ASSESSING SOIL HEALTH SERIES

Economics of Soil Health: Farmer Experiences across Systems

By Archie Flanders, Agricultural Economist, Soil Health Institute

The purpose of this article to provide detailed economic evidence of how soil health management practices can be profitable across cropping systems and geographies of the United States. We do this by providing more details of six farms that come from four larger studies developed and implemented at the Soil Health Institute to evaluate economic benefits of farmers adopting soil health management systems. The Assessing Soil Health Series is part of a larger Soil Science Society of America webinar series produced in partnership with The Soil Health Institute and sponsored by The Walton Family Foundation. Earn 0.5 CEUs in Soil & Water Management by reading the article and taking the quiz at https://web.sciencesocieties.org/Learning-Center/Courses.

Soil health management follows four principles, which farmers can follow to achieve more regenerative agricultural production and better soil health: (1) Minimizing soil disturbance is often attained by reducing tillage activities. (2) Maximizing biodiversity incorporates crop rotations, cover crops, and livestock grazing in the production of typical cash crops. (3) Maximizing living roots in the soil includes annual cover crops between cash crops or can include planting perennial cover crops that will live across several cash crops. (4) Maximizing soil armor (or soil cover) is attained with no-till residue as well as planting a cover crop. These are the more common practices that can be used to achieve soil health and can be applied across a multitude of geographies and cropping systems.

The purpose of this article to provide detailed economic evidence of how these management practices can be profitable across cropping systems and geographies of the United States. We do this by providing more details of six farms that come from four larger studies developed and implemented at the Soil Health

DOI: 10.1002/crso.20202

A Soil Science Society of America series

produced in partnership with The Soil Health Institute and sponsored by The Walton Family Foundation

Multi-species cover crop mixtures can help maximize biodiversity and soil cover. Photo by David Lamm/Soil Health Institute.

Institute (SHI) to evaluate economic benefits of farmers adopting soil health management systems (SHMS). With the support of Cargill, SHI conducted 100 interviews of corn and soybean farmers in nine states (Illinois, Indiana, Iowa, Michigan, Minnesota, Nebraska, Ohio, South Dakota, and Tennessee) who have adopted no-till, reduced tillage, and/or cover cropping for at least five years. A second and ongoing study supported by the Natural Resource Conservation Service (NRCS) and in partnership with National Association of Conservation Districts (NACD) includes surveys from 30 farms across various U.S. production regions. With 25 farms completed, crops in this project included corn, soybean, winter wheat, spring wheat, cotton, peanut, canola, dried bean, sunflower, yellow pea, grain sorghum, walnut, and sugarbeet. The Healthy Soils for Sustainable Cotton project interviewed five farmers across five states, including in North Carolina, South Carolina, Georgia, Mississippi, and Texas, with cotton production and rotation crops. A second project with NACD interviewed three farmers in Pennsylvania and New Jersey producing corn, soybean, and wheat.

Economics of Adopting Soil Health Management Systems

Adopting soil health management practices entails the adoption of marginal practice changes and does not require a complete overhaul of current farm management practices. Partial budget analysis of adopting soil health practices includes quantifying the changes in net farm income that are a result of changing production practices (see methodology in Soil Health Institute, 2021). Thus, partial budget results attempt to determine the expected changes in net farm income that result from adopting soil health practices.

Changes in management, input, and yield data were recorded from farmer interviews and then used to develop a partial budget analysis. The partial budget analysis compares the SHMS employed to management practices that do not include SHMS. The partial budget analyses at SHI quantified differences in production expenses and revenue for each crop produced. The expense categories considered included seed, fertilizer and amendments, pesticides, fuel and electricity, labor and services, post-harvest costs, and equipment ownership. Change in revenue was calculated using the reported yield changes due to adopting SHMS and U.S. long-term average crop price.

Average Change in Net Farm Income

For each crop, reduced expenses, additional expenses, and change in revenue were calculated for farms in each of the four studies. For the 100-farm corn and soybean study, average net farm income increased $48/ac for corn and soybean. For the 30-farm corn and soybean study, net farm income increased an average of $86/ac for the 25 farms completed. For the Healthy Soils for Sustainable Cotton project, average increase in net farm income was $101/ac for cotton and associated crops in rotation. The three farms in Pennsylvania and New Jersey averaged $32/ac in net farm income increase.

Farm Experiences in Adopting Soil Health Management Systems

Aggregating the results from multiple economic studies indicates that geography and climatic conditions are not significant limitations to prevent successful adoption of SHMS. Examination of six farms from the SHI economic studies provides specific circumstances for others who may be considering adoption of SHMS. The six farms include adoption of no-till only, adoption of no-till and cover crops, adding cover crops to existing no-till production, no-till and cover crops in an arid region, and cover crops in orchard crop production.

A 300-ac farm in New Jersey had adopted no-till corn and soybean production for 15 years. Eliminating tillage resulted in reduced expenses of $37.28/ac for corn and $32.77/ac for soybean. As herbicide applications replaced tillage in weed management, additional expenses were $24.15/ac for corn and $23.25/ac for soybean. Crop resiliency increased for corn during periods of climatic stress, and average yield increased 2 bu/ac. No yield change was reported for soybean. Average net farm income increased $22.13/ac for corn and $9.52/ac for soybean.

A farm in Delaware had adopted no-till production and cover crops for corn and soybean. The SHMS had been practiced for 15 years. Winter/cereal rye was planted as a cover crop for both cash crops with hairy vetch added for corn. Additional expenses for adopting the SHMS were $46.81/ac for corn and $28.54/ac for soybean. Benefits of reduced expenses were $98.90/ac for corn and $33.93/ac for soybean. Reduced corn expenses included $24.84/ac for fertilizers and amendments and $10.65/ac for reduced pesticide use. There were no expense reductions in these two categories for soybean. No yield changes were attributed to the SHMS, and net farm income increased $52.09/ac for corn and $5.39/ac for soybean.

An 800-acre farm in Minnesota had practiced no-till corn and soybean production for 20 years with cover crops added to the SHMS for 10 years. Cover crop species for corn and soybean included winter/cereal rye, rapeseed, radishes, and turnips. Cover crop seed costs were $20/ac, and custom planting was $11.00/ac. Benefits of the SHMS included reduced fertilizer and amendment expenses of $47.11/ac for corn and $24.83/ac for soybean, and reduced pesticide expenses were $7.52/ac for corn and $26.92/ac for soybean. Reduced production expenses were $24.20/ac greater than additional production expenses for corn and $24.84/ac greater than additional production expenses for soybean. Increased yields attributable to the SHMS were 20 bu/ac for corn and 6 bu/ac for soybean. Net farm income increased $124.20/ac for corn and $107.92/ac for soybean.

A 6,600-ac farm in South Carolina, with 2,000 ac of cotton, had been in no-till production for 10 years with cover crops planted for seven years. Cover crop seed expense was $22.00/ac for a mix of winter/cereal rye, hairy vetch, winter pea, crimson clover, tillage radish, and black oats. Reduced expenses of $157.14/ac included $89.91/ac for fertilizer and amendments. Additional expenses totaled $94.47/ac for adopting the SHMS. There was no cotton yield increase, and net farm income increased $62.67/ac.

A 2,400-ac farm in Oregon is an example of cover crop benefits in an arid climate. The farm planted 1,000 ac of winter wheat and 200 ac of sunflowers each year with 1,200 annual fallow acres. Cover crops (triticale, oats, common vetch, spring peas, and forage collards) with seed expense of $25.00/ac were planted in April before planting winter wheat in September. Although winter wheat additional expenses of the SHMS were $21.69/ac greater than reduced expenses, a 20 bu/ac wheat yield increase resulted in a $88.31/ac net farm income increase.

Maximizing soil armor (or soil cover), one of the four principles of soil health management, is attained with no-till residue as well as planting a cover crop. Photo by Dianna Bagnall/Soil Health Institute.

Sunflower had reduced expenses of $16.35/ac greater than additional expenses. There was no sunflower yield change, and net farm income increased $16.35/ac.

A walnut orchard in California demonstrates cover crops in conjunction with other regenerative production practices to enhance natural biological activity in agricultural production. The 193-ac farm had planted cover crops for six years. Cover crops with total seed costs of $25.00/ac were annual rye, oats, wheat, barley, triticale, chicory, mustard, radish, velvet peas, vetch, and phacelia. Cover crops were planted in November after the walnut harvest. The cover crop was roller-crimped and then shredded with a mower in April. Pesticide expense reductions for miticides, insecticides, and fungicides comprised $440.00/ac of the $695.92/ac reduced expenses. Additional expenses were $270.73/ac so that net farm income increased $425.19/ac due to the adoption of a cover crop.

Summary

Soil health practices are marginal changes from conventional production methods with most seasonal activities and inputs remaining unchanged compared with conventional practices. Data from multiple studies conducted by SHI demonstrate increased net farm income because of adopting soil health practices. The range of geography and cropping systems in the studies indicate the potential for other U.S. farmers to increase net farm income by adopting practices that improve soil health.

Reference

Soil Health Institute. (2021). *Partial budget analysis methodology used by the Soil Health Institute*. https://bit.ly/3PvVO90

SELF-STUDY CEU QUIZ

Earn 0.5 CEUs in Soil & Water Management by taking the quiz for the article at https://web.sciencesocieties.org/Learning-Center/Courses. For your convenience, the quiz is printed below. The CEU can be purchased individually or you can access as part of your Online Classroom Subscription.

1. **The economic studies on adoption of soil health management systems by SHI indicate**
   - **a.** benefits are greater than the costs of purchasing seed and managing cover crops.
   - **b.** a soil health management system with cover crops increases pesticide expenses.
   - **c.** cover crops should never be planted in arid regions due to soil moisture concerns.
   - **d.** All of the above.

2. **The SHI economic studies of farms with soil health practices such as no-till\reduced tillage and cover cropping showed that most of the farms increased expenses compared with conventional tillage so that net farm income only increased with increased crop yield.**
   - **a.** True.
   - **b.** False.

3. **The farmers interviewed for the SHI economic studies reported that the benefit of adopting soil health management practices was**
   - **a.** reduced expenses for seed drying.
   - **b.** elimination of soil testing.
   - **c.** shortened growing season for optimal production.
   - **d.** decreased expenses for fertilizer and amendments.

4. **Adopting soil health management systems**
   - **a.** provides net farm income benefits in fewer than five years.
   - **b.** involves marginal changes without a complete overhaul in production practices.
   - **c.** increases crop yields so that additional revenue is greater than additional expenses.
   - **d.** increases oil content of soybean so that price premiums are available.

5. **Cover crops are not planted in orchards because the tree roots grow deep in the soil so that cover crops provide no soil health benefits at those depths.**
   - **a.** True.
   - **b.** False.