Soil Health Case Study

Tom and Dan Rogers, CA

FEBRUARY 2020

Introduction

Tom Rogers and his brother Dan grow almonds on 175 acres of flat, sandy loam soils near Madera, California. The farm has been in the family since 1916, when their grandparents emigrated from Italy and purchased the property to raise dairy cows, pasture, cotton, corn, and alfalfa. In the late 1970s, Tom's father was compelled by a severe drought to transition to orchard farming.

By 2005, the entire farm was planted to almonds. To conserve water, the Rogers converted the irrigation system from flood to double-line drip on all but 22 acres, allowing Tom to apply water and fertilizer more efficiently through fertigation. As Tom and Dan became more involved with the farm, they realized that "everything relates to the soil." In 2009, Tom began applying compost, mulching the orchard prunings, and implementing nutrient management to improve tree and soil health. In 2018, he started maintaining the weed and native plant vegetation for conservation cover.

As a past recipient of the Farm Water Stewards Award, Tom recognizes the value of improving soil health and protecting water quality. Tom regularly consults Dan and crop advisors to improve his tree and soil conditions and spends about 22 hours each year at workshops and conferences to further his knowledge. To help with some planned innovations, the Rogers received $16,524 from the USDA Natural Resources Conservation Service (NRCS) in 2017 for irrigation system automation equipment and drip tubing, and $3,815 for conservation cover.

As a result, Tom reports improved soil tilth, water infiltration, water holding capacity, and more beneficial insects leading to decreased costs for pesticides (72%), fertilizer (55%), and irrigation (25%).

Soil Health, Economic, Water Quality, and Climate Benefits

Partial budgeting was used to estimate the marginal benefits and costs of adopting nutrient management, cover crops, mulching, and compost application in the Rogers' orchard. The study was limited to only those income and cost variables affected by the adoption of these practices. The table on page two presents a summary of these economic effects revealing that, due to the four soil health practices, Tom's net income increased by $991 per acre per year or by $173,345 annually on the 175 acres, achieving a 553% return on investment.

The Rogers believe their use of soil health practices has improved soil health and almond yields. Since 2009, Tom's average annual yield has increased 10% from 2,730 to 3,000 pounds per acre. Soon after planting almonds, Tom started practicing nutrient management. Through regular soil and leaf tissue sampling, he assesses soil and tree nutrition and considers appropriate fertilizer and microbial products to improve soil health. Over time, Tom transitioned from conventional fertilizers to ammonium thiosulfate (ATS) blends that include nitrogen (N), micronutrients, microbial products, and humic acids. These blends, combined with composting and mulching, have improved soil tilth and stabilized soil potassium (K) levels, allowing Tom to eliminate potash applications and saving him $160 per acre per year.

Mulching, composting, and conservation cover have also contributed to improvements in soil

Farm at a Glance

COUNTY: Madera, CA

WATERSHED: San Joaquin River

CROPS: Almonds

FARM SIZE: 175 acres

SOILS: Sandy loam on flat terrain

SOIL HEALTH PRACTICES: Nutrient management, conservation cover, mulching, & compost application

Once we started the soil health practices, we saw better water infiltration, yield, soil tilth, and an explosion of earthworms. It was an affirmation of what we were doing right, or a measure of how poorly we were managing the soil before.

—TOM ROGERS

USDA United States Department of Agriculture
Natural Resources Conservation Service

American Farmland Trust

health. The shredded wood deposited on the soil surface by mulching tree prunings eventually decomposes into organic matter, and air quality has improved from no longer burning the prunings. Tom's use of a shredder has a net increased cost of $15 per acre per year over the cost of burning. Adding cow manure and green waste compost to the soil costs $158 per acre annually. Rich in primary and micronutrients, compost increases microbial activity, adds 50 pounds of N per acre every year, and eliminates K purchases. Improved tree health from composting also helped eliminate fungicide applications during the last three years, saving $100 per acre per year.

For conservation cover, Tom faced a learning curve and still works to understand how to manage the cover differently from bare floor. Tom allows resident vegetation to germinate and develop with rainfall and then mows in mid-February prior to the almond bloom to minimize the risk of frost damage to developing flower buds. The cover also adds N to the soil and suppresses weed growth, saving $100 per acre annually on herbicide applications.

Tom believes that his improved soil health results in better water holding capacity. He has reduced irrigation applications, saving $95 per acre each year in decreased water and pumping costs. The drip irrigation system combined with a sound irrigation and fertilization strategy also reduces soil nitrate leaching, improving water quality.

To estimate the water quality benefits of adopting nutrient management, conservation cover, mulching, and compost application on all 175 contiguous orchard acres, USDA's Nutrient Tracking Tool was used and showed a minimal loss of nutrients and sediment, and also confirmed Tom's experience that reducing N had no adverse impact to yield. USDA's COMET-Farm Tool estimates the four soil health practices resulted in a 29% reduction in total greenhouse gas emissions.

Closing Thoughts

Tom's visionary approach toward farming and land stewardship stems from being a firm believer in the value of healthy soils. Early adoption of drip irrigation, nutrient management, mulching, composting, and the more recently added practice of conservation cover have resulted in greater almond yields and reduced costs. Despite the extra farming tasks and greater costs for some of the practices, Tom is realizing overall financial gain and improved soil health. Tom's trees are more productive, the soil is healthier, and his orchard is providing environmental benefits like better local air and water quality and lower climate emissions. Tom's farming philosophy is simple: "Take care of the soil and it will take care of the trees."

Economic Effects of Soil Health Practices on the Rogers Farm, CA (2018)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Increased almond yield due to soil health practices (10%)	$689.93	175	$120,738
Total Increased Income			**$120,738**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Fertilizer savings due to nutrient mgt ($160/ac on potash & $10/ac on N)	$170.00	175	$29,750
Fertilizer savings due to compost (50 lbs less N)	$15.00	175	$2,625
Pesticide savings due to compost (stopped fungicide)	$100.00	175	$17,500
Pesticide savings due to conservation cover (56% less herbicide)	$99.68	175	$17,444
Reduced irrigation water use by 25%	$95.00	175	$16,625
Total Decreased Cost			**$83,944**
Annual Total Increased Net Income			**$204,682**
Total Acres in this Study Area			**175**
Annual Per Acre Increased Net Income			**$1,170**

Decreases in Net Income

Decrease in Income

ITEM	PER ACRE	ACRES	TOTAL
None Identified			$0
Total Decreased Income			**$0**

Increase in Cost

ITEM	PER ACRE	ACRES	TOTAL
Leaf sampling	$3.00	175	$525
Increased mulching cost	$15.00	175	$2,625
Compost application cost	$158.00	175	$27,650
Combined practice learning activities cost (22 hrs/yr)	$3.07	175	$537
Total Increased Cost			**$31,337**
Annual Total Decreased Net Income			**$31,337**
Total Acres in this Study Area			**175**
Annual Per Acre Decreased Net Income			**$179**

Annual Change in Total Net Income = $173,345

Annual Change in Per Acre Net Income = $991

Return on Investment = 553%

This table represents costs and benefits attributed to nutrient management, conservation cover, mulching, & compost application over the 175-acre study area as reported by the farmer. • All values are in 2018 dollars. • Almond price used: $2.53/lb. Ave. yield in 2017/18: 2,260 lbs/ac. (Almond Board of California). Nitrogen: $.30/lb, Potash: $.27/lb (Estimated Costs of Crop Production in Iowa—2018, ISU). • Return on Investment is the ratio of Annual Change in Total Net Income to Annual Total Decreased Net Income expressed as a percent (i.e., net profit/cost of investment). • Financial assistance from NRCS was not included in the partial budget analysis, as it is not an economic effect of soil health practices themselves. • For study methodology, see https://farmland.org/soilhealthcasestudies. For USDA's Nutrient Tracking Tool, see https://www.oem.usda.gov/nutrient-tracking-tool-ntt. For USDA's COMET-Farm Tool, see http://cometfarm.nrel.colostate.edu. • Rounding errors may result in minor discrepancies in calculated results. • This material is based on work supported by a 2018 USDA NRCS CIG grant: NR183A750008G008.

For more information about this study or to discuss soil health practices, please contact

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