Cover Crops | Crop Rotation | No Till or Low Till | Nutrient Management

Kaderly Ag, WI
SOIL HEALTH CASE STUDY

MAY 2024

No-till planting corn green into living wheat cover crop

JAKE KADERLY

Jake Kaderly farms 330 acres in Green County, Wisconsin, where he grows a three-year rotation of corn, soybeans, and winter wheat on rolling hills with silty loam soils. This study focuses on the 150 acres Jake has owned the longest, where he has implemented conservation crop rotation (CCR), cover crops, no-till, and nutrient management (NM).

Jake's appreciation for soil health came in part from his father, a Conservation Board member who did custom no-till planting. Jake is a long-time Certified Crop Advisor (CCA), and has seen his customers succeed with no-till. When Jake started farming in 2005, he adopted no-till on winter wheat and steep slopes. By 2014, he was 100% no-till, finding it profitable and great for his soil.

Interested in what cover crops could offer his no-till system, in 2015, Jake planted an oat/radish cover crop after winter wheat. Now, he favors a 7-way mix[1] that includes cold-hardy legumes. In 2018, with funding from the NRCS Environmental Quality Incentives Program,[2] Jake began planting a wheat cover crop after corn and soybeans. He now plants green into the living wheat cover crop. In addition to resolving slug issues from no-till, Jake notes, "Adding cover crops reduces erosion and adds nutrition to the soil. Win-win!"

Cover crop adoption has not been without challenges. One wet fall, he couldn't plant cover crops until late December. A rainy spring delayed cover crop termination, which hurt the subsequent corn yield. Jake learns from these challenges, noting, "You have to be willing to adapt to whatever nature throws at you."

Jake also practices NM and CCR. In 2013, he increased the frequency of grid sampling and variable rate technology (VRT) fertilizer spreading, which has improved fertility consistency across his fields. To diversify his rotation, Jake has increased winter wheat acres, aiming to reach an even split between all three crops.

Jake's practices have built healthier soils. Over just the last five years, his average soil organic matter has increased from 4.0% to 4.5%. Jake notices his soil readily accepts rainfall and is more resistant to compaction, standing up to machinery traffic even in wet conditions.

Soil Health Economic & Environmental Estimated Outcomes

Partial budgeting analysis was used to estimate the marginal benefits and costs of CCR, cover crops, no-till, and NM on Kaderly Ag, LLC. The study was limited to income and cost variables affected by the adoption of these practices. The table on page 2 reveals that Jake's net income increased by $119/ac/yr on the 150-acre study area, achieving a 194% return on investment.

The largest total increase in income comes from attributing 60% of total yield increases to soil health practices, an additional $116/ac/yr. Jake sees his corn benefit from a more diverse rotation, noting, "When I follow winter wheat with a 7-way cover crop, the following corn crop is consistently 20+ bu/ac better than following soybeans." Despite not having the best soil types in his county, his crop insurance agent indicated his yields are about 10% above the county average.

Another increase in income comes from shifting 20 acres into wheat production, a $221/ac/yr increase over those 20 acres. Wheat is particularly profitable for Jake as he has a strong market for straw and wheat seed.

Jake has experienced several decreases in cost. The largest comes from reducing application rates of DAP (35% less on all crops) and potash (13% less on corn and soybeans) due to his NM plan and improved soil health, which saves $27/ac/yr. Machinery savings of going 100% no-till was also significant, saving $25/ac/yr.[3]

No longer rock-picking, made possible by no-till, saves $8/ac/yr. Additionally, Wisconsin's NM

Jake in knee-high no-till corn on June 4

NANCY COPLIEN

Farm at a Glance

COUNTY: Green, WI

WATERSHED: Lower Sugar River

CROPS: Corn, soybeans, & winter wheat (grain & straw)

FARM SIZE: 330 acres (150-acre study area)

SOILS: Silty loam on rolling hills with 4–8% slopes

SOIL HEALTH PRACTICES: Conservation crop rotation (CCR), cover crops, no-till, & nutrient management (NM)

7-way cover crop mix in September, one month after it was planted

JAKE KADERLY

Soil Health Case Study

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software SnapPlus conservatively estimates Jake reduced erosion by 0.2 ton/ac/yr with cover crops and increased no-till, a savings of $0.4/ac/yr.[4]

Jake faced several cost increases. The largest was from cover crops, with an additional $59/ac/yr from seed, planting, and herbicide costs. While Jake has not increased the number of spray passes, he spends more on herbicide to ensure complete termination after planting green.

Jake's healthier soils can support a higher corn population; he attributes $7/ac/yr, half the increased seed cost, to soil health. Jake also rebuilt his combine's corn head with knife rolls to chop corn stalks; this allows Jake to no-till drill cover crops right after corn harvest and only costs an additional $1/ac/yr. As Jake puts it, "Residue management is a must in the no-till system."

Going from grid sampling on 2.5 acres every four years to sampling on two acres every other year increased his costs by $3/ac/yr. Increasing fertilizer VRT spreading from every four years to every other year costs $0.4/ac/yr more.

USDA's Nutrient Tracking Tool estimates Jake's use of cover crops, no-till, and NM on a 50-acre field reduced N, P, and sediment losses by 59%, 81%, and 85%, respectively. The USDA's COMET-Planner Tool estimates Jake's use of cover crops and no-till on the same field reduced 21 metric tons of CO_2-equivalent emissions/yr, corresponding to taking almost five cars off the road for one year.

Closing Thoughts

Jake has placed in the top 10 of the National Corn Growers Association corn yield contest several times in the no-till division and won 1st place in Wisconsin for the National Wheat Yield Contest in 2023. He takes pride in his high yields while also prioritizing conservation. In 2024, Jake won a conservation legacy award from the American Soybean Association for embracing innovative practices. He is committed to sharing his success story with others, including through his current role as president of the Farmers of the Sugar River, a producer-led watershed group that promotes farm profitability while protecting soil and water.

—Jen Tillman

ECONOMIC EFFECTS OF SOIL HEALTH PRACTICES ON KADERLY AG LLC, WI (2023 PRICES)[5]

Increases in Net Income

Increase in Income

ITEM	PER ACRE	ACRES	TOTAL
Yield increases due to soil health practices (+18% corn, +11% soybeans, & +20% wheat)	$116	130	$15,037
Increase in net income due to 20-acre increase in wheat production	$221	20	$4,413
Total Increased Income			**$19,450**

Decrease in Cost

ITEM	PER ACRE	ACRES	TOTAL
Fertilizer reduction due to nutrient mgmt (-35% DAP all crops, -13% potash corn & soybeans)	$27	130	$3,498
Machinery cost savings on corn & soybeans due to no-till	$25	115	$2,902
Machinery cost savings from eliminating rock-picking due to no-till	$8	150	$1,190
Decreased erosion due to cover crops & no-till	$0.4	150	$62
Total Decreased Cost			**$7,651**
Annual Total Increased Net Income			**$27,101**
Total Acres in this Study Area			**150**
Annual Per Acre Increased Net Income			**$181**

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 costs (seed, planting machinery, & additional herbicide)	$59	121	$7,099
Higher corn seeding rate (+7%)	$7	58	$431
Installing knife rolls on corn combine	$1	58	$39
Additional soil sampling	$3	130	$423
Additional VRT spreading	$0.4	150	$57
Soil health practices learning activities (40 hrs/yr)			$1,169
Total Increased Cost			**$9,217**
Annual Total Decreased Net Income			**$9,217**
Total Acres in this Study Area			**150**
Annual Per Acre Decreased Net Income			**$61**

Annual Change in Total Net Income = $17,885

Annual Change in Per Acre Net Income = $119

Return on Investment = 194%

[1] The 7-way mix includes radish, red clover, hairy vetch, peas, oats, sorghum sudangrass, & volunteer wheat. [2] Jake received $25/ac/yr through the NRCS EQIP program (2018–2021) for cover crops. This is not included in the analysis because cost-share is temporary and not received by all. [3] Machinery costs include the cost of equipment, custom hire, labor, depreciation, interest, insurance, housing, repairs, and fuel (Univ. of IL at Urbana-Champaign, Sept. 2023, *Farm Business Management Machinery Cost Estimates: Field Operations).* [4] Value of decreased erosion ($2.07/ton) is based on estimated N & P content of the soil (2.32 lbs N/ton, 1 lb P/ton), fertilizer prices (USDA NRCS, May 2010, *Benefit-Cost Analysis for the EQIP*), & Wisconsin's SnapPlus estimate of reduced erosion. [5] This table represents estimated average costs and benefits attributed to adopting four soil health practices over the study area (150 acres), as reported by the farmer. • Rounding of per acre values may result in minor discrepancies in totals. • Prices used: Corn Grain: $5.65/bu, Soybeans: $13.26/bu, Wheat: $7.06/bu (USDA NASS, *Crop Values Summary, 2019–2023 avg*); Nitrogen: $.63/lb, Phosphate: $.61/lb, Potash: $.54/lb (ISU, *Ag Decision Maker: Estimated Costs of Crop Production, 2019–2023 avg*); 2023 labor rate: $29.23/hr (U.S. Bureau of Labor Statistics, 2023, *Supervisors of Farming*). • 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-Planner Tool, see comet-planner.com. • This material is based on AFT's work supported by a USDA NRCS Cooperative Agreement #NR223A750010C003.

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

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