over all the fertilizer treatments, indicating that with adequate nutrition, WOR can be beneficial. Additional years of research are necessary to narrow in on fertilization guidelines for young trees during orchard establishment, as well as evaluate long-term biomass breakdown in WOR and its effects on soil-borne disease and pathogens, tree growth, and walnut yield and quality.