

Compost Application to Alfalfa

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Alfalfa and Forage Field Day
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Since Fall 2020, we have been evaluating the effects of applying green waste compost on established alfalfa. The three-year project includes two trials – one in the San Joaquin County Delta and the other in Yolo County. The project is supported by a CA Department of Food and Agriculture Healthy Soils Program (CDFA HSP) demonstration grant. Our interests are in evaluating whether compost enhances soil carbon and nitrogen storage, improves soil physical characteristics (i.e. improved water infiltration, reduced compaction), reduces greenhouse gas emissions, and/or boosts alfalfa yield.

Compost is decomposed organic matter from plants or animals and may be classified by the carbon-to-nitrogen ratio (C:N). The C:N is the relative amount of carbon and nitrogen in the material. Plant-derived composts (like green waste compost) have a high C:N, and animal-derived composts (like composted manures) have a low C:N. A material with a ratio greater than 30:1 is considered a high C:N material. The ratio is important because it affects microbial metabolic functioning and plant-available nitrogen. Both high and low C:N composts promote soil functioning by increasing soil carbon that is in a form easily accessible to microbes. That, in turn, can improve soil biological activity and physical conditions. With a high C:N material, however, nitrogen may be immobilized (“tied up”), so soil nutrient monitoring is important in order to stave off impacts to crops.

Methods: Compost was applied on commercial alfalfa fields where there was no history of compost application. Applications were surface-applied in the fall/winter ahead of a rain event. We are comparing two green waste compost rates – 3 tons/ac and 6 tons/ac – to the untreated control. The first compost application was made in Fall 2020 following the first cutting season of the alfalfa stands. The second application was made in Winter 2021, and the final will occur in fall/winter 2022. Baseline soil samples were collected in October 2020, and annual sampling is done every fall season before compost application. Alfalfa yield is assessed 3-4 times per year by taking quadrat samples from the grower’s windrows. Greenhouse gas samples are collected monthly.

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Figure 1. Compost spreading at the San Joaquin County trial.

Why apply compost?

- Increases soil carbon
- Promotes soil microbes with slow-release nutrients and a steady food supply
- Improves soil structure and water infiltration

Preliminary results:

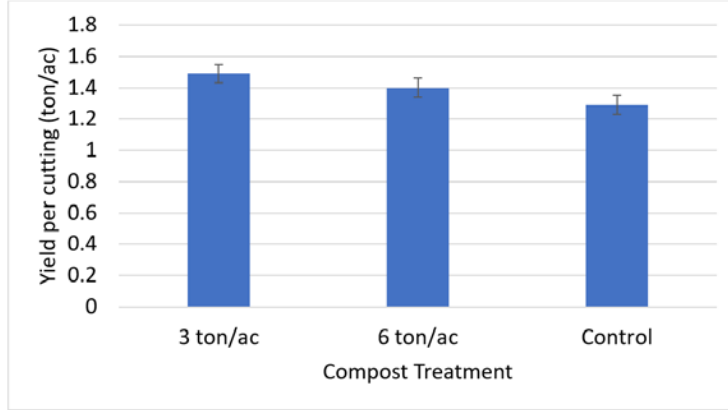


Fig 2. San Joaquin preliminary yield results over five cuttings in 2021 and 2022. The compost rate of 3 tons/ac improved alfalfa yield over the untreated control. We are also testing forage quality, and those results will be available later this fall.

Greenhouse gas fluxes:

- CO₂ efflux was higher with compost in the first year because first application spurs microbial activity.
- CO₂ efflux was similar between compost treatments and control in second year.
- Nitrous oxide efflux is similar between the compost and control.
- Methane has a negative flux in high OM soil; soil acts as sink. Trend unclear in low OM soil.

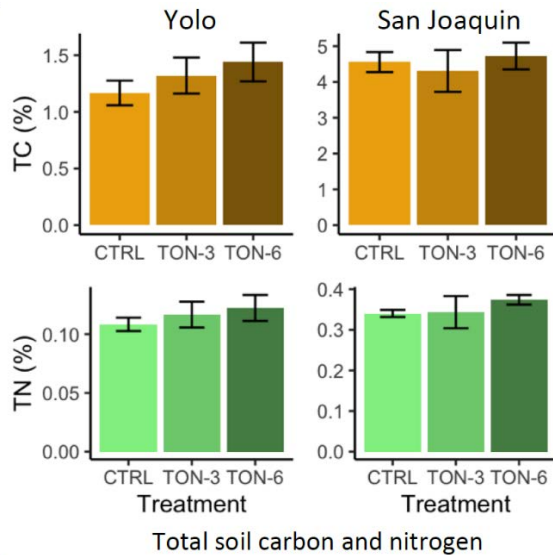


Fig 3. Total C and N have increased at the Yolo site where soil organic matter (OM) is inherently low. There have been limited changes at the San Joaquin site, which is a high OM soil.

Project funded by:



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Summary: Organic matter amendments, as from compost, can improve soil functioning and alfalfa yield, but changes take time to observe, let alone be realized financially. We estimate that compost (material plus hauling) costs approximately \$27/ton, with an additional \$10/ton for spreading. To help offset the costs, the CDFA HSP provides incentives grants for farmers and more funding may be available later this year (<https://www.cdfa.ca.gov/oefi/healthysoils/IncentivesProgram.html>). UC ANR Technical Service Providers Hope Zabronsky (hzaabronsky@ucanr.edu) or Caddie Bergren (cmbergren@ucanr.edu) are available to help growers with the application.