

# DATU CASE STUDY


## Moore Farm


Howard County, Iowa 


Average winter 17° F 


Average summer 70° F 

Average annual precipitation 40 inches 

2,300 acres of row crops 

Corn-soybean rotation 

Mostly loam soil, generally slopes of 2-5%  
with a few areas of 4-7% 

25 years of no-till, 3 years of cover crops 

2014-16 study of cover crops 

*Datu*  
data for the big picture

#### ABOUT THIS CASE STUDY

This case study was prepared in cooperation with the National Association of Conservation Districts for a 2014 USDA-NRCS Conservation Innovation Grant with generous support from the Walton Family Foundation.

#### ABOUT DATU RESEARCH

Datu Research is an international consulting firm that provides the right data to leading foundations, NGOs and governments working to solve humanity's most important challenges.

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#### DISCLAIMER

Errors of fact or interpretation remain exclusively with the authors. We welcome comments and suggestions.

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Frank with drill

# SUMMARY

This case study documents financial impacts of the first three years of cover crop adoption on the Moore Farm in northern Iowa from 2014 to 2016. Frank Moore, the founder's son, grows 2,300 acres of corn and soybeans in rotation here, and considers the soil one of the farm's most important assets. Having seen how 30 years of practicing no-till has improved his fields' soil health, he began looking at additional soil conservation practices and decided to plant cover crops on part of the farm. After three years, he was strongly considering planting cover crops on all his owned acres. This study begins with the average budget from four years of pre-adoption as a baseline, and traces the economic impact of cover crops by year and budget category.

In the first three years, the average annual net change in income attributed to cover crop adoption came to -\$22.33 per acre. Frank witnessed, over those years, improvements in soil health, demonstrated by better water infiltration and drainage, which he attributed to cover crops. In the third year, for the first time, his use of cover crops saved him the labor and expense of regular erosion-related repairs. The Moore Farm also saw cash crop yields after cover crop adoption higher than the baseline, though Frank did not conclude that cover crops were responsible for all of those increases.

## Key Lessons from Frank's Experiment

- Although some experts have said this region is too far north for cover crops, careful and thorough management of the process can make them work.
- It is important to think first about what your objectives for planting cover crops are, then choose varieties of cover crops accordingly.
- Some of Frank's observations of cover crop benefits, such as a decrease in white mold in soybeans and decreased weed pressure, are difficult to measure and quantify in the budget, but they are still valuable.
- Using cover crops makes landowners more likely to rent to you, because they can see that you will be taking care of their land.

## MOORE FARM DESCRIPTION

The Moore Farm was founded in 1969 by Frank Moore's father in Howard County, Iowa, where the average farm size is 340 acres.<sup>1</sup> Since then, the farm has expanded from the original 80 to 2,300 acres, and is operated under a corn-soybean rotation.



From the beginning, Frank was very conscious of the importance of controlling costs, and for this reason he adopted minimum-till practices in 1988. He started with ridge-till, and later moved to a combination of no-till and strip-till. He quickly saw financial benefits of these soil health practices in savings of time and machinery use.

Because long-term use of no-till has improved the health of the soil and helped mitigate weather-related costs, Frank became interested in adopting more soil improvement practices. He had heard about cover crops from other farmers, and so he began looking for practical guidance on how to use them on his farm. Finding relevant information was challenging, as most experts considered the Moore Farm too far north for cover crops to work.

In addition to attending events related to the practice, Frank discussed the idea regularly with a friend from the Oregon Ryegrass Commission. Ultimately, Frank decided to take a leap of faith. As he puts it, “Just go out and make it work.”

Frank started his cover crop experiment in the fall of 2013, gradually increasing the acreage until 2016, when it reached more than 500 acres. He experimented with different species to make his cover crop practice more profitable. Frank was not the only farmer in the area experimenting with cover crops. In 2016, Howard County had over 2,500 acres of cover crops planted that received state or federal funding to subsidize the cost of planting, of which 160 acres were on the Moore Farm.<sup>2</sup>

This case study focuses on changes in income during Frank's cover crop experiment on three specific fields—Dietz, Home North, and Wilkins—where Frank started and stayed with planting cover crops for all three years. The observations are simplified by the fact that these three fields shared the same cash crop rotation schedule. Frank experimented with different cover crops and seeding methods in the first three years. Table 1 shows the specifics of the processes and cash crops grown on those fields for each year.

**TABLE 1.** 2014-16 Cover Crops and Subsequent Cash Crops Planted on Three Moore Fields, Howard County, Iowa

Crop Year	Cover Crop	Seeding Method	Seeding Rate (lb/acre)	Cover Crop Acreage	Cash Crop
2014	Annual Rye	Drill and hand broadcast	15	115	Soybean
2015	Annual Rye	Aerial	20	255	Corn
2016	Cereal Rye	Aerial	70	255	Soybean

**Note:** Each year documented in this study begins in the fall of the preceding year, when cover crops were planted; e.g., 2014 begins in the fall of 2013.

<sup>1</sup> United States Department of Agriculture-National Agricultural Statistics Service (USDA-NASS), 2012 Census of Agriculture (United States Department of Agriculture, 2014), [https://www.agcensus.usda.gov/Publications/2012/Online\\_Resources/Watersheds/um07.pdf](https://www.agcensus.usda.gov/Publications/2012/Online_Resources/Watersheds/um07.pdf).

<sup>2</sup> IBID.

## YEAR-BY-YEAR FARM DATA

We averaged the budgets for four pre-adoption years of 2010, 2011, 2012, and 2013, and traced the changes from that baseline in eight cover crop-related budget categories, by year, from 2014 to 2016. In the years of study, no changes in income were attributed to cover crops in the categories of fertilizer application or yield; however, these two categories are included in the analysis because they are often expected to be affected by the practice.

Cover crop-related budget categories analyzed:

- Planting
- Termination
- Fertilizer application
- Erosion-related repairs
- Learning activities
- Additional scouting
- Yield



“Cover crops are also beneficial for weed and disease control. I saw less white mold in my soybeans compared to my neighbors’ fields without cover crops.”

—Frank

## Year 1 (2014): Learning is Part of the Initial Investment

Heavy rains in 2013 prevented planting on some of the Moore Farm's fields. This setback was the trigger for the start of Frank's cover crop experiment. He decided to seed cover crops on Dietz, Home North, and Wilkins fields, all of which were bare because of the rains. This planting and his additional learning activities brought the farm a negative net change in income of -\$39.64 per acre in this first year (see Table 2).

In September of 2013, Frank seeded annual rye grass on the Dietz, Home North, and Wilkins fields. Because he was looking for the best seeding method, he wanted fields that were large enough to accommodate different methods, and these fit the criterion. To test the seeding speed and quality of stand, he used a prairie grass drill on Home North and Wilkins fields, and a three-point hand broadcast seeder on Dietz. He also decided on a plan to try airplane seeding in subsequent years.

Establishment costs included buying seeds and running the machines to plant them, representing a negative change of -\$26.95 per acre. Frank's learning activities in this first year, which included time spent getting advice and attending field days and conferences, caused a negative change in income of -\$12.69 per acre. Frank also changed herbicide programs, going from a soil-applied herbicide to a burndown application to avoid any added termination expense, which did not affect the budget.

Frank saw no yield improvements attributable to cover crops in this first year, but he was not disappointed. He understood the necessity of long-term soil health practices before seeing significant economic returns. "It will take time before we see any impact on yield. As with no-till, the benefits are not immediate. You have to be committed to it before it pays off."

Before yield improvements, Frank wanted cover crops to control erosion. "I'm hoping that cover crops, by putting that root system down, will help control some of that." He chose annual rye grass for this very reason, and was already impressed with the significant root growth he had witnessed, which measured as much as 30 inches in the first year alone. With that much root mass, Frank was confident he would soon see improved erosion control.

## Year 2 (2015): More Changes Create New Challenges

In 2015, the Moore Farm spent more on the cover crop practice than in the first year. While the learning cost decreased with experience, the expenses of seeding method changes, termination, and additional scouting activities increased. So Frank's net change in income attributable to cover crops was -\$42.61 per acre, compared with -\$39.64 in 2014 (see Table 3).

Frank decided to repeat the use of annual rye in the fall of 2014 in advance of 2015's planting of corn, but he switched to aerial seeding.

**TABLE 2.** 2014 Changes in Income Attributed to Cover Crops on Three Moore Fields, \$/acre

Category	\$/acre
Planting	-26.95
Termination	0.00
Fertilizer Application	0.00
Erosion-Related Repairs	0.00
Learning Activities	-12.69
Additional Scouting	0.00
Change in Corn Yield	0.00
<b>2014 NET CHANGE IN INCOME</b>	<b>-39.64</b>

Note: This table represents average income and yield changes across Dietz, Home North, and Wilkins. For further detail, please refer to methodology notes on inside back cover.

**TABLE 3.** 2015 Changes in Income Attributed to Cover Crops on Three Moore Fields, \$/acre

Category	\$/acre
Planting	-32.25
Termination	-7.53
Fertilizer Application	0.00
Erosion-Related Repairs	0.00
Learning Activities	-2.59
Additional Scouting	-0.24
Change in Corn Yield	0.00
<b>2015 NET CHANGE IN INCOME</b>	<b>-42.61</b>

Note: See note for Table 2.

The addition of aerial seeding drove the cost of planting up because of the increased seeding rate. Frank used a rate of 20 pounds of seed per acre, which was one-third higher than the previous year's rate of 15 pounds per acre (see Figure 1 on page 7).

In the years before he began his cover crop experiment, Frank had typically sprayed herbicide with 28% liquid nitrogen fertilizer as the spray carrier. In 2015, however, he realized that “the nitrogen would shut down the cover crop’s processes and it would not absorb enough of the glyphosate to kill the plants.” Deciding not to spray to terminate and fertilize at the same time, he had to do two separate passes, one to terminate the grass, and the other to fertilize the corn, which added \$7.53 per acre to the expenditure of termination.

As in 2014, this second year of cover crops did not bring economic gains. The spring brought heavy rains, and the crops that were killed in the winter did little to control erosion. More than ever, Frank saw that choosing the right species for what you are trying to achieve is important. After this experience, Frank decided to rotate cover crops in the same way he rotated his cash crops, and to try cereal rye instead of annual rye the next year—the soybean year.

### Year 3 (2016): Erosion Control Brings Savings

In the third year of cover crop adoption, a reduction in erosion-related repairs delivered economic benefits. The savings compensated for part of the cost of planting and terminating cover crops, and of additional learning. This year’s negative net change in income attributed to Frank’s cover crop operation came to -\$33.59 per acre, the smallest in the three years (see Table 4).

2016 was a soybean year. Frank decided it was time to experiment with cereal rye, a species of cover crop he hadn’t used before. Because of his concern about a potential allelopathic effect that could damage the subsequent corn crop, Frank chose to seed cereal rye only before soybeans. Frank used aerial seeding again this year, and the high seeding rate of 70 pounds per acre raised the planting cost to a change of -\$38.47 per acre.

Frank followed his pre-adoption fertilizer application routine, but for termination he added 14 ounces of glyphosate per acre. He did not need post-emergent weed control this year, since he had seen that cover crops suppressed herbicide-resistant weeds. In addition to lower termination costs, he saw improved erosion control. He did not need to do any erosion-related repairs this year. He attributed 90% of this saving to cover crops, which brought him a positive change in income of \$10.59 per acre.

“Cover crops are also beneficial for weed and disease control,” Frank says. “I saw less white mold in my soybeans compared to my neighbors’ fields without cover crops.” Although these benefits are not measured in the analysis of net change in income, Frank concludes that they are ways in which cover crops contribute to improved soil conditions.

Soybean yield increased by an average of 20 bushels per acre on all three fields in this third year. Frank believes the yield increase should be attributed to good weather and to the benefits of long-term no-till, in addition to his use of cover crops.

**TABLE 4.** 2016 Changes in Income Attributed to Cover Crops on Three Moore Fields, \$/acre

Category	\$/acre
Planting	-38.47
Termination	-1.92
Fertilizer Application	0.00
Erosion-Related Repairs	10.59
Learning Activities	-3.79
Additional Scouting	0.00
Change in Corn Yield	0.00
<b>2016 NET CHANGE IN INCOME</b>	<b>-33.59</b>

Note: See note for Table 2.



**FIGURE 1.** 2014-15 Photos of Moore Farm, Wilkins Field, Seeded With Annual Rye Grass, Then Corn



September 25, 2014



October 25, 2014



November 21, 2014



April 13, 2015



May 28, 2015



June 20, 2015



July 29, 2015

Source: Moore Farm

“It will take time before we see any impact on yield. As with no-till, the benefits are not immediate. You have to be committed to it before it pays off.”

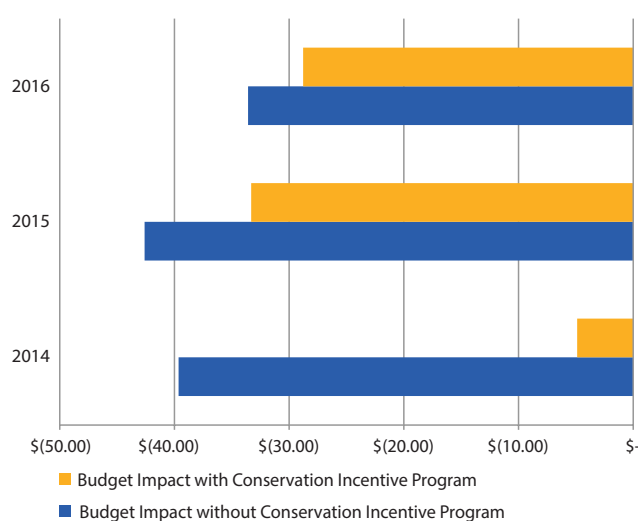
—Frank

## THE BOTTOM LINE

### Role of Conservation Incentive Programs

Frank's net changes in income in the early years of planting cover crops were always negative, mirroring other producers' experience. Early adopters often report a lag of at least two seasons before cover crops start making a difference. As a long-term adopter of no-till, which he has done successfully with corn and soybeans for more than 20 years, Frank did not expect to see benefits immediately. Iowa's Financial Incentive Program (FIP), the state cost share program for soil conservation administered by the Iowa Department of Agriculture and Land Stewardship, helped him mitigate the economic risk at the beginning. He has also received incentive payments through the USDA-NRCS Conservation Stewardship Program (CSP). Three years of participation in this program brought Frank a total of \$48.85 per acre.

**FIGURE 2.** 2014-16 Budget Impact of Conservation Incentive Programs on Three Moore Fields, \$/acre



Frank received \$4,000 from this conservation incentive program to support his cover crop practice in 2014, which drove his cover crops' impact on the farm budget from a negative net change in income of -\$39.64 per acre down to less than -\$5.00 per acre.

In the following two years, Frank expanded his cover crop areas, so the average payment per acre was not as significant as the first year, though it still helped reduce the cost of cover crop adoption (Figure 2). These programs encouraged not only Frank but also his neighbors to start using cover crops (see Box 1).

### BOX 1: Diminishing Financial Risk

Eric Hawbaker is a corn and soybean farmer who lives 25 miles west of the Moore Farm. In 2013, Eric started integrating cover crops into two of his farms. Although he saw results very early on, especially in soil tilth, he remembers the financial uncertainty he felt at the time. He recalls thinking, "I can't justify \$30 an acre without knowing that I will get a return, at least not at this stage."

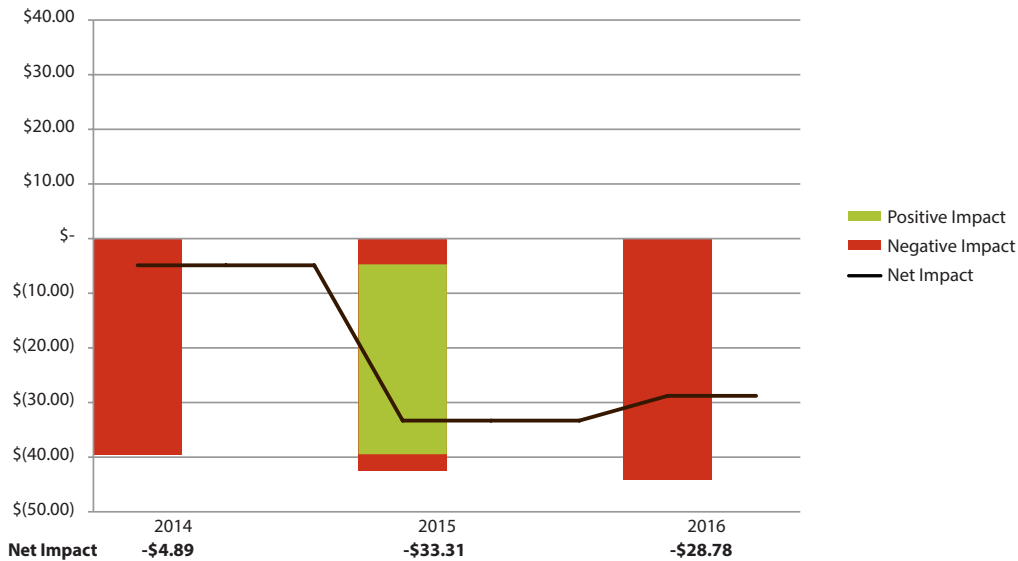


For Eric, having a support network made the difference. Frank helped him identify funding sources and submit applications, and Eric enrolled in the USDA Conservation Stewardship Program. Looking back, he realizes that this financial support was not only about money. What he gained was the ability to experiment on his farm and to figure out what was the best way to make cover crops work under his farm's specific conditions.

## Overall Budget Impact

Frank expected that cover crops would bring long-term economic benefits, but three years was not enough time for him to see full economic returns. Figure 3 illustrates how his annual budgets were affected by adoption of cover crops from 2014 to 2016, as compared to the baseline (the 2010-2013 average). The Moore Farm had not received a positive budget impact as of 2016. The economic impact of cover crops varied year by year as Frank experimented with different management strategies.

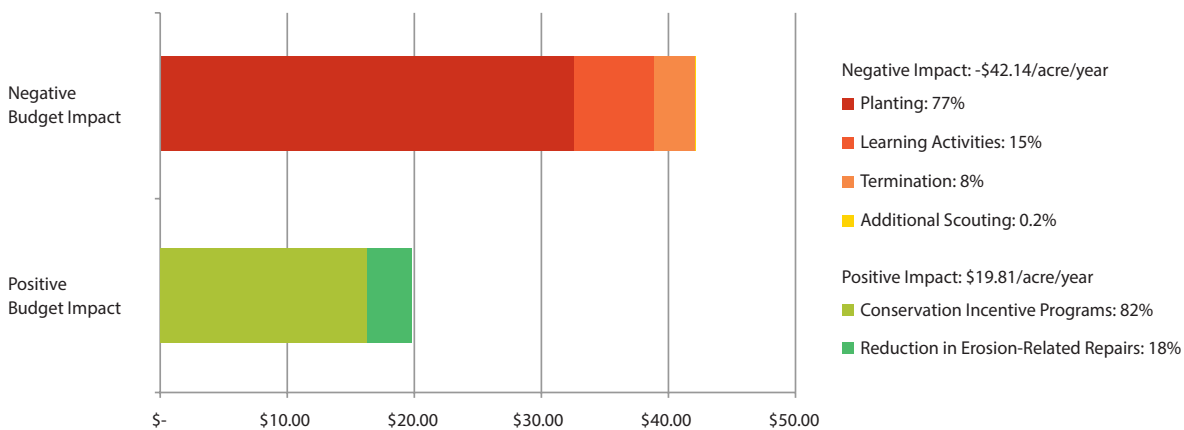
**FIGURE 3.** 2014-16 Overall Budget Impact of Cover Crops on Three Moore Fields, \$/acre



**Note:** The yearly income analysis in this case study does not include incentives from conservation programs; however, these incentives did have a positive impact on the Moore Farm's budget, as shown here.

Over these three years, cover crop operation together with participation in conservation incentive programs led to an average annual negative budget impact of -\$42.14 per acre, and a positive budget impact of \$19.81 per acre, for a net impact of -\$22.33 per acre. As Figure 4 shows, the planting of cover crops made up 77% of the total negative budget impact, with learning activities, increased termination and additional scouting accounting for the rest. On the positive side, conservation incentive programs played a significant role, accounting for 82% of the positive budget impact. Also, cover crops saved

**FIGURE 4.** 2014-16 Itemized Budget Impact of Cover Crops on Three Moore Fields, \$/acre/year



**Note:** The yearly income analysis in this case study does not include incentives from conservation programs; however, these incentives did have a positive impact on the Moore Farm's budget, as shown here. Percentages may not add up to 100% due to rounding.

erosion-related repairs, for a positive impact of \$10.59 per acre. In coming years, Frank expects that his per-acre costs will decrease as his acres under cover crops continue to grow, and that his learning costs will diminish as he becomes more familiar with the practice. He also anticipates soil health benefits to accrue, including reduced nitrogen needs, better yields, and less erosion damage.

**Changes in Yields Over Three Years**

On the three fields of study, the Moore Farm outperformed county average corn yields both before and after cover crop adoption. As for soybeans, the Moore Farm had lower yield than the county average before cover crop adoption. This gap narrowed in the first year of cover crop adoption, and in the third year, the Moore Farm soybean yield exceeded the county average (Figure 5).

**FIGURE 5.** 2010-16 Yield Comparisons: Three Moore Fields vs. Howard County Average, bu/acre



Note: The Moore Farm baseline refers to average annual yields of 2010-13 on three fields of study before adoption of cover crops.

In addition, post-adoption average yields all exceeded Frank's baseline. Frank attributed these yield increases to long-term no-till practices, and to the beginning of long-term cover crop practices.

## Soil Health and the Environment

Thanks to many years of no-till practices, soil organic matter (SOM) levels on the Moore Farm before cover crop adoption were already above 4%. Frank's cover crop experiment maintained or increased the strong SOM. For example, the 2015 soil test demonstrated a SOM level of 5.5% on Wilkins, and the 2016 soil test indicated a SOM level of 4.5% on Dietz. Some of Frank's landlords have begun to value the practices that improve soil health. For example, Dan Hoffman, a former landlord of Frank's, says that it was Frank's ethic of land stewardship that convinced him to rent him the land (see Box 2). Another landowner recently requested that Frank use cover crops on her land, and has committed to paying for 50% of the cost of seeding for the 2018 season.

An efficient internal drainage system has slowly been built up through many years of no-till and the recent addition of cover crops. In heavy rains, Frank can see its impact: "I have seen neighbors' fields ponded, with water running off. My fields have absorbed all that water."

Frank has also noticed an increased ability to maneuver through the farm without getting stuck in wet terrain. One field that he rented had a "wet hole" where the tractor got stuck every year. "Over time, that has disappeared. Now I hardly ever get stuck."

### BOX 2: A Landowner's Perspective

Dan Hoffman is a retired professor of farm management, a consultant, and former landlord of Frank's. For Dan and his wife, it was critical to find an operator they could trust to protect their land. They both had full-time jobs, and the farm was far from their home. "I couldn't see the farm every day, which is one reason I wanted someone who could manage it and care for it."

From a landowner's perspective, it makes sense to choose an operator who will protect your asset. Increasingly, landowners are beginning to realize that "farming for today"—with no concern for how practices will affect the long-term productivity of the land—is a luxury they cannot afford. Dan notes that rebuilding depleted soil is costly. "You'd better take care of what you've got. The reality is if you ruin a farm, you may not get it back into production."



## FRANK'S RECOMMENDATION: "BE OPEN TO CHANGE"

Frank started experimenting with cover crops because he considered soil a valuable asset to his farm, knowing he would have to wait some time before gaining sufficient economic benefits. "Looking back over my farm's history, I have learned that it's important to be open to change. With new information and changing technology, your options are continually changing."

The experience of long-term no-till on the Moore Farm encouraged Frank to adopt more soil health practices and be patient for returns. A producer who encouraged him to adopt cover crops told him, "I've never seen a guy doing cover crops three years in a row that isn't still doing it."

In fact, cover crops represented a risky experiment for Frank. Because most of his leases were for only one year, he risked losing his land if his experiments with cover crops negatively impacted yields. A landlord not satisfied with his results could easily choose a different tenant the following year. "Right now," says Frank, "there's somebody waiting in line to rent your ground. You have to keep your relationships with your landlords up. You need to explain to them what you're doing, the business side of it."

The humid continental climate in Frank's part of Iowa posed a challenge to the cover crop practice. The time for planting corn is extremely brief. "Up in this northern climate, you have a window of about 10 to 15 days to get your corn planted. Then you start losing yield."

Based on his cover crop experiment, Frank plans to continue expanding his acres of cover crops. To future adopters, he recommends they begin by asking themselves about their goals: *Is erosion control the goal? Am I trying to build soil health? Do I have livestock and want some more forage?* The answers will determine which cover crop species to choose.

Early planning is also important. "Most of the seed comes out of Oregon. Some comes out of Canada. If you wait until the 15th of August to decide you're going to seed cover crops, you may have a hard time finding enough seed."

Finally, Frank points out that learning from others is crucial. He consulted with friends frequently before adopting the practice, and he continues to attend events so he can stay current on cover crop knowledge. He recommends support networks and mentors. "When you have problems, you know where to look for information, and who to call to ask."

“Looking back over my farm’s history, I have learned that it’s important to be open to change. With new information and changing technology, your options are continually changing.”

—Frank

**PARTIAL BUDGET ANALYSIS**

This study uses partial budget analysis, tracing changes in relevant farm-level income categories after cover crop adoption, compared to the pre-adoption baseline. The framework simplifies data collection and is commonly used for economic analysis in resource conservation. We focused on cover crop-related income categories only. We relied on the case study farmer to estimate the percentage of each change from the baseline that was attributable to cover crops.

**PRE-ADOPTION BASELINE**

We established the pre-adoption baseline by averaging the 2010-2013 records on three studied fields of the Moore Farm. The baseline was then validated by Frank Moore to ensure it was representative of a normal year before cover crop adoption. The table below describes the baseline for each budget category. Standard valuation is applied to all categories, and all values are adjusted to 2015 dollars.

Description of Pre-adoption Baseline on Three Moore Farm Fields, \$/acre

Change Category	Description	Corn \$/acre	Soybean \$/acre
Planting	No cover crop planting cost before adoption.	n/a	n/a
Termination	No cover crop termination cost before adoption.	n/a	n/a
Fertilizer Application	On corn fields, applied 138 lb/acre of N, 84 lb/acre of P, and 116 lb/acre of K. No fertilizer applied on soybean fields—so a field received fertilizer application every other year. Fertilizer machinery cost not affected by cover crop.	143.81	0.00
Erosion-Related Repairs	A normal year of repairs on the four fields required 25 hours of moldboard plowing and disking tandem on 50 acres. Cost included implements, machinery, operator, and fuel.	11.77	
Learning Activities	Frank Moore estimated his hourly wage at \$30/hr.	n/a	
Yield	Average yields before cover crop adoption were 176 bu/acre for corn and 40 bu/acre for soybeans.	664.07	422.00

**COUNTY VS. FARM YIELD COMPARISON**

Comparing yields on the four Moore Farm fields to Howard County average allows readers to better understand the local context and consider trends over time. Many conditions that impact yields, such as soil types and topography, are not included in this research. The county comparison is included solely to provide local context.

For more details about methodology, please contact Datu Research.



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