
Planting green with a 40-ft, 16-row corn planter

KEVIN KEENAN PHOTOS


Forrest adjusting planter

Soil Health Case Study

Forrest Watson, Mulligan Farm, NY

Can soil health practices be adopted while improving economic performance?

JULY 2022

USING DATA FROM NY DAIRY FARM BUSINESS SUMMARY

Farm at a Glance

COUNTY: Livingston, NY

WATERSHED: Genesee River

CROPS: Hay, corn silage/grain, wheat

FARM SIZE: 2,618 acres; 1,275 milking cows plus 430 dry cows & heifers

SOILS: Loamy soils on gently sloping to steep rolling hills

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

Introduction


Forrest Watson

STEPHANIE CASTLE

Since 2008, Forrest Watson has farmed with his aunt and uncle, Lesa and Jeff, on their 1,500-head dairy in western New York. They farm 2,618 acres and practice an eight-year crop rotation: 1 year winter wheat (300 acres), 3 years alfalfa/grass (1,000 acres), and 4 years corn (1,318 acres), that is mostly corn silage. Occasionally other forage crops follow corn, such as triticale.

The farm constantly seeks to improve efficiencies and provide the best care for its animals, land, and employees. Forrest learns about soil health through participation in conferences and reading. As a result, Forrest has modified their crop rotation (e.g., increased wheat acreage), reduced tillage, adopted cover crops, and changed nutrient management strategies.

To improve soil health and productivity with fewer inputs, Forrest began experimenting with cover crops and no-till in 2015. He started no-till on just 75 acres of wheat but went "all-in" with cover crops. Today, Forrest plants a 6-way mix or a winter cereal following corn. In 2018, he began 'planting green'. On the remaining acres, alfalfa and wheat provide winter cover. Currently, all but 150 acres of corn are no-tilled and the rest are strip-tilled.

Forrest observes that the cover crops are improving the soil, enabling easier no-till drilling, which in turn, saves them time. "The feeling of needing to till due to compaction is virtually gone," says Forrest. "We're breaking up compaction with roots instead of iron." The farm received financial and technical assistance from the USDA Natural Resources Conservation Service to implement cover crops.*

Mulligan Farm works with consultants to implement a Comprehensive Nutrient Management Plan. Since 2008, Forrest has increased the frequency and intensity of their soil testing by introducing grid sampling, begun split applications of chemical fertilizers, and switched to drag hose and injection of their manure (versus spreading). These improvements optimized fertilizer application rates, timing, volume, and location.

Soil Health, Economic, Water Quality, and Climate Benefits

A marginal analysis was conducted using the Mulligan Farm's Cornell Dairy Farm Business Summary (DFBS) dataset† from 1998–2019 to answer the question, "Can soil health practices be adopted while improving economic performance?" We analyzed the benefits and costs before and after implementation of soil health practices. The study was limited to comparing only crop production income and cost variables that differed between the conventional "before" period (1998–2014) and the soil health "after" period (2015–2019). Variables taken from the Cornell DFBS survey include acres, yield, and production by crop, fertilizer and lime, seeds and plants, spray and other crop expenses, and various machinery expenses. The following results summarize the changes in these cost variables. We do not try to isolate specific changes due to soil health practices because the DFBS data do not breakdown the costs by crop or specific farm operations.

The DFBS data show Forrest was able to adopt soil health practices while improving economic performance as the farm's net income increased


Planting green

USDA United States Department of Agriculture Natural Resources Conservation Service

Great Lakes RESTORATION

American Farmland Trust

by $75/ac, or $196,350 annually, for the 2,618-acre study area, achieving a 129% return on investment. Forrest believes this increase in net income is due to multiple factors, including soil health practice adoption. In particular, the DFBS data highlight a modification in crop rotation with an increase in acres planted in higher-value wheat. Also, the data show higher average yields of both corn grain and wheat, which resulted in an increased value of crops harvested by $76/ac.

The farm decreased costs in the "machine hire, rent and lease" category by $27/ac, while increasing costs in the "machinery repair and farm vehicle" and "machinery ownership expenses (depreciation and interest)" categories by $2 and $10/ac, respectively. This overall cost-savings could be driven by the switch to no-till, which takes less time and improves efficiency.

The "seeds and plants" category increased by $8/ac. This category reflects all changes in seed expenses across all crops—cash crops, forage crops, and cover crops. These changes are driven both by the crop rotation modifications and introduction of cover crops between the periods.

The "fertilizer and lime" cost category decreased by $11/ac, while the "spray and other crop expenses" category increased by $38/ac. According to Forrest, he has reduced fertilizer applications due to better nutrient capture with cover crops and injecting instead of spreading manure.

In total, the difference in average costs was a $1/ac increase, while the value of crop production increased by $76/ac/yr. Yield resiliency also improved as the data show more consistent annual yields.

The USDA's COMET-Farm Tool was used to estimate water quality benefits and greenhouse gas emission changes. Analysis suggests that on one of Forrest's 35-acre fields from the study area, the farm's use of no-till, cover crops, and nutrient management reduced nitrogen, phosphorus, and sediment losses by 4%, 33%, and 60%, respectively, and resulted in a 252% reduction in total greenhouse gas emissions, which corresponds to taking two cars off the road.

Closing Thoughts

Commitment to using the most environmentally friendly practices guides crop production at Mulligan Farm. "You can't give up after the first little failure," says Forrest. Soil health practice adoption supports improved operational efficiencies. For example, less labor going to tillage allows labor to go to activities that provide additional value like cover crop establishment, double cropping, and nutrient management. Forrest has observed improvements in soil health, such as reduced soil compaction, and the DFBS data show more consistent and higher crop yields. Overall, Mulligan Farm has managed to improve economic performance while investing in soil health practices.

Economic Effects of Soil Health Practices on Mulligan Farm, NY (2019)

Using Survey Data from Cornell Dairy Farm Business Summary

Increases in Net Income			
Increase in Income			
ITEM	PER ACRE	ACRES	TOTAL
Increase in value of crops harvested	$76	2,618	$198,968
Total Increased Income			**$198,968**
Decrease in Cost			
DFBS EXPENSE CATEGORY	PER ACRE	ACRES	TOTAL
"Machinery hire, rent & lease"	$27	2,618	$70,686
"Fertilizer & lime"	$11	2,618	$28,798
"Fuels, oils & greases"	$19	2,618	$49,742
Total Decreased Cost			**$149,226**
Annual Total Increased Net Income			**$348,194**
Total Acres in this Study Area			**2,618**
Annual Per Acre Increased Net Income			**$133**

Decreases in Net Income			
Decrease in Income			
ITEM	PER ACRE	ACRES	TOTAL
None identified			$0
Total Decreased Income			**$0**
Increase in Cost			
DFBS EXPENSE CATEGORY	PER ACRE	ACRES	TOTAL
"Machinery repair & farm vehicle"	$2	2,618	$5,236
"Machinery ownership expenses (depreciation and interest)"	$10	2,618	$26,180
"Seeds & plants"	$8	2,618	$20,944
"Spray & other crop expenses"	$38	2,618	$99,484
Total Increased Cost			**$151,844**
Annual Total Decreased Net Income			**$151,844**
Total Acres in this Study Area			**2,618**
Annual Per Acre Decreased Net Income			**$58**

Annual Change in Total Net Income = $196, 350

Annual Change in Net Income Per Acre = $75

Return on Investment = 129%

†This table represents average costs and benefit data reported by Mulligan Farm annually to Cornell University Cooperative Extension through the NY Dairy Farm Business Summary survey. For this analysis, we analyzed crop production and expenses from 1998–2019 to estimate averages for yields and expenses for the pre- ('98 to '14) and post-soil health years ('15 to '19). • All values are expressed in real terms using USDA price indices, 2011 = 100. • Value of crop production prices: Forage: $164/ton (Source: New York NASS, various years). • For information about: (1) study methodology, review the working paper: nydairyadmin.cce.cornell.edu/uploads/doc_942.pdf; and (2) USDA's COMET-Farm Tool, see http://comet-farm.com/ • This material is supported by a 2019 Great Lakes Restoration Initiative Grant (#00E02807) & 2018 USDA NRCS CIG Grant (NRI183A75008G008). *Mulligan Farm received financial support from the Environmental Quality Incentives Program (2004–'07, '15) and the Conservation Stewardship Program (2015–'20) for cover crops. This is not included in the analysis because cost-share is temporary and not received by all.

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

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