Seeding soybeans into cereal rye

Seeding cereal rye into corn

Soil Health Case Study

Larry, Adam, and Beth Thorndyke, Thorndyke Farms, IL

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Introduction

Larry Thorndyke started growing crops over 40 years ago and currently farms with his wife, Beth, and son, Adam. The family grows corn and soybeans on 2,600 acres across several counties in North Central Illinois, leasing all but 230 acres. Roughly half the fields are flat with silty clay soils while the rest have clay and silt loam soils with 2 to 3% slopes. Faced with extremely tight margins, including rising rents and fertilizer costs, the Thorndykes wanted to reduce their inputs without hurting yield. Ten years ago, Larry began attending conferences and field days where he learned about the importance of soil biology and function, which motivated him to improve the health of his soils.

Adam Thorndyke started farming with his father in 2001, and together they started their soil health journey in 2008 by transitioning from conventional tillage to strip-till on a 200-acre bean field going into corn. Prior to this change, they would make two or more tillage passes across the field. When soil washed away, additional passes were needed to level up the field and fill in gullies.

While Larry said the transition to strip-till was painless, transitioning their soybean fields to no-till on their rented ground was a challenge. They saw some fields taking longer to transition than others due to the management by previous tenants and landowner preference. Because of this, the study only includes 1,400 acres because these acres are successfully under conservation tillage (700 acres of strip-till corn and 700 acres no-till soybeans).

Larry and Adam's first attempt in 2011 at cover crops was discouraging. The aerial seeding application method missed places along roadsides and turn rows and did not allow for good seed to soil contact. Adam now seeds cereal rye with a Hagie sprayer, and they currently plant rye on about 700 acres after corn and soybeans.

In 2015, the Thorndykes refined their nutrient management by purchasing a fertilizer buggy that allows them to apply phosphorus (P) and potassium (K) directly into the strips after soybean harvest. This allowed them to cut P and K in half (now only applying 100 pounds each) and to stop applying anhydrous ammonia in the fall. By applying all their nitrogen (N) in the spring (via pre-plant and Y-drop), Larry and Adam can time nutrient applications to match their crop needs.

Soil Health, Economic, Water Quality, and Climate Benefits

When comparing their five-year yield averages before and after implementing soil health practices, the Thorndykes observed yield increases of over 15% on both corn and soybean fields. Though Larry and Adam recognize the role that changes in seed hybrids and seeding rates play in improved yields, they still believe some of their yield gains are due to soil health practices.

This study chose to include a conservative yield gain attributable solely to cover crops—a 4% increase for soybean yields and a 2% increase for

Farm at a Glance

COUNTY: Ford County, IL

WATERSHED: Vermilion Headwaters

CROPS: Corn & soybeans

FARM SIZE: 2,600 acres cropland

SOILS: Silty clay loam soils, 50% flat fields & 50% rolling with 2–3% slopes

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

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USDA United States Department of Agriculture Natural Resources Conservation Service

American Farmland Trust

corn yields—and ignore the yield benefits of strip-till, no-till, and nutrient management. This information is based off the last four years of data from the 2016–17 National Cover Crop Survey by CTIC.* Thus, the Thorndyke's yield bump from a consistent use of covers over the last three years led to a $16 per acre increase in net income for soybeans and $10 per acre increase for corn, or an average net income increase of about $13 per acre.

Additional benefits come in the form of lower machinery costs due to less fuel and labor needed with less tillage and using one less fertilizer pass thanks to application of P and K into the strips. This is in addition to the fertilizer savings described earlier. Fewer tillage and fertilizer passes, lower nutrient applications, and use of cover crops all translate to less sediment and nutrient loss.

In fact, USDA's Nutrient Tracking Tool (NTT) estimates that Larry reduced his N, P, and sediment losses by 45, 89, and 76%, respectively, by instituting strip-till and no-till, nutrient management, and cover crops on a 70-acre field selected for the NTT analysis. USDA's COMET-Farm Tool estimates that Larry's soil health practices resulted in a 192% reduction in total greenhouse gas emissions from this same field. This corresponds to taking 14 cars off the road.

Achieving their soil health goals hasn't come without costs. They report about 100 hours each year or nearly $2 per acre in increased cost due to learning activities. In addition, they spend $39 per acre to grow cover crops and have increased their use of herbicide for weed control since they no longer plow or cultivate.

Partial budgeting was used to analyze the benefits and costs of adopting conservation tillage, nutrient management, and cover crops on the Thorndyke Farm. The study limited its focus to variables affected by the adoption of these soil health practices.

The table below presents a summary of these economic effects showing Larry improved his bottom line by $34 per acre and by $47,086 on the 1,400 acres in this study by adopting the soil health practices.

Closing Thoughts

Larry compares soils to the human body with the motto, "what you put in is what you get out." By putting in practices to improve soil health such as nutrient management, conservation tillage, and cover crops, Larry and Adam believe they have increased the water holding capacity, organic matter content, aggregate stability, and earthworm activity of their soil resources. Though adopting cover crops presented some initial challenges, the Thorndykes have succeeded in implementing a system of changes over time that have proven to be successful in reducing their inputs while increasing their yields.

Economic Effects of Soil Health Practices on Thorndyke Farms (2018)

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield Impacts due to Cover Crops	$12.95	700	$9,067
Total Increased Income			**$9,067**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Nutrient Savings Due to Nutrient Management	$66.00	700	$46,200
Reduced Machinery Cost due to Reduced Tillage	$17.68	1,400	$24,746
Reduced Machinery Cost due to Nutrient Mgt.	$2.73	1,400	$3,815
Total Decreased Cost			**$74,761**
Annual Total Increased Net Income			$83,828
Total Acres in this Study Area			1,400
Annual Per Acre Increased Net Income			$60

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
Nutrient Management Learning Activities	$0.87	1,400	$1,221
Cover Crops Learning Activities	$1.74	700	$1,221
Cover Crop Costs	$39.00	700	$27,300
Increased Pesticide Cost due to Reduced Tillage	$5.00	1,400	$7,000
Total Increased Cost			**$36,742**
Annual Total Decreased Net Income			$36,742
Total Acres in this Study Area			1,400
Annual Per Acre Decreased Net Income			$26

Annual Change in Total Net Income = $47,086

Annual Change in Per Acre Net Income = $34

This table represents costs and benefits over the entire study area (1,400 acres) as reported by the farmer.
All values are in 2018 dollars.
Crop prices used in the analysis: Corn: $3.55/Bu, Soybeans: $8.60/Bu. Source: Crop Values 2018 Summary, USDA, NASS
Fertilizer prices used in the analysis: Phosphate: $.39/LB, Potash: $.27/LB. Source: Estimated Costs of Crop Production in Iowa—2018
For information about study methodology, see http://farmland.org/soilhealthcasestudies. For information about USDA's Nutrient Tracking Tool, see https://www.oem.usda.gov/nutrient-tracking-tool-ntt. For information about USDA's COMET-Farm Tool, see http://cometfarm.nrel.colostate.edu/. This material is based on work supported by a USDA NRCS CIG grant: NR183A750008G008.
*CTIC is the Conservation Technology Information Center.
The Thorndykes are receiving technical and financial assistance through the federal Conservation Stewardship Program. Due to insufficient information about the contract, the study does not include the CSP income.

For more information about this study or to discuss soil health practices, please contact
- Dr. Emily Bruner, American Farmland Trust, Midwest Conservation & Stewardship Program Manager, ebruner@farmland.org
- Ford County Soil & Water Conservation District, 217-349-4388 ext. 3 and NRCS Paxton Field Office, 217 379-2371 ext. 3.

Both are at: 1380 West Ottawa, P.O. Box 232, Paxton, IL 60957.

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