Rye cover crop residue after herbicide termination, prior to corn planting

Earthworms on a root ball

Soil Health Case Study

Scotty Herriman, Herriman Farms, OK

JULY 2022

Introduction

Scotty Herriman

Scotty Herriman farms 2,000 acres near South Coffeyville, Oklahoma, with his wife, Jo. They grow corn and soybeans, and occasionally grain sorghum (milo) and wheat. His farmed fields consist primarily of silt loam and silty clay soils in the Verdigris River floodplain. After a historic flood in 2007 resulted in profiting from only 13 acres, then a poor crop yield in 2008, it became clear to Scotty that he needed to change his farming practices.

Scotty heard about producer-successes with reduced tillage, so in 2010 he adopted no-till soybeans and strip-till corn. Scotty has increased herbicide applications since adopting no-till, but this is offset by Scotty's time savings, reduced equipment maintenance, and significant positive changes in his soil. For example, Scotty sees that prior year plant-root channels run deeper into the ground, which improve soil infiltration and create a more stable and resilient soil structure. Scotty has also seen higher quality crop stands that are less stressed by drought and pests due to increased crop vigor.

With the goal to reduce herbicide use, Scotty adopted cover crops, primarily cereal rye in 2016. While the cover crop did provide weed suppression benefits enabling Scotty to reduce his herbicide applications slightly, he still experiences higher overall herbicide costs since adopting no-till, in addition to a herbicide pass for cover crop termination. Scotty observes the cover crops leave a mulch layer an inch thick, which he believes has increased soil moisture retention.

In 2016, Scotty also modified his nutrient management. For corn, to provide optimal nutrient placement for crop growth, Scotty switched from anhydrous ammonia and diammonium phosphate fertilizers to a split-application of liquid NPK blend fertilizer (first in-row then a side-dress application). For soybeans, per a recommendation from another producer, Scotty began applying an agro-liquid pro-germinator NPK blend (9-24-3) at planting to improve seed establishment with no-till. Thus, nitrogen and phosphorous applications to soybeans increased by 5 lbs/ac/yr and 13 lbs/ac/yr, respectively, because previously Scotty applied no fertilizer in soybean years since the crop is a nitrogen-fixing legume.

While Scotty incorporates various soil health practices on all 2,000 farmed acres, the following economic analysis focuses on 350 acres where the soil health practices as described above have been implemented.

Soil Health, Economic, Water Quality, and Climate Benefits

A partial budget analysis (PBA) was used to analyze the marginal benefits and costs of adopting cover crops, strip-till corn, no-till soybeans, and nutrient management changes within the 350-acre study area. We used a combination of published machinery and material cost estimates and farmer-provided data to estimate the cost of operations, on average, before and after soil health practice adoption. The analysis was limited to only those income and cost variables affected by the adoption of these practices. The PBA table below summarizes these economic effects, revealing that due to soil health practice adoption, Scotty's net income increased by $4/ac/yr, a total of $1,402/yr, achieving a 7% return on investment.

Farm at a Glance

COUNTY: Nowata, OK

WATERSHED: Verdigris River

CROPS: Corn & soybeans

FARM SIZE: 2,000 acres (350-acre study area)

SOILS: Silt loam & silty clay, 0–1% slopes

SOIL HEALTH PRACTICES: Cover crops, strip-till & no-till, nutrient management

Scotty discussing soil health practices with another producer

USDA United States Department of Agriculture Natural Resources Conservation Service

Oklahoma Conservation Commission Conserve-Protect-Restore

American Farmland Trust

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Scotty attributes 25% of his corn and soybean yield increases since 2010 to his adoption of soil health practices, thus accounting for the largest benefit in the PBA table of $28/ac/yr. Scotty's average annual soybean yield has increased overall by 5 bu/ac, and his corn yield has increased by 40 bu/ac. Scotty did not change seed varieties but did change seed companies.

While herbicide costs have increased by $7/ac/yr, Scotty's machinery costs have decreased by $32/ac/yr since his adoption of no-till and strip-till. Fewer passes across the field has resulted in fewer mechanical issues, less overall machinery maintenance costs, less fuel needed, and more time savings.

As a result of the combined soil health practices, erosion has decreased by 1 ton/ac/yr as estimated by USDA's Nutrient Tracking Tool (NTT), worth $713/yr across the study area based on the $1.18/ton value of soil nutrients no longer running off, and Scotty's estimated $300/yr reduced mechanical erosion repair costs. This averages to be $2/ac/yr.

In addition to the economic benefits Scotty has experienced, he has noticed benefits to his soil structure and biota. Scotty has observed less soil compaction, an increase in earthworm activity, and higher levels of soil organic matter.

To estimate the water quality and climate benefits of these soil health practices, we used NTT and COMET-Farm tools on a 60-acre, representative field. Scotty's use of cover crops, strip-till, no-till, and nutrient management reduced nitrogen, phosphorous, and sediment losses by 73%, 22%, and 86%, respectively, as estimated by NTT. Further, his combined soil health practices resulted in a 54% reduction in total greenhouse gas emissions as estimated by the COMET-Farm Tool, corresponding to taking 3.9 cars off the road.

Closing Thoughts

Herriman Farms has benefited from soil health practices, but Scotty recognizes the challenges that come with getting started. "It's a learning curve. Learning how to work in harmony with the weather, resisting the urge to break out the plow when things didn't go exactly how I envisioned, and timing the planting windows to get the most benefit of moisture while staying ahead of weeds," he said to emphasize the effort required to forge the right soil health management system. Scotty believes in the importance of sharing his story to help others make informed decisions about conservation practices. He celebrates his healthy soil and looks forward to the lasting benefits of his hard work.

Writer: Maryanne Dantzler-Kyer, Oklahoma Conservation Commission, Environmental Projects Coordinator

Economic Effects of Soil Health Practices on Herriman Farms, OK (2020)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Increased soybean (+1.25 bu/ac) and corn (+10 bu/ac) yields due to SH practices	$28	350	$9,964
Total Increased Income			**$9,964**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Machinery cost savings due to reduced till	$32	350	$11,196
Value of decreased erosion	$2	350	$713
Total Decreased Cost			**$11,908**
Annual Total Increased Net Income			**$21,872**
Total Acres in this Study Area			**350**
Annual Per Acre Increased Net Income			**$62**

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
Increased herbicide cost due to reduced till	$7	350	$2,590
Cover crop costs	$37	350	$12,950
Increase in fertilizer on soybeans	$7	175	$1,306
Increased machinery cost due to switch from dry to liquid fertilizer applications	$7	350	$2,317
Learning costs (50 hrs/yr)			$1,308
Total Increased Cost			**$20,471**
Annual Total Decreased Net Income			**$20,471**
Total Acres in this Study Area			**350**
Annual Per Acre Decreased Net Income			**$58**

Annual Change in Total Net Income = $1,402

Annual Change in Per Acre Net Income = $4

Return on Investment = 7%

• This table represents estimated average costs and benefits reported by the farmer, Scotty Herriman, for adopting no-till soybeans, strip-till corn, cereal rye cover crop, and nutrient management over a 350-acre study area. • All values are in 2020 dollars. • Prices used: Corn: $4.30/bu, Soybeans: $11.15/bu (USDA NASS, Feb 2021, Crop Values: 2020 Summary); Nitrogen: $0.34/lb, Phosphate: $0.39/lb (ISU Extension and Outreach, Jan 2021, Ag Decision Maker: Estimated Costs of Crop Production in Iowa). • Value of decreased erosion ($1.18/ton) is based on estimated N & P content of the soil (2.32 lbs N/ton, 1 lb P/ton) and fertilizer prices (USDA NRCS, May 2010, Final Benefit-Cost Analysis for the EQIP) and Scotty's estimate of reduced mechanical erosion repair costs. • Return on Investment is the ratio of Annual Total Change in Net Income to Annual Total Decreased Net Income, as a percent. • For information about: (1) study methodology, see farmland.org/soilhealthcasestudies; (2) USDA's NTT, see ntt.tiaer.tarleton.edu/; and (3) USDA's COMET-Farm Tool, see comet-farm.com • This material is based on work supported by a USDA NRCS CIG grant (NR183A750008G008) and a grant from the Oklahoma Conservation Commission. • Scotty received $5/ac/yr through the USDA Risk Management Agency Cover Crop Program (2016–present). This is not included in the analysis because cost-share is temporary and not received by all.

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

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