Nitrogen Fertility in Common Beans following Whole Orchard Recycling

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UC CE

What is whole orchard recycling (WOR)?

- Process of grinding or chipping trees, spreading the wood chips evenly over the soil surface, and incorporating the biomass into the soil after the productive life of the orchard.
- More common because air quality regulations restrict growers' ability to manage biomass by burning.

Benefits and challenges of WOR

- Soil health benefits, like enhancing the soil microbial community and water infiltration.
- Woody biomass has a high carbon to nitrogen ratio (C:N), which means that initially, the N is primarily used for microbial energy and maintenance.
- Our understanding of nutrient cycling and availability is most advanced in almond WOR sites replanted back to almond, where the UC recommendation is to double the N rate in the first year after WOR.

Trial purpose and objectives

- Evaluate soil properties and bean yield following WOR of a walnut orchard.
- Compare between WOR and non-WOR control, and with two N fertilizer rates.
- We hypothesized that bean yield might be reduced following WOR due to N immobilization but that higher fertilizer N might help to overcome the yield gap.

This presentation will:

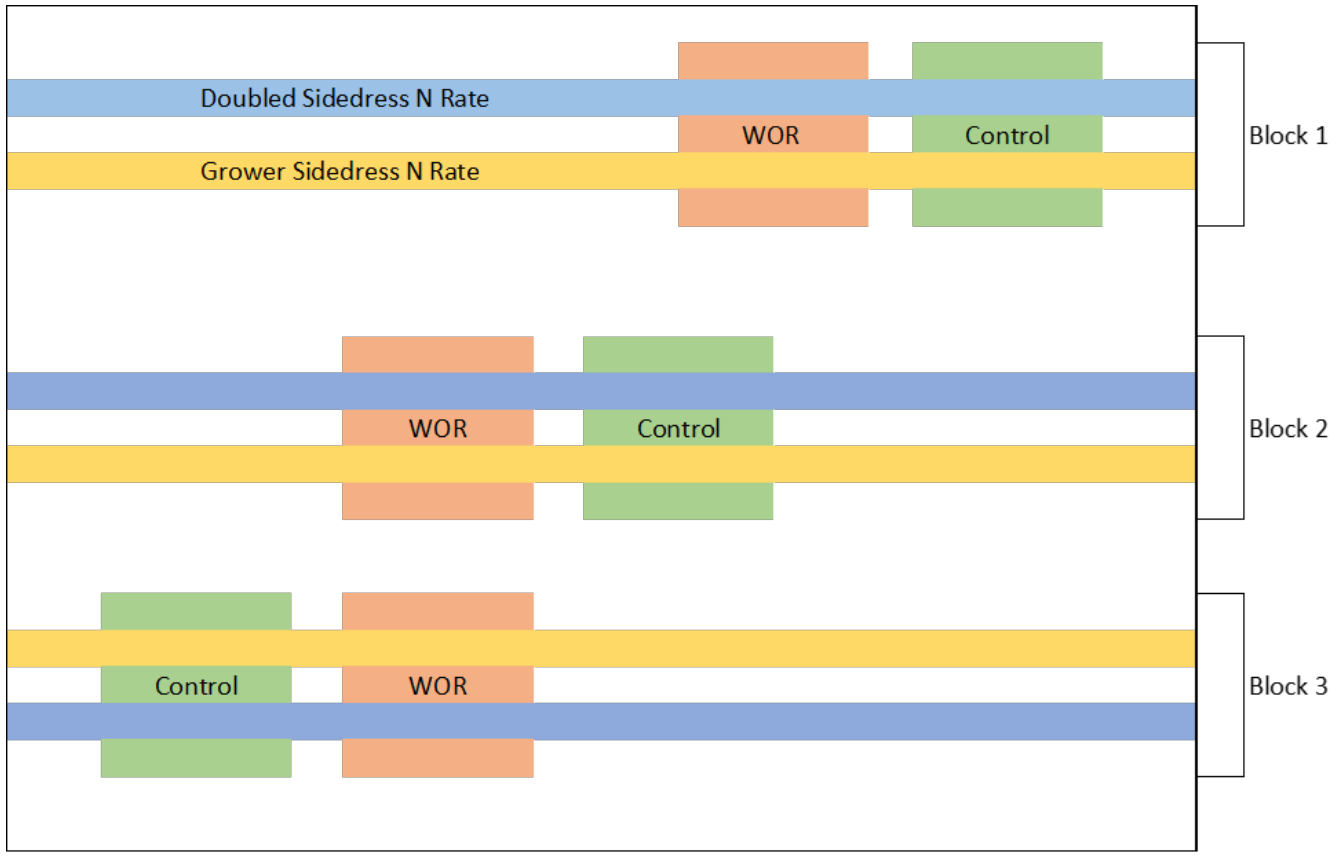
Focus on the 2020 trial results.

We also evaluated this site in 2021 to understand whether WOR was having an impact on soil properties and bean yield in the second year after recycling. Results will be available soon!

Walnut WOR occurred in June 2019 and incorporated ~70 tons of wood chips per acre

Winter cover crop, microbe colonization – Mar. 2020

Trial occurred on a 35-acre site

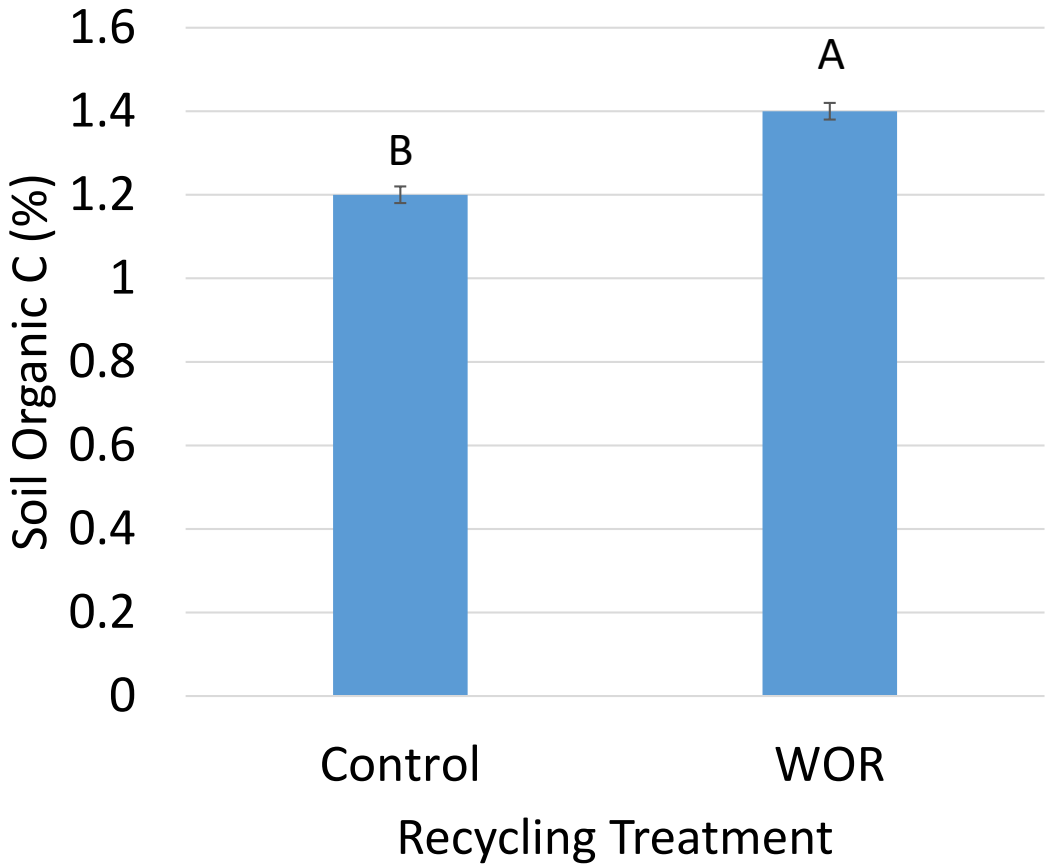


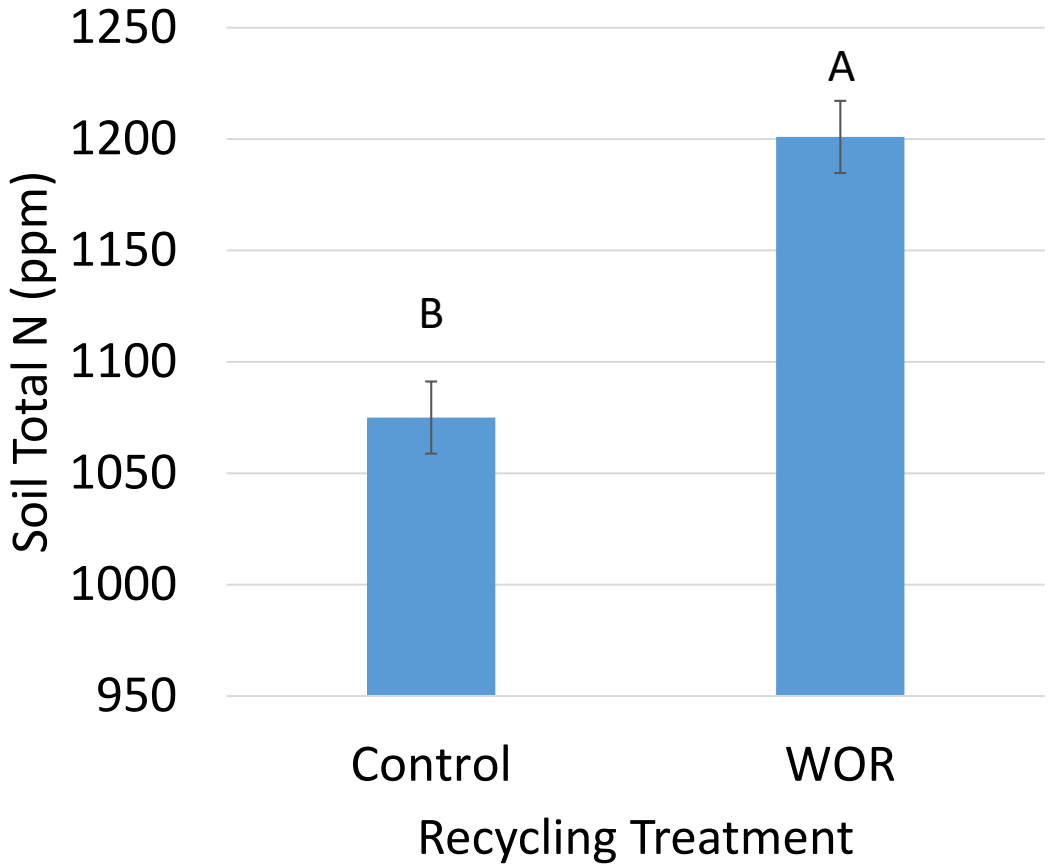
N Treatment	Standard* rate (Grower rate)	Doubled rate
Soil residual	18 lb	18 lb
At-planting fertilizer	10 lb	10 lb
Sidedress fertilizer	88 lb	176 lb
Total	**116 lb N/ac**	**204 lb N/ac**

*Based on UC dry beans production manual which indicates that a 2000 lb/ac bean crop needs approximately 80-120 lb of N to grow the crop.

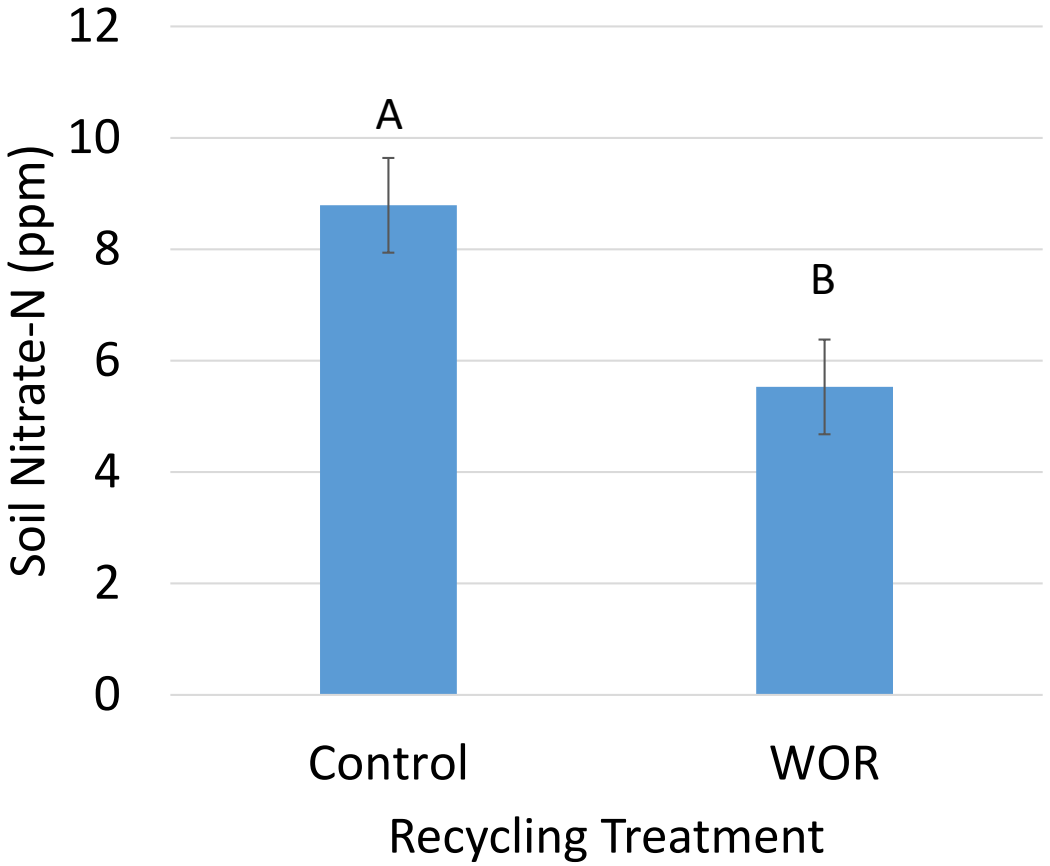
Bean growth was visibly better in the control – Aug. 2020

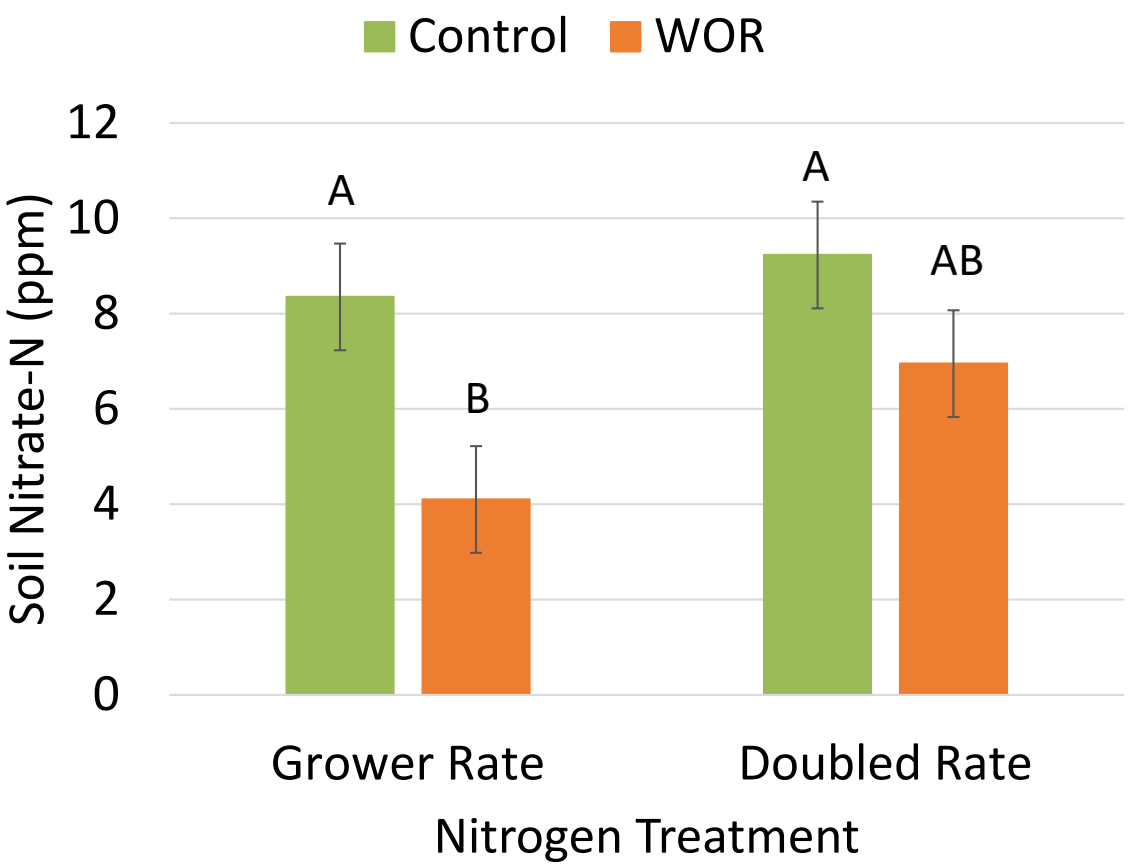
Soil organic C and N were enhanced with WOR (Oct. 2020)





Plant-available nitrate was limited by WOR (Oct. 2020)





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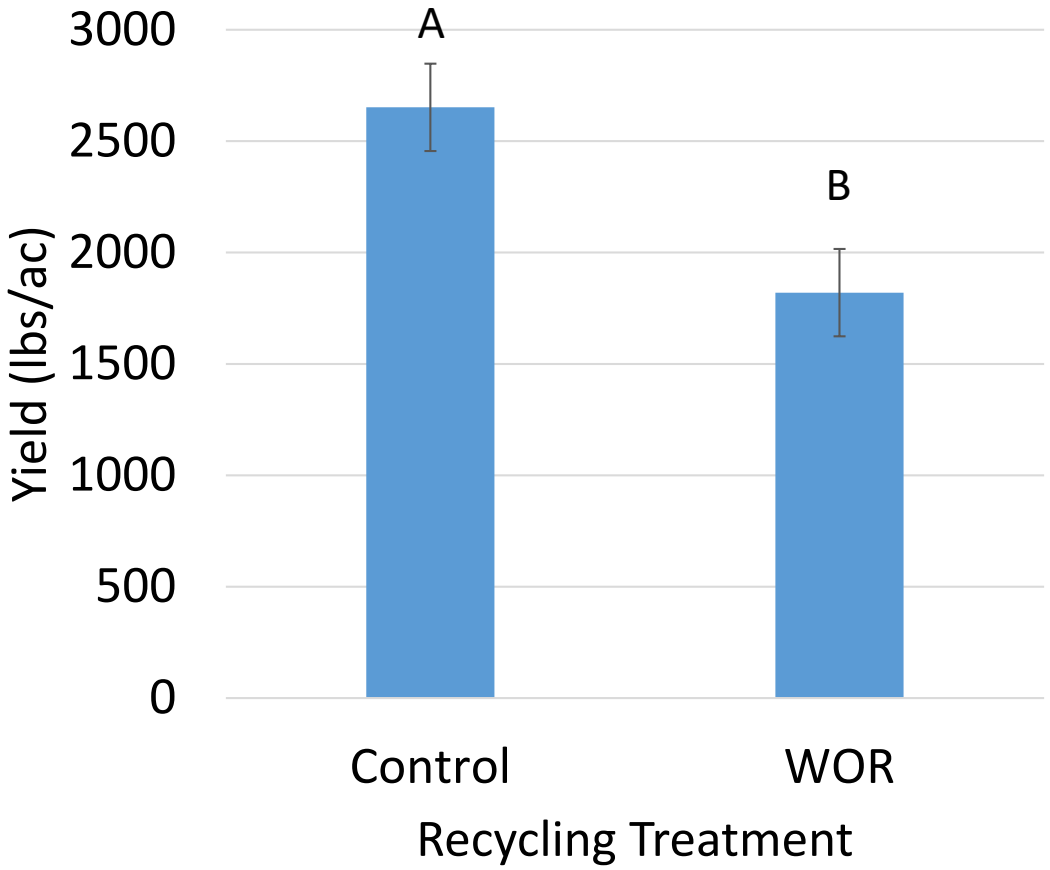
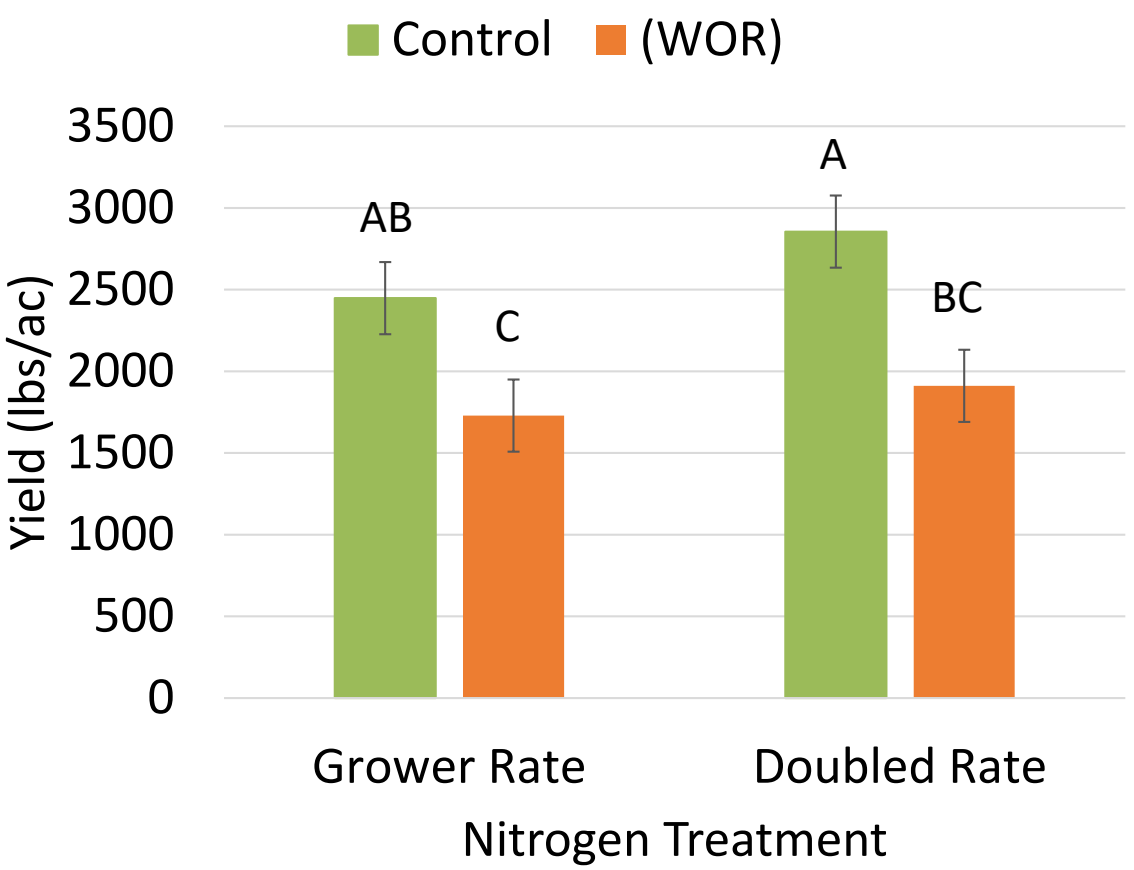
Yield was lower in the WOR treatment, but the yield penalty was overcome by the doubled sidedress rate





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Summary

- We found organic C and N to increase with WOR, but plant-available nitrate was limited by WOR.
- Bean yield suffered as a result of WOR, but doubling the fertilizer N to just over 200 lb/ac mitigated the yield penalty.
- We thank Mike Machado and Drew Cheney for their cooperation.
- See the full report at https://ucanr.edu/sites/deltacrops/Dry_Beans/

Thank you

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http://ucanr.edu/sites/deltacrops/

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