Vineyard Soil Health with Cover Crops

Dr. Lauren Hale, USDA-ARS, Parlier, CA
lauren.hale@usda.gov, 559-596-2865

Cover crops in vineyards may require irrigation inputs and can uptake soil water and nutrients. But cover crops can also enhance soil health and crop water productivity by

1. providing shade to reduce evaporative losses and/ or suppress weeds,
2. enhancing water infiltration into soil, reducing ponding and evaporative losses
3. inputting carbon into soils, which can enhance soil structure, nutrient and water retention, and microbial biomass and activity

Trial Overview

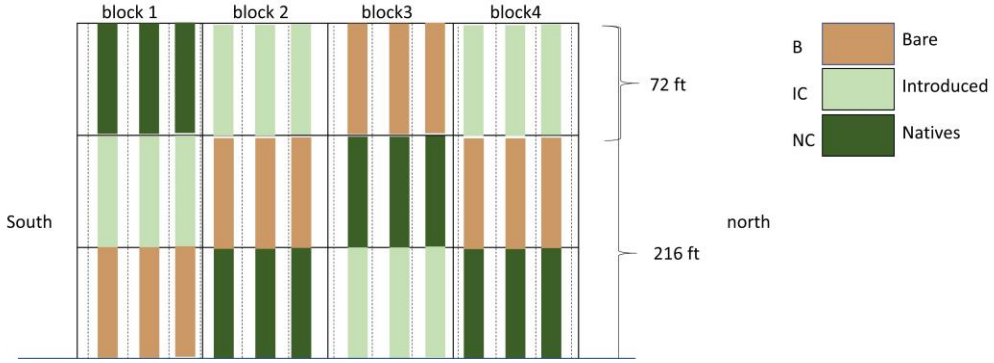
Autumn King table grapes on Freedom root stock

Cover crop treatments and control:

1. Introduced: Merced Rye (an annual grass introduced to the region)
2. Native: Tansy Phacelia (a broad leaf annual, originally from California, attracts bees)
3. Control, unplanted alleys maintained as bare ground using herbicide

Methods

Cover treatments were established in Fall 2019. Across the Spring and Summer in 2020 and 2021 we measured carbon, nitrogen, microbial biomass, infiltration rates, aggregate stability, and moisture in soils in the alleys beneath the cover (or residual cover residue) and beneath the vine rows. In the Winter of 2020 and 2021 we measured vine vigor via determining pruning weights and trunk diameters. We also quantify weekly irrigation inputs for all treatments.



Trial layout. Cover crops are planted in every alley within each subplot Two vine rows are flanked by treatment and control alleys in each subplot. All treatments are on independent, metered irrigation lines. Irrigation scheduling is determined based on soil moisture, which is monitored in all sub plots

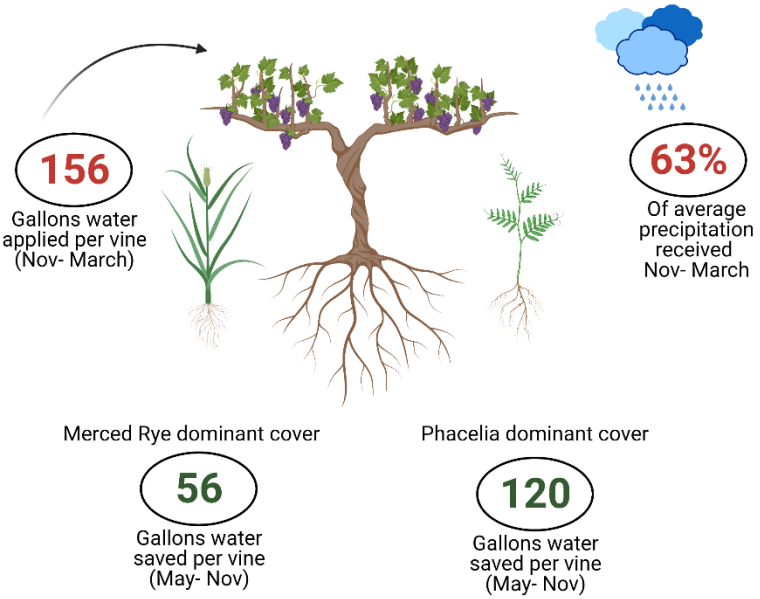
The following researchers contributed to the collection of these data: Margaret Fernando, Jean Carlos Rodriquez Ramos, Natalie Scott, Daniel Curtis, Nicole Leon.

USDA ARS

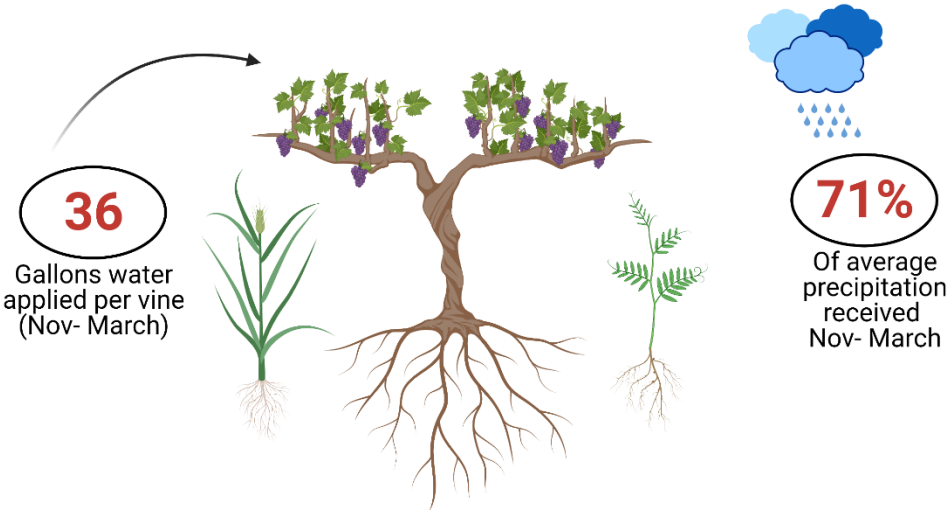
Healthy Soils Program
CDFA OFFICE OF ENVIRONMENTAL FARMING & INNOVATION

Findings

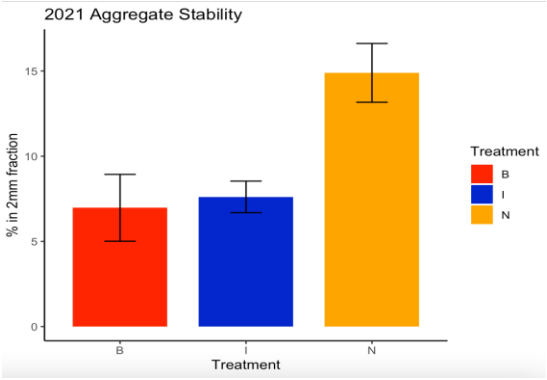
In 2020 we supplied ample water to our cover crop to ensure we had a dense stand for our research trial. We saved water in the summer because less water was supplied via drip lines to maintain similar soil moisture statuses in our cover crop treatments. We did not make up for the water used to establish the cover but did save water during hot summer months.



In 2021 we supplied less water to our cover crop treatments. We had large variation in our soil moisture data, so we did not reduce irrigation inputs to any of the treatments during the summer. But at the end of the summer there was a significant difference in the ratio of the soil water content to applied water, which indicated that the cover crop treatments did improve water dynamics in 2021 summer months.

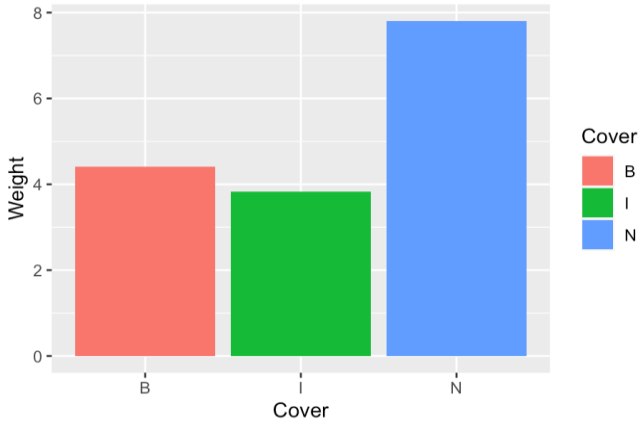


The native plant species, Tansy Phacelia, enhanced soil carbon, soil microbial biomass, and soil aggregate stability in the alleyway soils and in the vine row soils.



2021 soil aggregate stability based on the percentage of water stable aggregates larger than 2 mm.

Vine vigor was also enhanced in the native, Tansy Phacelia, cover crop treatment, which was consistent when looking at pruning weights and trunk diameters.



Per vine dry weight of pruned material in 2020

Key Takeaways

- During the cool season of dry years, cover crops were supplied irrigation water, but a good stand could be achieved with low inputs.
- Cover crops resulted in vine soils that maintained higher soil moisture per unit irrigation water input, which was consistent when cover stands were large and moderate.
- Vine vigor estimates also positively responded to the native cover crop treatment.
- We observed higher microbial biomass in response to the native cover crop treatment, even in vine row soils during the summer.
- Positive implications for vineyard soil health were associated with the native cover crop.

Notes:

Disclaimer: Mention of trade names or commercial products in this publication is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture. USDA is an equal opportunity provider and employer.