Cover Crops

No-Till or Low-Till

Thiele Dairy Farm, PA
SOIL HEALTH CASE STUDY

FEBRUARY 2022

Aerial view of the Thiele family homestead

DRONE FOOTAGE BY WILLIAM THIELE

William Thiele, his parents Ed and Lorraine, and his brother James farm 295 acres of rolling hills in western Pennsylvania. The Thieles established their farm in 1868, and now own 154 acres. In 1997, they were the first farm in Butler County to adopt a conservation easement through the state-approved Agricultural Land Preservation Program—forever protecting the farm from development pressure from nearby Pittsburgh. Their rotation includes 1-year corn grain, 1-year oats, and 1-year soybeans, as well as 4-years hay for their 80-head dairy operation. The Thiele family adopted no-till and cover crops across the farm in 2015 to reduce erosion and as "a long-term investment in the land." Other conservation practices they use include planting corn and soy into green cover, planting oats on contour, and installing sod waterways.

The Thieles' cover crop journey began in 2012 with an Environmental Quality Incentives Program (EQIP) cost-share contract encouraged by their local NRCS office, which allowed them to experiment with a cover crop mix before soybeans on 27 acres.[1] The results were pleasing; "cover crops are good for more than just erosion; they're good for nutrient uptake and compaction," says William. Now they cover crop on all their acres and grow their own rye cover crop seed (about 7 ac/yr).

They plant cereal rye after corn and soybeans, and plant their "Thiele's Crazy mix" (rye, millet, buckwheat, sunflower, rapeseed, radish) after oats are harvested mid-summer. But cover crops brought challenges, especially in dry springs when the cover crop and cash crop compete for water. "There can be spots where we don't get great germination because we waited too long to terminate the cover crop," he says. But William emphasizes that the long-term crop resilience provided by cover cropping and planting green far outweighs short-term stumbling blocks. "In spots planted green, we've seen that our corn and soybeans have less drought stress in July and August because of that mulch we've created," says William. Increased pollinator and earthworm populations and higher soil organic matter are additional benefits he has observed.

In 2015, Thiele Dairy Farm transitioned entirely to no-till, alongside fully adopting cover crops. To do so, they purchased a 12′ no-till drill for oats and hay and a 7-row, 15′′ splitter no-till planter for corn and soybeans. Also, the Thieles removed the teeth from their cultimulcher to roll down cover crops when planting corn green. Their main reasons for adopting no-till were to reduce erosion, save time, and be more efficient with field operations. William notes that their years of no-till have greatly reduced ponding and run-off; in 2023, they received 1.25 inches of rain in 45 minutes and there was no ponding.

Soil Health, Economic, Water Quality, and Climate Benefits

Partial budget analysis was used to estimate the marginal benefits and costs of using cover crops and no-till on Thiele Dairy Farm. The study was limited to only those income and cost variables affected by the adoption of these practices. The table on page 2 presents a summary of these economic effects, revealing that Thiele Dairy Farm's net income increased by $31/ac/yr, or by $9,228/yr for the 295-acre farm, achieving a 96% return on investment.

The Thiele family's greatest savings was in machinery costs[2] due to the adoption of no-till, saving the farm $54/ac/yr. The number of passes for each crop was more than halved. Thiele Dairy Farm's second largest savings can be attributed to their reductions in herbicides and fungicides. The farm applies 25% less

William in a soybean field

Farm at a Glance

COUNTY: Butler, PA

WATERSHED: Buffalo Creek

CROPS: Corn, oats, soybeans, & hay

FARM SIZE: 295 acres

SOILS: Silty loam on 3–8% slopes

SOIL HEALTH PRACTICES: No-till & cover crops

Corn planted green into cereal rye cover crop

American Farmland Trust

Pennsylvania No-Till Alliance — Farmers Improving Soil Health

USDA Natural Resources Conservation Service
U.S. DEPARTMENT OF AGRICULTURE

Soil Health Case Study

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herbicide on corn and soybeans since their cover crop suppresses most weeds. Healthier soils have also led to healthier, more disease-resistant crops, allowing the Thieles to eliminate the use of fungicide-treated soybean seed. Together this saved $24/ac/yr.

The Thieles estimate that while their nutrient inputs have remained the same on corn and soybeans, they have reduced their phosphorus and potassium inputs by 25% on oats as recommended by their soil tests, saving them $8/ac/yr.

NRCS's soil erosion calculation software, RUSLE2, estimates that the Thieles have achieved their initial goal of preventing further soil erosion, saving 2.1 tons of soil per acre per year as a result of their implementation of cover crops and no-till across their entire acreage, a savings of $5/ac/yr.[3]

No-till planter for corn and soybeans

Cover crop costs are the largest cost incurred, averaging $39/ac/yr. However, this cost is at least $13/ac less than if the Thieles were purchasing their rye seed from local seed dealers, instead they grow their own. Finally, William estimates that the Thieles spend 60 hours annually enhancing their knowledge about soil health practices, a cost of $1,571/yr.

The USDA's COMET-Planner Tool estimates that the Thieles' soil health practices reduced greenhouse gas emissions by 154 metric tons of CO_2-equivalent/yr, corresponding to taking 34 cars off the road for one year.

Closing Thoughts

Over the years, William has transitioned from student to teacher of no-till and cover crop practices. He recognizes, "yes, there is trial and error for sure, so I make sure to show other farmers the good, bad, and ugly of what we have tried to do." In 2020, William was asked to join the Pennsylvania No-till Alliance board to educate other farmers about soil health. When curious farmers ask him where to begin, William says, "I tell them cereal rye is the gateway drug to soil health. Start with cereal rye and grow from there. You won't regret it."

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ECONOMIC EFFECTS OF SOIL HEALTH PRACTICES ON THIELE DAIRY FARM (2021 PRICES)[4]

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
None identified			$0
Total Increased Income			**$0**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Machinery cost savings from reducing passes due to adopting no-till on all crops (acreage adjusted for hay)[2]	$54	239	$12,988
Reduced herbicide inputs by 25% on corn & soy; stopped using fungicide-treated soybean seeds	$24	170	$4,068
Reduced P & K inputs by 25% on oats	$8	50	$413
Value of decreased erosion due to no-till[3]	$5	295	$1,419
Total Decreased Cost			**$18,888**
Annual Total Increased Net Income			**$18,888**
Total Acres in this Study Area			**295**
Annual Per Acre Increased Net Income			**$64**

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 planting & rye cover crop seed costs (grown on-farm)	$39	205	$8,089
Cover crop and no-till learning activities (60 hrs/yr)			$1,571
Total Increased Cost			**$9,660**
Annual Total Decreased Net Income			**$9,660**
Total Acres in this Study Area			**295**
Annual Per Acre Decreased Net Income			**$33**

Annual Change in Total Net Income = $9,228

Annual Change in Net Income Per Acre = $31

Return on Investment = 96%

[1]Thiele Dairy Farm received an average of $1,620/yr for cover cropping through EQIP from 2012 to 2014. This is not included in the analysis because cost-share is temporary and not received by all. Readers can assume that during the contract years, the Thiele's family net income was higher than presented in this analysis.

[2] Machinery costs include cost of custom hire, labor, depreciation, interest, insurance, housing, repairs, and fuel (University of Illinois at Urbana-Champaign, 2021, *Farm Business Management Machinery Cost Estimates: Field Operations*).

[3] Value of decreased erosion ($1.18/ton) is based on estimated nitrogen (N) & phosphorus (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 NRCS's RUSLE2 soil erosion software estimate of reduced erosion.

[4] Rounding of per acre values may result in minor discrepancies in totals. This table represents estimated average costs and benefits attributed to adopting no-till and cover crop across the farm (295 acres), where corn, oats, soybeans, and hay are grown, as reported by the farmer. • All values are in 2021 dollars, unless provided by the farmer. • Prices are stated as per acre values for items that vary by area. Prices such as learning costs, which don't vary by area, are only given as total costs. • Prices used in analysis: Nitrogen: $.72/lb, Phosphate: $.62/lb, Potash: $.56/lb. (Iowa State University Extension, 2022, *Ag Decision Maker: Estimated Costs of Crop Production in Iowa*). • For information about: (1) study methodology, see farmland.org/soilhealthcasestudies, (2) RUSLE2, see fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm, and (2) USDA's COMET-Planner Tool, see comet-planner.com. • This material is based on work supported by USDA NRCS Cooperative Agreement #NR223A750010C003 and NE-SARE project #LNE22-442.

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