Cover Crops | Crop Rotation | Nutrient Management

Springhill Farms, KY
SOIL HEALTH CASE STUDY

OCTOBER 2024

Canola field at sunset

Jonathan Reynolds and his wife, Gracie, are the owner-operators of Springhill Farms, a 1,600-acre farm in Hickman County, Kentucky. They, alongside two employees, grow canola, corn, and soybeans on highly productive silt loam rolling hills, with 40 acres of flat creek bottom. Prior to introducing canola into their rotation after corn in 2020, the farm grew 800 acres each of corn and soybeans annually. Now, in addition to corn and soybeans, the Reynolds plant 300 acres of canola over the winter after corn, a cover crop mix after the soybeans, and the remaining 500 acres go into a cover crop mix.

Jonathan, a 6th generation farmer who first sat on a combine at 18 months old, inherited Springhill Farms from his grandfather, Jerry Peery, who started the farm in 1957. Jerry was an early adopter of no-till in the '70s, and the farm has been no-till ever since. Cover crops were the missing piece of the soil health puzzle, however, until Jerry received an NRCS Environmental Quality Incentives Program (EQIP) cost-share contract in 2010 to implement cover crops.[1] Although it was a long learning curve for the first ten years, Jonathan emphasizes, "in the last four years, we've really got our cover crop dialed in, and we've figured out what works for us. I can't imagine not putting a cover crop out now."

Jonathan plants a cereal rye/black oats/kale/crimson clover cover crop mix after corn and swaps out the cereal rye for annual rye in his mix after soybeans. The cover has eliminated the need for a pre-emergent herbicide pass before planting. "Cover crops help keep the weeds at bay. It's not going to be perfect, but it keeps them suppressed long enough for us to wait and get in with our regular post-emergent pass. That's where the cover crops really shine for us," Jonathan explains.

In 2016, the Reynolds began experimenting with their nutrient management program, particularly on corn. Prior to 2016, they applied anhydrous nitrogen (N) and chicken litter. Now, they apply chicken manure more consistently and have switched from anhydrous to UAN fertilizer, which they Y-drop with a split application, using Variable Rate Technology (VRT). They also switched from grid to zone sampling. These practices have lowered their synthetic N application considerably.

Canola was first introduced into the farm's rotation in 2020 to increase and diversify the farm's income and improve soil health. They currently sell it to Perdue for industrial purposes, but Jonathan may pivot to producing it for sustainable aviation fuels in the future.

Soil Health Economic & Environmental Estimated Outcomes

Partial budgeting analysis was used to estimate the marginal benefits and costs of adopting conservation crop rotation, cover crops, and nutrient management at Springhill Farms. The study was limited to only those income and cost variables affected by the adoption of these soil health practices. The table on page 2 presents a summary of these economic effects, revealing that, due to the three practices, Springhill Farms' net income increased by $129/ac/yr on the 1,600-acre study area, achieving a 151% return on investment.

The largest per-acre increase is the 11% higher yields on corn and 23% higher yields on soybeans that Jonathan ascribes to soil health practices. This constitutes an additional $126/ac/yr income for the farm. In addition to yield boosts from soil health practices, Jonathan also noticed that soybeans could handle cooler conditions, yielding an extra 10 bu/ac yield increase simply by planting them earlier in the season.[2] The adjustment in crop rotation to include canola constitutes the farm's other increase in net income, adding a significant $289/ac/yr.

With changes in nutrient management and enhanced fertility provided by cover crops, Jonathan reduced his applied N by 18%, saving the Reynolds $25/ac/yr. He noted, "We've

Jerry Peery & Jonathan Reynolds, with Jonathan's son, Noah

Farm at a Glance

COUNTY: Hickman, KY

WATERSHED: Cane Creek–Obion Creek

CROPS: Canola, corn, & soybeans

FARM SIZE: 1,600 acres

SOILS: Silt loam on rolling hills of 12–15% slopes

SOIL HEALTH PRACTICES: Conservation crop rotation, cover crops, & nutrient management

Planting corn into terminated 4-way cover crop mix

seen that we've been able to pull back on nitrogen and not sacrifice yield. If anything, we've gone up in yield, so we've reallocated those dollars to other things instead of just nitrogen and that's really paid off for us." Cover crops have also decreased weed pressure in Springhill Farms' fields, resulting in reduced herbicide product needed on soybeans, accounting for $36/ac/yr in savings. Switching from grid to zone sampling also saves the farm an additional $1,200/yr.

NRCS's soil erosion calculation software, RUSLE2, estimates that Springhill Farms is saving 1.2 tons of soil/ac/yr, equating to $3,976/yr in saved nutrients.[3] The reduced runoff is evident in the creek that runs through the farm. Jonathan explains, "When we get a really big rain, the water that's coming out of our fields and going into that creek is much, much clearer than some of our neighbors and some of the other creeks that surround it."

The largest incurred cost on the farm is due to cover crop establishment, termination, and machinery costs, which have increased farm spending by $75/ac/yr. One herbicide pass on corn was shifted to terminate the cover crop before planting, while an additional herbicide pass is used to terminate cover crops prior to soybeans. A minor cost ($0.05/ac/yr) involved switching one fertilizer pass on corn from liquid to chicken litter. The farm's second largest cost increase comes from the increase in nutrients applied to soybeans, with Jonathan now applying potassium, sulfur, and boron, totaling an additional $47/ac/yr. However, the resulting yield increases more than offset all these costs.

Finally, Jonathan estimates spending an average of 25 hours per year on learning activities related to soil health practices, resulting in an annual cost of $731.

Closing Thoughts

Jonathan attributes the successful management of Springhill Farms to his grandfather Jerry, who passed away this past January. "He let me take risks and try some things I otherwise wouldn't have done," Jonathan reflects. "He set me and my family up for success on this farming operation." Jerry instilled in Jonathan qualities he now believes are essential for the soil health journey: curiosity and humility. "My grandad never believed he had it all figured out and sought to surround himself with people that would challenge his current views, push him to learn more, and support him in that process. That's what I try to emulate."

—Lia Raz, American Farmland Trust, Case Study Conservation Agronomist

ECONOMIC EFFECTS OF SOIL HEALTH PRACTICES ON SPRINGHILL FARMS, KY (2023 PRICES)[4]

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield increase due to soil health practices (+11% corn, +23% soybeans)	$126	1,600	$201,162
Increase in net income due to adding canola to rotation	$289	300	$86,751
Total Increased Income			**$287,913**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Fertilizer cost decrease on corn due to cover crops and nutrient management	$25	800	$20,080
Herbicide savings due cover crop adoption	$36	800	$28,800
Switching from grid to zone soil sampling	$2	800	$1,200
Value of decreased soil erosion (1.2 tons/ac/yr) due to cover crops	$2	1,600	$3,976
Total Decreased Cost			**$54,056**
Annual Total Increased Net Income			**$341,969**
Total Acres in this Study Area			**1,600**
Annual Per Acre Increased Net Income			**$214**

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
Cover crop establishment, termination, & machinery costs	$75	1,300	$98,089
Machinery cost increase on corn from switching one pass to dry fertilizer	$0.05	800	$40
Fertilizer cost increase on soybeans due to increases in potassium, boron, and sulfur	$47	800	$37,464
Soil health practices learning activities (25 hrs/yr)			$731
Total Increased Cost			**$136,324**
Annual Total Decreased Net Income			**$136,324**
Total Acres in this Study Area			**1,600**
Annual Per Acre Decreased Net Income			**$85**

Annual Change in Total Net Income = $205,645

Annual Change in Per Acre Net Income = $129

Return on Investment = 151%

[1] Springhill Farms received $26/ac/yr for cover crops over a period of 7 years through the NRCS EQIP Program. This is not included in the analysis because cost-share is temporary and not received by all. [2] Because this soybean yield boost is not a result of a soil health practice, it is excluded from the analysis. [3] Value of decreased erosion 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, *Benefit-Cost Analysis for the EQIP*), and NRCS's RUSLE2 soil erosion software estimate of reduced erosion. [4] This table represents estimated average costs and benefits attributed to adopting conservation crop rotation, cover crops, & nutrient management over the entire study area (1,600 acres), where canola, corn, & soybeans are grown, as reported by the farmer. • All values are in 2023 dollars. • Rounding of per acre values may result in minor discrepancies in totals. • Prices used: Canola: $13.32/bu, Corn Grain: $5.65/bu, Soybeans: $13.26/bu (*USDA NASS, 2022-2024, Crop Values Summary, 2019–2023 averages*); Nitrogen: $.63/lb, Phosphate: $.61/lb, Potash: $.54/lb (Iowa State University, 2022–2024, *Ag Decision Maker: Estimated Costs of Crop Production in Iowa, 2019-2023 averages*); Sulfur: $.90/lb, Boron: $18.89/lb (Farmer-provided); 2023 hourly labor rate: $29.23/hr (U.S. Bureau of Labor Statistics, 2023, *Occupational Employment & Wage Statistics, First-Line Supervisors of Farming*) • For information about study methodology, see farmland.org/soilhealthcasestudies. • This material is based on AFT's work supported by a USDA NRCS Cooperative Agreement #NR223A750010C003.

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