East Stanislaus
RESOURCE CONSERVATION DISTRICT

DECEMBER 2025

Soil Health Economic Case Study

Gurdial Grewal, Grewal Brothers Farming

Gurdial Grewal is a participating almond farmer in East Stanislaus Resource Conservation District's (ESRCD) **Soil Health Management Systems for Orchards in California's Central Valley** project. Funded by a Natural Resources Conservation Service (NRCS) Conservation Innovation Grant (CIG), the project addresses regional resource concerns, including impacted water supplies, poor water infiltration and water holding capacity, compaction, and low soil organic matter content. To assess the benefits of soil health practices, ESRCD conducted four cover crop and compost **comparison trials from 2021 to 2025** in almond and walnut orchards throughout the Northern San Joaquin Valley to analyze the benefits from soil health practices.

Located in Madera County, California, Gurdial, his brothers Ranbir and Bob, and his mother Sarjit purchased land in 1985 and began planting a variety of crops, including table and wine grapes, apricots, almonds, peaches, and pistachios. Irrigation water is sourced from the Madera Irrigation District and supplemented by groundwater supplies pumped by a deep well on the farm. Double line drip systems and flood irrigation serve the trees and vines on sandy loam soils on flat terrain.

For this **Soil Health and Economic Case Study**, we assessed the economic and climate impacts from Gurdial's adoption of cover crops planted annually and compost every other year on a **30-acre Treatment orchard** compared to an adjacent **23-acre Control orchard**, which was not cover cropped nor received compost. Both orchards were planted in 2012 and "in their prime" at the 13th leaf. Compost and cover crop seeds were provided to Gurdial free of charge in exchange for trial management and field access for research. ESRCD's project objectives were to quantify the outcomes from soil health practices, demonstrate successful farm implementation and encourage producers to integrate the soil health practices on their farms.

Cover Crop Management

Gurdial planted cover crops on the Treatment orchard each fall from 2021 to 2024. Seeds were provided by Project Apis m., a farmer and bee-keeper collaborative.

Species from the "BioBuild 3" blend consisted of 35% bell beans, 30% triticale, 28% peas, 3% yellow mustard, 3% daikon radish, and 1% canola. Multiple plant types are recommended due to their ability to extend the timing of emergence, bloom, and growing periods. Additional benefits include increased nitrogen fixation, flexibility in planting dates, and resilience to weather conditions. Radish, in particular, is valued for its rooting depth and ability to penetrate compacted soil layers. The seeding rate was 60lb. per acre, resulting in a cost of $50 per acre.

However, each year presented operational challenges and cost increases compared to the Control. Extra tillage was required to prepare the soil for seeding, and several mowing passes were required to terminate the cover and prepare for harvest. In 2022, the lack of fall rains resulted in forcing Gurdial to irrigate twice to germinate seeds and maintain seedling development. Gurdial notes, "We did more field work than expected and had to consider the costs and benefits. But I like the fact that the soil is showing more life, contributing to tree health, and the soil is less compacted."

Compost Application

Compost improves soil structure and porosity, and accelerates microbial activity, leading to improved water-holding capacity and nutrient cycling (nutrient availability). Typical application rates range from 3 to 10 tons per acre, applied after harvest or during the fall to allow for emergence

Farm at a Glance

COUNTY: Madera, CA

WATERSHED: San Joaquin River

CROPS: Almonds

TRIAL SIZE: 53 acres

SOIL: Sandy Loam

REGENERATIVE PRACTICES:

- Cover cropping
- Compost application
- Nutrient Management
- Irrigation Management

The trees look healthier and yields have increased. I expect additional improvement each year as we continue to add life to the soil.

—GURDIAL GREWAL

USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

seeds for bees® Project Apis m.

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and incorporation by rainfall. Gurdial applied 8 tons per acre in the Treatment on **every-other-year**, and this analysis assumes a 50% pro-rated value to determine annual compost costs. Gurdial explains, "I wasn't able to access compost each year, but I did get an opportunity to see its effectiveness as a soil amendment. After applying it twice in four years, plus annual cover cropping, I'm observing better water retention and higher organic content. The cost of the material was $28 per ton and $25 per acre for spreading, totaling $224 per acre for each year it was applied."

Climate Benefits

To estimate the climate benefits associated with the farm's soil health practices, USDA's COMET-Planner tool found that adding cover crops and compost applications, reduced tillage, and nutrient management to the Treatment orchard results in an average reduction of 196 metric tons of CO_2-equivalent per year, equal to the amount of carbon sequestered by 3,200 tree seedlings grown for ten years.

The Bottom Line

A **Partial Budget Analysis** (PBA), displayed in a T-Chart, was used to analyze the marginal benefits and costs of adopting cover crops and compost in the Treatment acreage. We used published machinery and materials costs. Along with producer-provided data to estimate the cost of operations.

This study estimates a net revenue gain of **$50 per acre per year** for the duration of the trial. Gurdial experienced slight yield gains (7%) compared to the untreated orchard but also incurred higher costs related to cover crop seeds, compost, and overall management. Gurdial believes yields will continue to increase as a result and is encouraged by the healthier soil and vigorous trees.

Closing Thoughts

Gurdial described critical soil and water resource concerns that affect his farm and the region in general. "In Madera County, groundwater levels are impacted and at very low levels. As a result, pumping is expensive and limited, and during drought years, our surface supplies are limited as well. I learned that by improving our soils, we have better water retention and soil nutrition, allowing us to stretch water use while still maintaining productive crops. The treated block is already showing yield increases over the control, and the trees look productive."

T-CHART: BENEFIT & COST ANALYSIS FROM SOIL HEALTH PRACTICES

GREWAL BROTHER FARMING

RESOURCE CONCERNS/BENCHMARK CONDITION
53 acres of almonds planted 2012
Resource concerns include soil compaction, poor water infiltration, poor water retention, and nutrient cycling.

SOIL HEALTH PRACTICES, 2021–2025
Treatment 30 acres: • 8 tons/ac greenwaste compost annually • 60lb/ac cover crop mix (PAm BioBuilder) annually
Control 23 acres: No cover crop or compost applied

POSITIVE EFFECTS	
REDUCED COSTS	**$/AC/YR**
Fertilizer costs—no reduction through 2025	
Irrigation/water—no reduction through 2025	
Mowing—no reduction through 2025	
Herbicides—no reduction through 2025	
Benefit—earlier access to orchard after rains due to cover crops	$25
Total Reduced Costs	**$25**

NEGATIVE EFFECTS	
INCREASED COSTS	**$/AC/YR**
Cover Crop costs: • Seed—60lb/acre annually • Planting equipment & labor • Light tillage/soil prep for seeding • Extra mowing termination pass	 $50 $12 $32 $32
Compost Costs • 8 tons/ac green waste x $28/ton x 50% (every other year) • Application $25/acre x 50% (every other year)	$112 $13
Total Increased Costs	**$251**

INCREASED REVENUE	$/AC/YR
Almond yield improvement 7% attributed to cover crops/compost	$266
Total Benefits = $291/ac/yr	**$291**

DECREASED REVENUE	
None identified	
Total Costs = $251/ac/yr	**$251**

$291/ac/yr Total Benefits **– $251**/ac/yr Total Costs **= $50/ac/yr Net Benefits**

Change in Net Income Per Acre = $50/ac/yr

American Farmland Trust utilized the following tools to quantify economic and environmental benefits of regenerative farming practices: NRCS's Level III T-Chart analysis to produce cost and benefits and USDA's COMET-Planner to estimate climate benefits. This table represents estimate average costs and benefits from the adoption of additional cover crop and compost application over the 30 acre study area • Values are in 2025 dollars. Almond price determined by average 2022–2025 $2.00/lb. (USDA NASS Quick Stats). • Funding for this analysis and case study was made possible by the US Department of Agriculture Conservation Innovation Grant #NR203A750008G013. • Its contents are solely the responsibility of the authors and do not necessarily represent the official view of the USDA. • Authored by Paul Lum, AFT Sr. Agricultural Specialist.

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To read more case studies, visit https://farmland.org/soil-health-in-california
For USDA's COMET-Planner Tool, see https://comet-planner-cdfahsp.com