
Milo at mid-bloom


No-till planting milo after winter cover crop mix

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Soil Health Case Study

Mark Nault, 2N2E Farms, OK

Introduction


Mark and his father, Franklin

Mark Nault is a third-generation farmer of 2N2E Farms, in Blaine County, Oklahoma, growing grain sorghum (milo) and wheat on 450 acres. This case study analyzes Mark's adoption of no-till, cover crops, nutrient management, and a diversified crop rotation on a sloping 126-acre leased field. This field is currently managed in thirds with a rotation of winter wheat, summer milo, and summer and winter cover crop mixes.

In 2017, Mark went "all in" on no-till planting of wheat to reduce soil erosion and improve water-holding capacity in his increasingly dry climate. His decision was influenced by an urgency to correct low soil organic matter and erosion issues. After adopting no-till, Mark observed higher soil moisture retention, encouraging him to continue adopting soil health practices.

Mark adopted cover crops in 2019 then introduced milo in 2020 to diversify his crop rotation. Mark chose milo for its hardiness and because it requires less nitrogen than wheat given rising fertilizer costs. Until 2019, he had planted wheat each fall and fallowed every summer. Now, Mark aims to have a cash or cover crop growing year-round, and all are no-till planted. Before wheat, Mark plants a summer cover crop mix of legumes, brassicas, and grasses that changes slightly each season. Before milo, Mark plants a winter cover crop mix of wheat, barley, triticale, crimson clover, hairy vetch, rape, and winter peas.

Mark began reducing nutrient applications after grid sampling in 2018 and continued doing so in 2021 when he zone-sampled using the Haney Test instead of a standard soil test. The Haney Test measures both organic and inorganic forms of soil nitrogen, typically resulting in a lower recommended nitrogen application rate than a standard soil test. Mark has reduced the amount of nitrogen and phosphorus fertilizer he applies to wheat by 15 lbs/ac and 25 lbs/ac, respectively, with no effect on yield.

Also, Mark has changed the form and way he applies fertilizer due to adoption of no-till, with no change in average application costs. Mark no longer applies anhydrous ammonia, but instead applies a liquid or dry nitrogen blend fertilizer as needed according to the Haney Test recommendations. For milo, he adds all recommended nitrogen and phosphorus prior to planting. For wheat, he splits the nitrogen application: applying a dry-starter fertilizer then a spring liquid top-dress application.

Mark works closely with the Oklahoma Conservation Commission's Soil Health Team as he continues to learn about soil health practices in his fifth year of adoption. The OCC Soil Health Team provides general consulting, regular soil testing and analysis, and guidance on planting and fertilizer operations.

Soil Health, Economic, Water Quality, and Climate Benefits

A partial budget analysis (PBA) was used to analyze the marginal benefits and costs of adopting no-till, cover crops, diversified crop rotation, and nutrient management changes within the 126-acre study area. We used a combination of published machinery and material cost estimates and farmer-provided data to estimate the cost of operations, on average, before and after soil health practice adoption. The analysis was limited to only those income and cost variables affected by the adoption of these practices. The PBA table below

Farm at a Glance

COUNTY: Blaine, OK

WATERSHED: Middle Cimarron

CROPS: Wheat & grain sorghum (milo)

FARM SIZE: 450 acres (126-acre study area)

SOILS: Clay & silt loam

SOIL HEALTH PRACTICES: No-till, cover crops, diversified crop rotation, nutrient management


Wheat ready to ripen

USDA United States Department of Agriculture Natural Resources Conservation Service

Oklahoma Conservation Commission Conserve-Protect-Restore

American Farmland Trust

summarizes these economic effects, revealing that due to soil health practice adoption, Mark's net income increased by $28/ac/yr, a total of $3,523/yr, achieving a 34% return on investment.

Mark attributes a 7.5 bu wheat/ac increase on average to soil health practice adoption, increasing his net income by $38/ac/yr. The addition of milo to Mark's crop rotation has increased Mark's net income by $44/ac/yr. These increases in income together offset Mark's cover crop costs of $52/ac/yr.

Since adopting no-till, Mark makes 2–3 fewer tractor passes for each crop, saving a significant amount of fuel and time. Also, multiple tillage implements have been replaced by a single no-till drill. Machinery costs have decreased on average by $38/ac/yr.

Additional savings are achieved using the Haney Test fertilizer recommendations in place of standard soil tests, and Mark has observed results improving through the years since adopting his soil health practices. Mark has saved $15/ac/yr in fertilizer costs. The Haney Test is more expensive than standard soil testing, resulting in a cost increase of $200/yr.

As a result of the combined soil health practices, erosion in the study area has decreased by 2.2 tons/ac/yr as estimated by USDA's Nutrient Tracking Tool (NTT), worth about $327/yr across the study area based on the $1.18/ton value of soil nutrients no longer running off. This averages to almost $3/ac/yr.

To estimate the water quality and climate benefits of these soil health practices, we used NTT and COMET-Farm tools on a 42-acre representative field. Mark's use of no-till, cover crops, a diversified crop rotation, and a change in nutrient management reduced nitrogen, phosphorus, and sediment losses from the field by 26%, 36%, and 36%, respectively, as estimated by NTT. Further, his soil health practices resulted in a 60% reduction in total greenhouse gas emissions as estimated by the COMET-Farm Tool, corresponding to taking 1.7 cars off the road.

Closing Thoughts

"Timing is everything," Mark said to emphasize the importance of careful planning of field activities around weather and seasonality of all crops in rotation. Early in his soil health transition, he struggled to get cover crops planted on time and yields suffered as a result. However, with the adoption of both summer and winter cover crop mixes, acres that were unable to be planted to summer cover could be planted to winter cover. Flexibility and trying new things are key. Despite the challenges, in just five years, Mark has seen visible aggregation in high-clay soils and improved water-holding capacity in the top 12 inches of soil after a dry winter. As rainfall in western Oklahoma becomes more erratic, Mark will be prepared to capture and retain every drop that falls on his soil.

Writer: Maryanne Dantzler-Kyer, Oklahoma Conservation Commission, Environmental Projects Coordinator

Economic Effects of Soil Health Practices on 2N2E Farms, OK (2020)

Increases in Net Income

ITEM	PER ACRE	ACRES	TOTAL
Increase in Income			
Wheat yield improvement (+7.5 bu/ac)	$38	63	$2,363
Increased net income due to milo	$44	126	$5,544
Total Increased Income			**$7,907**
Decrease in Cost			
Machinery cost savings due to no-till	$38	126	$4,826
Fertilizer savings in wheat due to nut. mgt.	$15	63	$936
Value of decreased erosion	$3	126	$327
Total Decreased Cost			**$6,089**
Annual Total Increased Net Income			**$13,995**
Total Acres in this Study Area			**126**
Annual Per Acre Increased Net Income			**$111**

Decreases in Net Income

ITEM	PER ACRE	ACRES	TOTAL
Decrease in Income			
None identified			$0
Total Decreased Income			**$0**
Increase in Cost			
Cover crop costs	$52	126	$6,610
Annual Haney Tests		126	$200
Learning costs (140 hours/year)			$3,662
Total Increased Cost			**$10,472**
Annual Total Decreased Net Income			**$10,472**
Total Acres in this Study Area			**126**
Annual Per Acre Decreased Net Income			**$83**

Annual Change in Total Net Income = $3,523

Annual Change in Per Acre Net Income = $28

Return on Investment = 34%

• This table represents estimated average costs and benefits reported by the farmer, Mark Nault, with his adoption of no-till, summer and winter cover crop mixes, nutrient management, and adding milo to wheat over a 126-acre study area. • All values are in 2020 dollars. • Prices used: Wheat: $5.00/bu (USDA NASS, Feb 2021, Crop Values: 2020 Summary); Net income (value of production minus operating costs) Wheat: $310/ac, Milo: $204/ac (USDA ERS, May 2021, Commodity Costs and Returns: Recent Costs and Returns); Nitrogen: $0.34/lb, Phosphate: $0.39/lb (ISU Extension and Outreach, Jan 2021, Ag Decision Maker: Estimated Costs of Crop Production in Iowa). • Value of decreased erosion ($1.18/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, Final Benefit-Cost Analysis for the EQIP). • 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-Farm Tool, see comet-farm.com. • This material is based on AFT's work supported by a USDA NRCS CIG grant (NR183A750008G008) and a grant from the Oklahoma Conservation Commission.

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

- Meg Greski, Oklahoma Conservation Commission, Soil Health Educator & Regenerative Agriculture Specialist, meg.greski@conservation.ok.gov, 405-522-4303
- Steven Alspach, Oklahoma NRCS State Soil Scientist, steven.alspach@usda.gov, 405-742-1247

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