Cover Crops | No-Till or Low-Till | Nutrient Management

Lyden Farms, OH
SOIL HEALTH CASE STUDY

JUNE 2023

No-till planting into terminated cover crop

TIM LYDEN

Tim Lyden is the owner and chief operator of his family's beef and crop farm in Logan County, Ohio, working alongside his son and grandson. The family owns 140 of their 320 acres of row crops, grown on silty loam soils on gently to steep rolling hills. The remaining 150 acres of their land is mostly in strip-grazed permanent pasture or continuous hay for their 25 cattle. This case study will focus on the 320-acre crop rotation that includes one year of corn, two years of soybeans, and one year of wheat.

Tim began experimenting with no-till on corn and soybeans in the 1970s, inspired by a neighboring friend's success making the transition. However, Tim didn't commit fully to no-till until 2016 to help address his region's tremendous amount of erosion. After attending a workshop that year with NRCS's Ray Archuleta, Tim said, "It's just like a lightbulb went off. I'd kind of been doing stuff the wrong way."

Tim soon sold most of his tillage tools and one tractor, allowing him to purchase the equipment required to go 100% no-till. Despite initial corn and soybean yield losses, today the farm's yields are consistently on par with area yields. This can be partly attributed to Tim hiring out the planting of 75% of his corn acres. Since corn is more sensitive to seeding depth and spacing, Tim believes the custom planter does a better job with their larger and more modern no-till planter. This also allows Tim to plant his soybeans in a timelier manner.

Tim replaced his field sprayer with a larger, self-propelled sprayer, which improved the timeliness of herbicide, nutrient, and pesticide application, resulting in better weed management and higher yields. The farm received support from the USDA Natural Resources Conservation Service (NRCS) for their no-till efforts.*

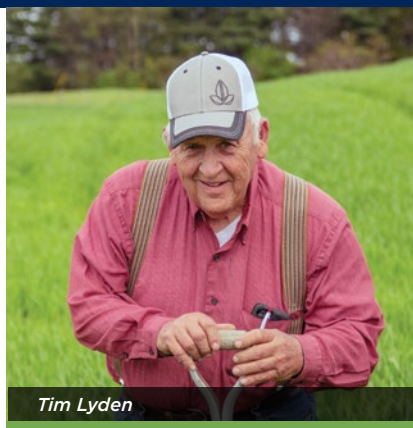
To further reduce erosion of his soil, Tim adopted cover crops when he switched to no-till, planting primarily cereal rye after corn and soybeans. He experiments with a more diverse mix on 35 acres following wheat, seeding 25 acres into a four- to eight-way blend that always includes rye, radish, and clover. The remaining 10 acres are seeded with sorghum-sudangrass, which Tim wet-bales as hay at first cutting and uses to feed his cattle. Rather than take a second cutting, he lets the grass grow before it winter kills, ensuring that his soil is covered through the winter before no-tilling his corn into the residue the following spring.

Soil Health, Economic, Water Quality, and Climate Benefits

Partial budgeting analysis was used to estimate the marginal benefits and costs of adopting no-till, cover crops, and nutrient management on Lyden Farms. The study was limited to only those income and cost variables affected by the adoption of these practices. The table on page two presents a summary of these economic effects, revealing that Lyden Farms' net income increased by $70/ac/yr, or by $22,429/yr, on the 320-acre study area, achieving a 158% return on investment.

Switching to no-till resulted in Lyden Farms achieving the largest overall savings. Eliminating three passes on their corn and two to three passes on their soybeans saved $62/ac/yr in machinery costs.[1] No-till also reduced rock-picking labor costs by an estimated $10/ac/yr. The use of no-till and cover crops has helped Tim achieve his goal of reducing rill erosion by 1–2 tons/ac/yr, saving the farm $3/ac/yr, as the soil and its nutrients are staying in the fields rather than running off.

The second largest savings came from improved nutrient management. Although grid sampling is more expensive compared to standard soil sampling (an additional $8/ac/yr), the reduction



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Tim Lyden

Farm at a Glance

COUNTY: Logan, OH

WATERSHED: Upper Scioto & Miami River

CROPS: Corn grain, soybeans, wheat & hay

FARM SIZE: 470 acres (320-acre study area); 25 beef cattle

SOILS: Silty loam on gently rolling hills with 1–20% slopes

SOIL HEALTH PRACTICES: No-till, cover crops & nutrient management

TIM LYDEN

Tim in flowering cover crop

American Farmland Trust

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

in nutrient inputs more than offsets that by better meeting crop demand, ultimately saving $41/ac/yr. Given fertilizer prices in the past few years, Tim's focus on nutrient management has been both timely and cost-saving, as well as beneficial for water quality. He is proud to say that he's gotten the farm's fields into optimum fertility ranges.

The largest cost increase involves cover crop adoption ($50/ac/yr), but Tim offsets a third of that by wet baling the sorghum-sudangrass cover crop as hay. We estimate the value of this hay as feed to be $4,650/yr towards Lyden Farms' livestock enterprise, less the $250/yr harvest cost. Outside of the feed benefit, Tim appreciates what cover crops have done for his cropland's soil structure and water infiltration, improving the farm's resilience to drought, excessive rain events, and high temperatures.

He estimates that he spends about 50 hours a year attending workshops,


Tillage radish

TIM LYDEN

speaking with local mentors, and educating himself on how to best care for his soil. He consults *A Soil Owner's Manual* by John Sitka frequently.

The USDA's Nutrient Tracking Tool was used to estimate the water quality benefits on one of Tim's 30-acre fields in the study area, finding that the farm's use of no-till, cover crops, and nutrient management reduced nitrogen, phosphorus, and sediment losses by 79%, 83%, and 97% respectively. The USDA's COMET-Planner Tool estimates that Lyden Farms' soil health practices resulted in a reduction of 209 metric tons of CO_2-equivalents/yr, corresponding to taking 47 cars off the road for one year.

Closing Thoughts

Now that he has experienced the economic and ecological benefits of soil health practices firsthand, Tim is dedicated to encouraging farmers in his region to adopt them as well. To that end, he has hosted field days over the past two years showing soil-health-curious farmers what he's experimenting with. Though he still encounters a lot of skepticism, fellow farmers in his county are starting to take note. "The best compliment I got last year was from one of the fellows that came to the field day. He said, 'I've been going by your farm the last five years and it used to be the poorest farm in Logan County, but you've made a tremendous change here.' And that makes it all the worthwhile—when people acknowledge that you are doing something great."

Writer: Lia Raz, American Farmland Trust, Case Study Conservation Agronomist

ECONOMIC EFFECTS OF SOIL HEALTH PRACTICES ON LYDEN FARMS (2021)[2]

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Value of harvesting cover crop as hay	$465	10	$4,650
Total Increased Income			**$4,650**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Machinery & labor cost savings due to no-till	$62	240	$14,863
Less time rock picking	$10	320	$3,200
Value of decreased erosion	$3	320	$825
Nutrient management fertilizer savings	$41	320	$13,090
Total Decreased Cost			**$31,978**
Annual Total Increased Net Income			**$36,628**
Total Acres in this Study Area			**320**
Annual Per Acre Increased Net Income			**$114**

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
Cost of switching to grid soil sampling	$7.50	80	$600
Cover crop costs	$50	240	$12,040
Cost of harvesting cover crop as hay	$25	10	$250
Learning costs (50 hrs/yr)			$1,309
Total Increased Cost			**$14,199**
Annual Total Decreased Net Income			**$14,199**
Total Acres in this Study Area			**320**
Annual Per Acre Decreased Net Income			**$44**

Annual Change in Total Net Income = $22,429

Annual Change in Net Income Per Acre = $70

Return on Investment = 158%

*Lyden Farms received $7,800/yr through the Conservation Stewardship Program 2019-23 for use of no-till and an enhancement payment for pollinator habitat. This is not included in the analysis because cost-share is temporary and not received by all. [1]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). [2]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, cover crops and nutrient management over the entire study area (320 acres) where corn grain, soybeans and wheat are grown, as reported by the farmer. • All values are in 2021 dollars, unless provided by the farmer.

• 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); Hay: $186/ton (USDA NASS, 2021). • Value of decreased erosion ($2.29/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, Benefit-Cost Analysis for EQIP) and Tim's estimate of reduced erosion (1.5/ton/ac/yr). • For information about: (1) study methodology, see farmland.org/soilhealthcasestudies; (2) USDA's Nutrient Tracking Tool, see ntt.tiaer.tarleton.edu; (3) USDA's COMET-Planner Tool, see comet-planner.com. • This material is based on work supported by USDA NRCS Cooperative Agreement #NR223A750010C003 and USEPA Gulf of Mexico Division #02D01121.

For more information about this study or to discuss soil health practices, please contact
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To read more case studies, visit farmland.org/soilhealthcasestudies