Gary Swede Farm LLC, NY

COVER CROP DEMONSTRATION TRIAL CASE STUDY

2021–2025

TRIAL TREATMENTS

Treatment	Description
No Cover Crop	No cover crop planted
Pre-Plant Termination	Cover crop terminated with herbicide 2–4 weeks **prior to** cash crop planting
Planting Green	Cover crop terminated with herbicide **at the time of cash crop** planting

DEMO FARM OVERVIEW

An example of planting green: Jay planting corn between rows of wheat, which has been sprayed for termination.

KEVIN KEENAN

County	Genesee, NY
Watershed	Genesee River & the Great Lakes Basin
Crops in Trial	Wheat, corn silage, soybeans
Cover Crops in Trial	10-species mix;[1] rye with radish; triticale
Farm Size	4,500 acres (10-acre trial)
Soils	Clay, loamy & gravely soils; flat & rolling hills
Annual Precipitation	37 inches
Elevation	890 feet

TRIAL GOAL

Evaluate cover crop use (both planting green and early termination) for soil function and farm profitability. Jay Swede is a farmer innovator who has been building soil health using cover crops for 40 years and reduced tillage for 20 years. He was curious to try planting green into living cover crops to allow for a few more weeks of cover crop growth before termination.

KEY TAKEAWAYS

- **The use, or lack of use, of cover crops did not significantly change most laboratory soil health measurements within this five-year trial**, likely due to Jay's soil scoring high in overall soil health going into this trial.
- **Planting green had the fewest soil resource concerns** as identified by the In-Field Soil Health Assessment, accumulated more cover crop biomass than pre-plant termination, and had the lowest soil moisture in the spring.
- **Planting Green had a lower net income than No Cover Crop,** although the difference was smaller each subsequent year, and was only $11.60/ac (1%) less than No Cover Crop in the final year. Pre-Plant Termination had a higher net income than No Cover Crops for one year (rye into soybeans).
- **For Jay, the trial reinforced his preference for pre-plant termination of cover crops.** The high amount of residue on the field at planting was a challenge with planting green, though he found the cash crop handled it better than he thought it might.
- **Jay appreciated discussions with the three other NY farmers in this project**: *"Seeing what they were doing gave me a lot of good ideas on what we should be trying… I've learned more from them than anything else."*

Farmer Jay Swede in front of a reduced-tillage planter.

KEVIN KEENAN

"We use a lot of dairy manure here and I really love using the cover crops as a way of capturing the nutrients from the manure and recycling it. If we go out and just put manure on bare ground, I don't think we see as much of a benefit as putting it on a cover crop."

—JAY SWEDE

American Farmland Trust

"With our use of cover crops, our corn seems to be staying healthy longer and performing well through the whole season, even with drought conditions. I really think soil health has helped us pull through some of those bad times."

Jay Swede farms 4,500 acres of rolling cropland in northwestern New York with his father Gary and brother Ryan. The farm uses several flexible crop rotations based on seasonal needs and markets, including corn, soybeans, wheat, alfalfa, and processing vegetables. A portion of these crops support a 2,000-cow dairy partnership.

Jay has a long history of experimenting with soil health practices. Since the 1980s, the Swedes have planted rye as a cover crop. In 2005, they adopted strip-till to reduce erosion, compaction, and fuel costs, and began using oats as a cover crop to better suit their newly reduced tillage system. Oats winterkill, leaving more manageable residue than rye for spring planting. Today he plants 450 acres of alternating cover crops rows after corn and soybeans: an oat/radish blend that becomes the low residue crop row, and a winter wheat cover crop to restore soil function after intensive cropping between cash crop rows.

The Swedes have also embraced manure management and nutrient optimization. They apply manure to cover crops based on a Comprehensive Nutrient Management Plan and use variable rate fertilizer applications and weather-adjusted nitrogen fertilizer side-dressing to better match crop needs while reducing nitrogen losses.

The Swede family partnered with American Farmland Trust (AFT) on a five-year on-farm soil health demonstration trial from 2021 to 2025 to evaluate the economic and soil health outcomes of "planting green" into cover crops versus conventional termination timing. **Planting green is the practice of planting the cash crop into the living cover crop, then terminating the cover crop after.** This practice prolongs the cover crop growing season, which can help dry out wet spring soils, add biomass, retain nitrogen in the field, and provide mulch to suppress weeds. However, it can have drawbacks, including difficulty planting through thick residue and the potential for a yield drag due to excessive drying of soil and competition with cash crops.

Jay joined the trial to inform better decisions on managing cover crop mixes under tight planting windows and variable field conditions. By sharing lessons learned, Jay is committed to helping other farmers weigh the risks and rewards of different approaches to cover crops.

TRIAL DESIGN

The field selected for this trial had been in a diverse row crop rotation. Oats had been periodically planted as a cover crop (in 2013, 2014, 2015, and 2018), and manure had been applied at most once per year. Jay has practiced strip-tillage in this field since 2006.

The study was conducted on 10 acres divided into three replicated 3.3-acre blocks, each with three 1.1-acre (800' x 60') plots assigned to each treatment (Figure 1):

- No Cover Crop (unusual for this farm),
- Pre-Plant Termination of cover crop (the status quo on this farm), and
- Planting Green into cover crop (an advanced level of cover cropping that had not been pursued until the trial).

Cover crops were terminated using herbicide, with timing dependent on treatment. This replicated design helps differentiate effects of the cover crop treatments from natural variation between years and within the field.

The trial started with cover crop planting in August 2021 and all treatments followed the same cash crop rotation (Table 1). Cover crops included a diverse 10-species mix[1] after wheat, a rye with some radish mix after corn, and triticale after

Soil cover at the time of planting corn silage May 14, 2024. From left to right: ***No Cover Crop*** *plot sprayed with herbicide April 29;* ***Pre-Plant Termination*** *plot cover crop terminated April 29;* ***Planting Green*** *cover crop to be terminated May 15 (darker areas between the green cover crop rows are from the planter).*

soybeans (Table 1). The variation in cover crops was due to the variation in cover crop planting timing. While Jay would like to use cover crop mixes as much as possible due to their ability to perform multiple functions at once, there are not many cover crops that can thrive when planted late in the season in his area of New York.

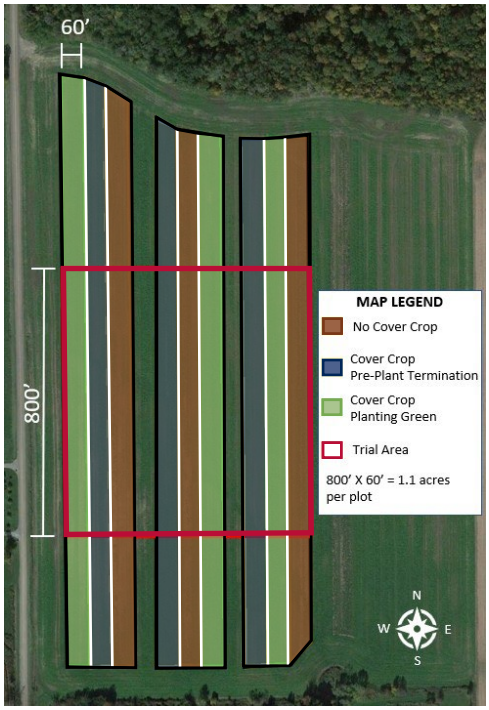
Data Collection

Annual soil samples were collected in the springs of 2021 through 2025, where 2021 reflects pre-treatment, baseline conditions. Soil health indicators were analyzed with the qualitative observation-based NRCS In-Field Soil Health Assessment (IFSHA) and the quantitative Comprehensive Assessment of Soil Health (CASH) in addition to bulk density by the Cornell Soil Health Lab. Annual field operations data (i.e., machinery, inputs, input costs, yield) were provided by Jay Swede in the cover crop years (2021-2024) and used alongside published machinery costs to estimate average annual per acre net income by treatment. See Technical Note[2] for methodology details.

Trial expectations

We anticipated that planting green into cover crops could gradually lead to improved soil health and higher net income by allowing additional time for growth (between 2 and 4 weeks in this trial), while stopping cover cropping could degrade soil health and reduce net income. However, previous research indicates that soil health benefits tend to take longer than five years to accrue, even for first time adopters of cover crops who start with degraded soil and are making a significant change in management. In Jay's case, with only three years of cover crop treatments on a field that had been in a diverse crop rotation with reduced tillage and cover crops, it was anticipated that any measurable soil health changes in this trial would be small, if even detectable.

FIGURE 1: TRIAL DESIGN MAP



"Experimenting using replicated plots is a little bit of a challenge, but worth it. It gives us really good data. We're starting to use replication more instead of just a side-by-side trial."

SOIL HEALTH CHANGES

In-Field Soil Health Assessment (IFSHA)

The IFSHA consistently indicated all four resource concerns (compaction, soil organism habitat loss, soil organic matter depletion, and aggregate instability) were present in the No Cover Crop treatment every year (Table 2). Except for Year 2, the same was true for Pre-Plant Termination. Planting Green had the fewest resource concerns identified overall. This may be due to treatment effects (meaning increased time in cover crops reduced resource concerns) or due to subjective variability in the assessment.

Comprehensive Assessment of Soil Health (CASH) Report

The CASH report analyzes 12 indicators (four physical, four biological, and four chemical indicators, listed below) and provides individual and an overall soil health score (0–100, 100 being best).

There was no significant difference between treatments for any of the indicators in any year. This could be due to Jay's long-time use of soil health practices on the field (soil amendments such as potash and manure, reduced tillage, and cover crops) leading up to the trial. Despite no significant differences between treatments in any particular year, surface hardness scores did improve for Planting Green over time.

Overall Soil Health Score

The overall score (average of all 12 indicators) for all treatments was consistently in the **high** range each year, likely because of Jay's long-time use of multiple soil health practices. High overall scores indicate the soil is functioning relatively well compared to farms with soils of similar texture. While improvements in management could further improve soil functionality, the trial's length was not adequate for planting green to improve the overall score over Jay's status quo management.

Physical Soil Indicators

The average scores for the physical indicators (predicted water holding capacity, aggregate stability, surface hardness, and subsurface hardness) were consistently in the **medium**

TABLE 1: CASH CROP AND COVER CROP ROTATION. Pre-Plant Termination occurred 2-4 weeks prior to planting the cash crop. Planting Green cover crops were terminated within two days after cash crop planting. A cover crop was not planted in fall 2024; winter wheat, a cash crop, was planted across all treatments.

No Cover Crop	Winter Wheat		Fallow		Corn Silage	Fallow	Soybeans		Fallow		Corn Silage	Winter Wheat
Pre-Plant Termination	Winter Wheat		Cover Crop Mix		Corn Silage	Rye with Radish	Soybeans		Triticale		Corn Silage	Winter Wheat
Planting Green	Winter Wheat		Cover Crop Mix		Corn Silage	Rye with Radish	Soybeans		Triticale		Corn Silage	Winter Wheat
Year	**2020**	**2021**		**2022**		**2023**		**2024**				**2025**

TABLE 2: RESOURCE CONCERNS IDENTIFIED BY THE IN-FIELD SOIL HEALTH ASSESSMENT. Numbers one through five indicate the year of the trial (1=2021, 2=2022, etc.). Red indicates the resource concern was *present* in the given year, blue indicates the resource concern was *not present*.

Resource Concerns	No cover crop					Pre-plant termination					Planting Green				
Year	*1*	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
Compaction															
Soil Organism Habitat Loss															
Soil Organic Matter Depletion															
Aggregate Instability															

"When we put the cash crop seed in the ground, we want the soil to look perfect. With planting green, the soil is as far from looking perfect as you can get. But by the time you terminate the cover crop and the crop starts to grow, it's not as bad as I thought it would be."

range (Figure 2), indicating a need for improvement. The four physical indicators were not statistically different between treatments in any year, however **surface hardness scores for Planting Green improved significantly over time** whereas they did not for the other two treatments. This may be due to the increase in biomass and roots physically creating macro-pores, loosening the top six inches of soil.

Biological Soil Indicators

The average scores for the biological indicators (organic matter, ACE soil protein index, soil respiration, and organic carbon) were consistently in the **high** range (Figure 2), indicating biologically high functioning soil. The four individual indicators were not statistically different between treatments in any year.

While cover crops have been shown to improve organic matter quantity and quality in the long run due to the addition of biomass and carbon to the soil, the biological processes take many years to make a significant difference.

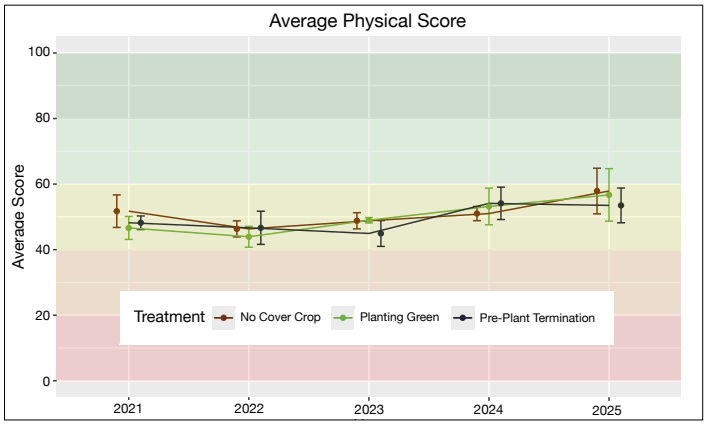
Chemical Soil Indicators

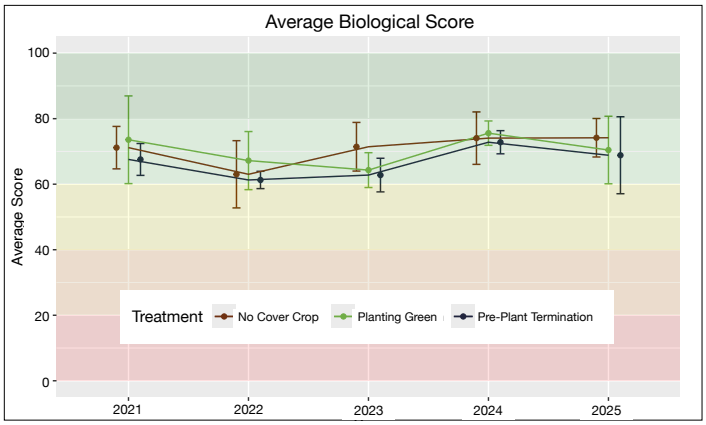
The averaged scores for the chemical indicators (phosphorus, pH, potassium, and minor elements) were consistently in the **very high** range (Figure 2), indicating they were not limiting for plant growth, nor excessive for environmental degradation. This finding is common for CASH analyses, since the assessment and management of soil chemical constraints is well-researched, standard practice on farms, and relatively easier to manage compared to other soil health indicators. The four individual indicators were not statistically different between treatments in any year.

Soil Moisture

Soil moisture was measured at cash crop planting 2022 through 2024. **Planting Green plots had lower soil moisture** during the typically wetter spring months, especially in 2022 and 2023. Drier soils can allow for earlier access into the field for planting and manure spreading.

FIGURE 2. PHYSICAL, BIOLOGICAL, AND CHEMICAL SOIL HEALTH SCORES BASED ON CASH REPORT.
Red = very low, orange = low, yellow = medium, light green = high, dark green = very high.





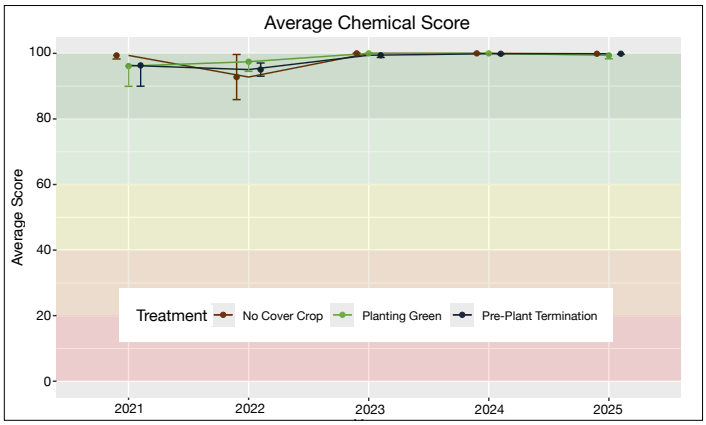
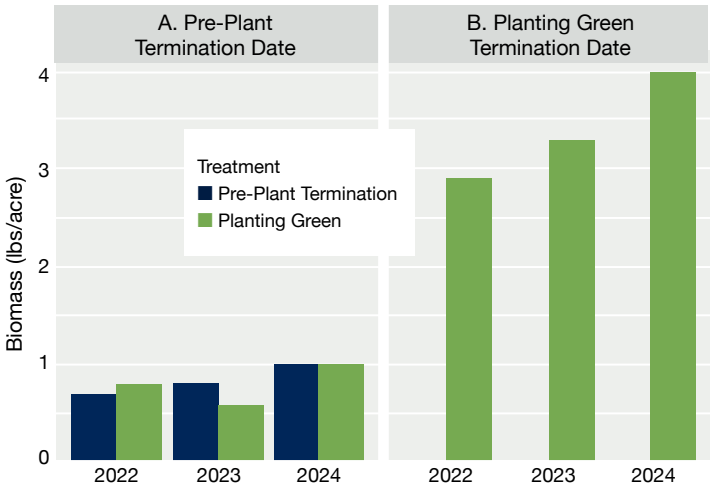


FIGURE 3: COVER CROP BIOMASS (LBS/ACRE) COMPARISON BETWEEN PRE-PLANT TERMINATION AND PLANTING GREEN. A: Biomass of both treatments the day Pre-Plant Termination was terminated. B: Biomass of Planting Green two to four weeks later, when the cover crop for this treatment was terminated.



Cover Crop Biomass

Cover crop biomass was sampled when the Pre-Plant Termination cover crop was terminated, and again a few weeks later when the Planting Green cover crop was terminated. Samples were analyzed for dry biomass weight and nitrogen content.

Planting Green produced over three times the cover crop biomass compared to Pre-Plant Termination, due to the additional two to four weeks of cover crop growth (Figure 3). This additional residue on the soil surface can help suppress weeds to allow for a reduction in late-emergent herbicides and can minimize compaction from heavy equipment. The additional biomass also retained 2.5 times more potentially available nitrogen in the Planting Green cover crop biomass, which could allow for reduced nitrogen inputs over time when planting green.

ECONOMIC CHANGES

We calculated per acre **cover crop costs, value of production** (crop yield times crop price), and **net income** (value of production minus all machinery and input costs) to compare the effect of the treatments on annual economic outcomes (costs versus benefits).

Overall, none of the three treatments consistently held the highest net income across all years, primarily because crops and yields varied annually. However, **No Cover Crop consistently had the lowest costs and the highest net income two of the three years**. (No statistical comparisons were made for economic calculations due to lack of comparable data.)

Cover crop costs

Differences in cover crop seed costs were the main source of variation in cover crop costs year-to-year (Figure 4). Planting (30' grain drill at $15.40/ac) and termination machinery costs (herbicide sprayer at $4.50/ac) did not vary. Termination material costs were the same between the cover crop treatments ($9.36/ac) in two of the three years. However, in 2021, Sharpen was added to the glyphosate for longer weed suppression after Pre-Plant Termination. This resulted in a termination material cost of $18.11, while Planting Green with inherent longer weed suppression was only $8.58/ac.

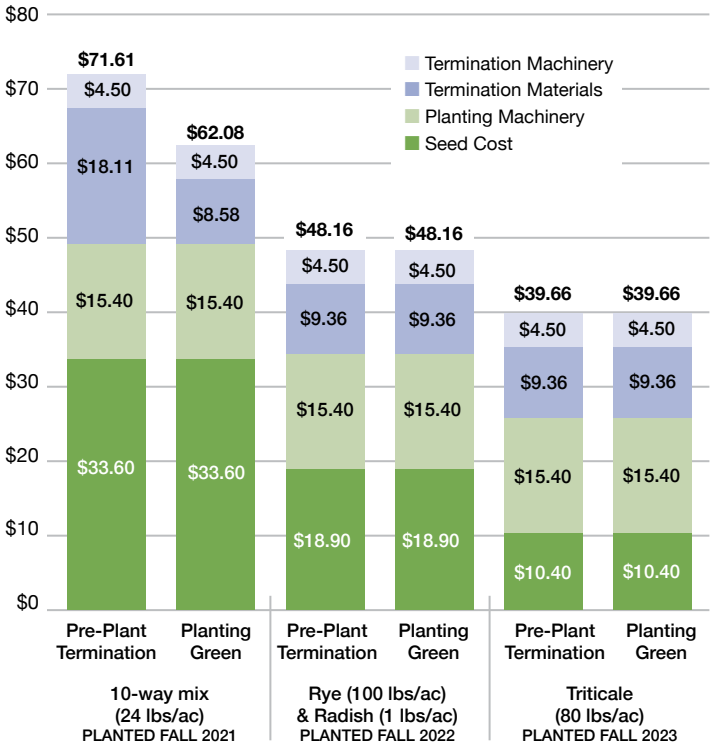
Net income change

Net income (value of production minus costs) differed between years and treatments due to differences in cover crop costs and cash crop yields.

The first crop year of the trial included the 10-species cover crop mix on both cover crop treatments, followed by corn silage. The **No Cover Crop Treatment held the highest net income** at $702.04/ac; Pre-Plant Termination was $80.35/ac (11%) lower, followed by Planting Green at $182.46/ac (26%) lower than No Cover Crop (Figure 5). This difference was mainly due to the higher yields on the No Cover Crop treatment: 0.65 tons/ac ($39.65/ac) higher than Pre-Plant Termination and 2.48 tons/ac ($151.28/ac) higher than Planting Green. Additional differences included a $49/ac cost for cover crop seed and planting for both cover crop

"It was interesting to see that just because it was the best yield, it wasn't the best return on some of them…I mean, we kind of know that, but it was really spelled out for us. Helps you make some decisions."

FIGURE 4: COVER CROP COSTS BY TREATMENT AND SPECIES



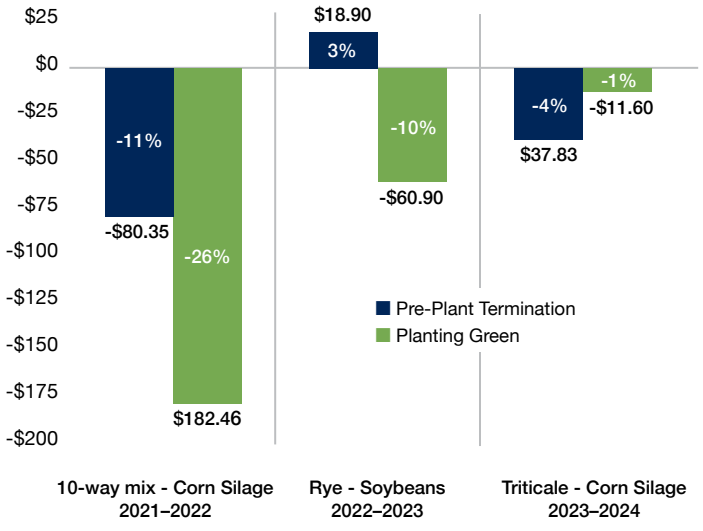
"I never really felt as though cost was the issue with cover crops. It's always been part of our practice and we know the benefits. I don't want the soil to sit bare all winter long. We know that in the spring, it's going to be better if we had a cover crop."

treatments, and an additional herbicide pass for the No Cover Crop treatment at $8.29/ac.

In the second year of the trial, the rye cover crop followed by soybeans resulted in **Pre-Plant Termination having the highest net income** at $606.32/ac, which was $18.90/ac (3%) higher than No Cover Crops (Figure 5). Planting Green held the lowest net income, $60.90/ac (10%) below No Cover Crops. The differences were a result of the higher crop yield, thus higher value of production, for Pre-Plant Termination (+4 tons/ac; +$53.20/ac), which was offset by the additional cost from the rye cover crop ($34.30/ac).

Finally, in the third year, corn silage with a triticale cover crop resulted in the **No Cover Crop treatment having the highest net income** ($1,068.39/ac). Although **Planting Green had a 0.5 ton/ac higher yield**, it did not outweigh the increase in costs from cover crops ($39.66/ac; Figure 4), which caused the net income to be $11.60/ac (1%) lower than No Cover Crop (Figure 5). Pre-Plant Termination produced a Net Income $37.83/ac (4%) lower than No Cover Crop despite having nearly identical yields.

FIGURE 5: CHANGE IN NET INCOME ($/AC) OF BOTH COVER CROP TREATMENTS COMPARED TO NO COVER CROP BY CROP YEAR. Average net income of No Cover Crop each year was $702/ac, $587/ac, & $1,068/ac, respectively. Positive values indicate higher net income than No Cover Crop; negative values indicate a lower net income.



CONCLUSION

Even for Jay, an experienced cover crop farmer, a new practice like planting green still takes a few seasons of trial and error. Reflecting on the trial, Jay notes, "One of the biggest challenges we had was just getting that timing right. Sometimes the cover crops would get away from us…but when it was all said and done, it wasn't as much of a challenge as it seemed like at the time."

So, was planting green worth it? Over three years, the net income for **Planting Green got closer and closer to the net income for No Cover Crops, with only a 1% difference in the final year.** That shows real promise for Planting Green, which does offer many other potential soil and agronomic benefits, despite not measuring consistent improvements in soil health measurements in this short trial. Jay had been using cover crops and other soil health practices on that field prior to the trial, and his soils were already quite healthy and thus resilient and functional even when cover cropping was stopped for a few years under the No Cover Crop treatment. As with most soil health practices, refining cover crop management is a long-term investment that will provide multiple benefits to Jay's farm in the future.

A key strength of the on-farm demonstration trial design is how it encourages peer learning among farmers. Jay connected with nearby farmers experimenting with other cover cropping techniques as part of this project, sharing the challenges and successes they experienced. Jay notes, "I learned a lot from some of the other people that were participating. Just seeing what they were doing gives me a lot of good ideas on what we should be trying…I've learned more from them than anything else." While the trial ultimately reinforced Jay's preference for pre-plant termination of cover crops, he still plans to try new techniques and refine his cover crop practices.

"The more you use cover crops, the better it gets. At first, you're going to struggle, the cover crops will give you some headaches. Don't get discouraged right away. Give it some time and be patient with it. As time goes on, you'll really start to see improvements."

NOTES

1 10-species cover crop mix was Maize Pro DT from King's AgriSeeds, a blend of winter rye, winter vetch, field peas, sorghum, crimson clover, linseed, alsike clover, persian clover, sunflower, and tillage radish.

2 For more information about the methods used for these analyses, see the Technical Note at https://farmlandinfo.org/publications/cover-crop-demonstration-trial-case-studies.

This material is based upon work supported by the U.S. Department of Agriculture, under agreement number NR213A750013G009. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the views of the U.S. Department of Agriculture. In addition, any reference to specific brands or types of products or services does not constitute or imply an endorsement by the U.S. Department of Agriculture for those products or services. USDA is an equal opportunity provider and employer.

For more information about this study or to discuss soil health practices, contact
Caitlin Tucker, American Farmland Trust, NY Agricultural Stewardship Manager, ctucker@farmland.org