DATU CASE STUDY

Willis Farm

Gentry County, Missouri

Average winter 27°F

Average summer 75°F

Average annual precipitation 37 inches

1,000 acres of row crops

Corn-soybean rotation

Terraced fields, with slopes ranging from 2% to 14%, clay soil

30 years of no-till, 4 years of cover crops

Cow-calf

2013-16 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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Ron, Michael, and Matthew Willis

SUMMARY

This case study presents detailed budget results of four years of experimentation with cover crops on four fields of the Willis Farm between 2013 and 2016. This northwestern Missouri farm has 1,500 acres, including 1,000 acres of corn and soybean in rotation. Noting the benefits of no-till, which the family had used since 1986, Michael Willis decided in the fall of 2012 to try cover crops to further improve soil health. Our analysis of his experiment uses an average of the previous three years' budgets as a baseline, tracing income changes by category of expenditure.

In three of the four years, the impact was positive, with a net change in income ranging from $16.48 to $18.43 per acre. In the remaining year—in which a heavy rainy season prevented soybean planting—cover crops helped reduce the need for fertilizer and erosion repairs, and (via cattle grazing) produced a small reduction in feed costs. Still, in this year of zero soybean yield due to weather, these cost reductions were insufficient to offset the planting costs of the cover crops, resulting in a net change in income of -$33.08 per acre. When conservation incentive programs are taken into account, cover crops on average made a positive impact of $16 per acre to the farm's budget each year, compared to the baseline.

Yield improvements were observed over the four years of cover cropping. Average corn yield on all four fields studied increased from 120 bushels per acre before cover crop adoption to 153 bushels per acre after. Average soybean yield (without the year of no planting) increased from 38 bushels per acre to 52 bushels per acre. Michael believes that over the four years, cover cropping played a role in the yield improvements, as well as increased soil stability via reduced erosion, and improved water holding capacity.

Key Lessons from Michael's Experiment

- Devote time to learning about cover crops before trying them on the farm.
- Start small, adding more acres each year to decrease risk and learn from experience.
- Save money by joining conservation incentive programs and grazing cattle on cover crops.

WILLIS FARM DESCRIPTION

The Willis family manages a large farm located in Gentry County, Missouri, where the average farm size is 290 acres.[1] The land farmed by the Willis family supports 1,000 acres of crop ground, 500 acres of hay and pasture ground, and a 120-head cow-calf operation. Michael and his father and brother have established a diverse rotation for their cash crops of soybeans and corn—and sometimes wheat, particularly on erosion-prone ground where they would like to build terraces.

The Willis family has been practicing no-till farming since Michael's father founded the farm on its original 240 acres in 1986. They have reaped the benefits of this practice, in savings of time, and wear and tear on the machinery. Michael also attributed the 3% to 4.5% levels of soil organic matter to decades of no-till.

After seeing the soil benefits of 30 years of no-till farming, Michael felt that cover crops were the Willis family's logical next step, since this practice would further prevent erosion, build up organic matter, and increase water infiltration. First, though, he needed to know what financial risks and rewards the practice would generate, and what it would do to his bottom line. To manage risk, he decided to first experiment with 37 acres. That experiment grew to more than 600 acres, including the four fields we focus on in this study: Crouch, Hanks NW, Hanks SW, and Hillyard-Philips (referred to hereafter as "Hillyard"). These four fields total 145 acres. All four are typically planted in rotation with soybeans and corn in alternating years.

In 2012, Michael began a year of learning by attending his first cover crop information meeting. "Preparing the transition was mainly about learning and looking at which cover crops work best for our area," Michael recalls, "so I read Sustainable Agriculture Research and Education Program (SARE) publications, and decided to attend a meeting." His primary goals for the soil were better prevention of erosion, greater build-up of organic matter, and increased water infiltration. He suspected that cover crops would help control erosion by holding field ditches in place and preventing gullies after heavy rains.

In 2013, armed with information and up-to-date research from Natural Resources Conservation Service (NRCS) and from his father, a board member of the local Soil and Water Conservation District (SWCD), he began his experiment with cover cropping. Table 1 shows the cover crops Michael chose and the planned cash crops following cover crops for each field. Cover crop species were chosen based on the prior year's cash crop, their differing growing seasons, and their potential impact on the next season's cash crops.

TABLE 1. 2013-16 Cover Crops and Subsequent Cash Crops Planted on Four Willis Fields, Gentry County, Missouri

	2013		2014		2015		2016	
Field	**Cover**	**Cash**	**Cover**	**Cash**	**Cover**	**Cash**	**Cover**	**Cash**
Crouch (21 acres)	Mix*	Corn	--	Soybean	Cereal Rye	Corn	Cereal Rye	Soybean
Hanks NW (9 acres)	Mix*	Corn	--	Soybean	Cereal Rye	--	Mix***	Corn
Hanks SW (28 acres)	Cereal Rye	Soybean	--	Corn	Cereal Rye	--	Mix***	Corn
Hillyard (87 acres)	Cereal Rye	Soybean	--	Winter Wheat	Mix**	Corn	Cereal Rye	Soybean

Note: Each year documented in this study begins in the fall of the preceding year, when cover crops were planted; e.g., 2013 begins in the fall of 2012.
*cover crop mix of turnips, canola (rapeseed), crimson clover, hairy vetch, cereal rye, and Austrian winter pea
**cover crop mix of cereal rye, hairy vetch, nitro radish, soybeans, spring forest pea
***cover crop mix of crimson clover, canola/rapeseed, forage turnip, nitro radish, purple top turnip, hairy vetch, sorghum-Sudan grass, sunflower, oats, mustard.

[1] 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.

The following analysis lays out Michael's budget numbers year by year. It breaks down the budget effects by category of expenditure and year, describes the process of integrating cover crops into each year's planting rotations on each of the four fields, and discusses what Michael learned along the way.

YEAR-BY-YEAR FARM DATA

Cover crops impact the Willis Farm's budget in terms of farming operation, learning, cattle grazing, yield and additional income from conservation incentive programs. We used a budget average from 2010 to 2012 as the baseline to trace changes in each category that related to cover crops, by year, from 2013 to 2016.

Cover crop-related change categories analyzed:

- Planting
- Termination
- Fertilizer application
- Erosion-related repairs
- Learning activities
- Cattle grazing
- Yield

> "Having cover crops made me a lot more comfortable about reducing fertilizer. I think that after fertilizing with cover crops for several years, they also helped keep what fertilizer I did apply in the field, rather than letting it erode away."
>
> —Michael

Year 1 (2013): The Learning Curve Begins

In the first year, Michael's foray into using cover crops returned a net income of $16.48 per acre on four studied fields (see Table 2). This included the costs of planting (including cover crop seed purchases) and learning activities—investments that brought him positive income changes in termination, fertilizer application, erosion-related repairs, and cattle grazing. Corn yields in this first transition year were a negative change, but an increase in soybean yield—on greater acreage than corn—contributed to the overall positive net change in income.

On the corn fields of Crouch and Hanks NW, the legumes in the cover mix were expected to reduce the need for fertilizer by building up nitrogen, so Michael reduced fertilizer application. The cover crop did not impact his corn planting. Unfortunately, Michael estimated he lost 26 bushels of corn yield per acre on Crouch, and 43 bushels per acre on Hanks NW, attributed to cover crops. He suspected this was because the legume cover crop did not supply enough nitrogen, and the carbon from the rye tied up more nitrogen in the soil.

TABLE 2. 2013 Changes in Income Attributed to Cover Crops across Four Willis Farm Fields, $/acre

Category		$/acre
Planting		-34.61
Termination		2.61
Fertilizer Application		16.37
Erosion-Related Repairs		1.99
Learning Activities		-4.13
Cattle Grazing		8.45
Changes in Yield	**$/acre**	
Corn Yield	-70.37	
Soybean Yield	50.89	
Change in Combined Yield		25.80
2013 NET CHANGE IN INCOME		**16.48**

Note: This table represents average income and yield changes across Crouch, Hanks NW, Hanks SW, and Hillyard. Change in combined yield = (average corn yield x corn acreage + average soybean yield x soybean acreage)/ (corn acreage + soybean acreage). For further detail, please refer to methodology notes on inside back cover.

Fortunately, the nitrogen miscalculation on these corn fields was offset in other ways. Soybean yields on Hanks SW, where cereal rye preceded soybeans, were up. Heavy rains caused erosion early in the season on nearby unplanted fields, but similar erosion was prevented by the rye on Hanks SW. Michael believed that the cover crop of rye on these soybean fields had protected newly planted soybean seed from washing away, adding an extra 20 bushels of harvested grain in the fall. This protective effect, which Michael could confidently attribute to cover crop adoption, contributed to the year's overall yield increase of $25.80 per acre on four fields.

Overall, $1.99 per acre was saved on erosion repairs on all four fields. No repairs were needed on Crouch or Hillyard. Michael also replaced 24.5 bales of hay—each of which weighed between 1,200 and 1,400 pounds—by grazing his 17 cattle on the cereal rye, saving $8.45 per acre.

Each cover crop species required a different termination strategy. For example, on Hanks NW, the cover crop grew so tall that more powerful herbicides were needed for termination. On Hanks SW, in contrast, the cereal rye covering the soybeans controlled weeds so well that clethodim and lactofen could be replaced with glyphosate. The field "looked really clean," says Michael, and across all four fields the average savings on termination were $2.61 per acre.

In that first year, Michael invested $4.13 per acre to expand his knowledge, attending a meeting for training, and doing 20 hours of online research after harvest to supplement his understanding. This was his trial-and-error year as he made progress up the learning curve.

Year 2 (2014): Prior Year's Cover Crops Deliver Benefits

In 2014, Michael decided against seeding cover crops on any of the four fields. Instead, he continued his typical rotation of soybeans on Crouch and Hanks NW, and corn on Hanks SW. On Hillyard, Michael planted winter wheat as a cash crop, but allowed a small strip of cereal rye that was not completely terminated in the previous year to continue growing, in hopes it would produce seed he could store and plant as the next year's cover crops. In this atypical year for cover crop adoption, Michael still attributed a small net change in income of $2.50 per acre to having planted cover crops previously, in fall 2012 (see Table 3).

TABLE 3. 2014 Changes in Income Attributed to Cover Crops across Four Willis Farm Fields, $/acre

Category		$/acre
Planting		0.00
Termination		0.00
Fertilizer Application		0.00
Erosion-Related Repair		0.68
Learning Activities		-2.07
Cattle Grazing		0.00
Changes in Yield	**$/acre**	
Corn Yield	0.00	
Soybean Yield	18.81	
Change in Combined Yield		3.89
2014 NET CHANGE IN INCOME		**2.50**

Note: See note for Table 2.

Michael was not completely comfortable planting corn into cereal rye, because of nitrogen tie-up and the potential for a negative allelopathic effect. The disappointing corn yield on Crouch the previous year demonstrated how rye can compete with a subsequent corn crop for nutrients, and Michael had concerns that rye may produce biochemicals that suppress corn growth. He harvested the cereal rye for seed, and grew wheat as the cash crop. From this experiment, he concluded that purchasing rye seed was more economical than harvesting his own to plant.

Neither Hanks NW nor Hanks SW required erosion-related repairs, which contributed to a savings of $0.68 per acre across all four fields. The $3.89 per-acre yield increase came from the soybean crop alone. Michael's only negative income effect was -$2.07 per acre, the cost of continuing his online research and attending meetings to hear and share ideas.

Year 3 (2015): Rainy Season Prevents Soybean Planting

TABLE 4. 2015 Changes in Income Attributed to Cover Crops across Four Willis Farm Fields, $/acre

Category		$/acre
Planting		-38.13
Termination		-0.38
Fertilizer Application		0.22
Erosion-Related Repairs		6.02
Learning Activities		-2.19
Cattle Grazing		1.38
Changes in Yield	**$/acre**	
Corn Yield	0.00	
Soybean Yield	0.00	
Change in Combined Yield		0.00
2015 NET CHANGE IN INCOME		**-33.08**

Note: See note for Table 2.

A heavy rainy season in this year prevented planting of soybeans on Hanks NW and Hanks SW. The cover crops helped reduce the need for fertilizer, and reduced the need for damage repairs. Cattle grazing produced a small reduction in feed costs. Still, in this year of zero soybean yield, these cost reductions were unable to offset the planting costs of the cover crops, and Michael experienced a negative net income, -$33.08 per acre attributed to cover crops (see Table 4).

The planting of this year's cover crops was costlier by $38.13 per acre than in the previous cover crop year, 2013. On Crouch, wanting to avoid the allelopathic effects observed in 2013, Michael seeded four acres of cereal rye only around field ditches. On Hillyard, he tried a mix that cost $4.50 per acre more than the 2013 cover, and increased his use of herbicides for termination there by $0.38 per acre. The nitrogen boost from the cover crops brought total fertilizer costs down slightly, saving $0.22 per acre.

Michael benefitted considerably from cover crops this year via his reduced need for erosion repairs. It was a wet year, and some terraces and field ditches had to be repaired after the heavy rains, but there was less work than he predicted, a positive change of $6.02 per acre. Reduced hay expenditure from his cattle grazing also constituted a positive change of $1.38 per acre.

Despite these gains, Michael saw no impact on yield that he could attribute to cover crops. There was no increase in the corn crop yields of Crouch and Hillyard, and, because of prevented planting due to rain, there was no yield at all on the soybean fields of Hanks NW and SW. The disappointing overall picture didn't dampen Michael's commitment to continuing education, and he invested $2.19 per acre to attend a winter conference and to keep up with online research.

Year 4 (2016): Higher Yields and More Savings

Four years into the project, it was clear that all the work and expense of the adoption process was paying off. Planting costs were stable. Fertilizer and erosion repair costs were down. The grazing benefit was holding, and yields were up on all four fields. The year ended with a net change in income of $18.43 per acre attributed to cover crops (see Table 5).

TABLE 5. 2016 Changes in Income Attributed to Cover Crops across Four Willis Farm Fields, $/acre

Category		$/acre
Planting		-37.35
Termination		-1.28
Fertilizer Application		24.56
Erosion-Related Repairs		5.49
Learning Activities		-6.45
Cattle Grazing		4.38
Changes in Yield	**$/acre**	
Corn Yield	-14.22	
Soybean Yield	37.17	
Change in Combined Yield		29.08
2016 NET CHANGE IN INCOME		**18.43**

Note: See note for Table 2.

One major contributor to the positive net change in income in 2016 was a $24.56 per-acre reduction in the cost of fertilizer. For the 108 acres of soybeans, fertilizer savings were $31.64 per acre compared to the baseline, and for the 37 acres of corn fields, fertilizer savings were $3.88 per acre. When Michael tried using less fertilizer in 2013, the reduction was ill timed, and a corn yield decrease followed. Three years later, Michael decided to experiment reducing his fertilizer application again, and this time he saw a significant yield increase on all four fields. "Having cover crops made me a lot more comfortable about reducing fertilizer. I think that after fertilizing with cover crops for several years, they also helped keep what fertilizer I did apply in the field, rather than letting it erode away." Michael attributed 40% of yield improvement in 2016 to cover crops, which led to an increase of $29.08 per acre from the baseline.

The weather was cooperative that year, and all four fields experienced yield increases. Michael acknowledged the significant contribution of very good weather, but attributed 40% of the improved yields to cover crop adoption. The benefits of erosion control continued to grow. No terraces or ditches needed erosion repairs, and grazing his cattle eliminated the need for 13 bales of hay.

Due to cover crops, Michael increased pre-adoption levels of glyphosate by 8 ounces per acre. Although the budget saw a $1.28-per-acre increase in the cost of cover crop termination, Michael pointed out that cover crops eliminated the need for some post-emergent spot spraying. Those savings were not reflected in the budget. Before adopting cover crops, Michael sometimes had to do a second post-emergent spot spray on problem areas. "Since using cover crops, we've noticed we don't need to do that much at all." Because spot spraying wasn't typically needed every year, this benefit wasn't clear until the fourth year.

In this very good year, Michael invested more time in his continuing education. Michael began to share his knowledge and experience, delivering a presentation at a three-day cover crop conference for which his travel and registration costs were reimbursed. He spent $6.45 per acre on 10 hours of online research and some of the conference expenses.

THE BOTTOM LINE

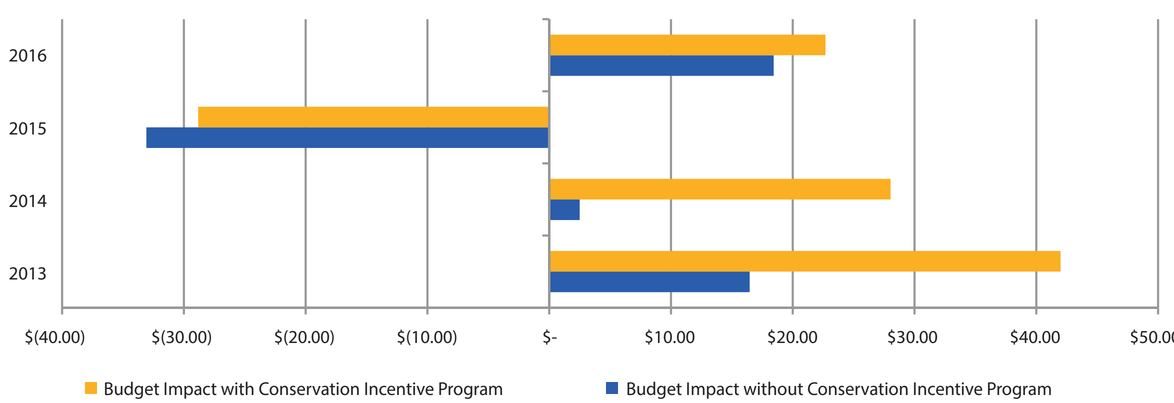
Role of Conservation Incentive Programs

In 2013 and 2014, Michael participated in the Environmental Quality Incentives Program (EQIP) led by NRCS, a voluntary program providing financial and technical help to farmers so they can plan and implement conservation practices that improve soil, water, and other natural resource conservation on their land. Each year, Michael's participation contributed $25.53 per acre in income across the four studied fields. Even in 2014, when the cost of cover crop planting did not appear in the budget, Michael planted winter wheat, qualifying him to receive the EQIP payment that subsidized his future cover crop planting.

In 2015 and 2016, he participated in a Missouri cost-share program that uses a portion of state taxes on water sales and other sources to help landowners incorporate soil and water conservation measures. The two years he participated in the program contributed $4.25 per acre each year to his budget.

Figure 1 shows how conservation incentive programs enhanced the budget impact of cover crops, especially at the beginning. Given the time delay between establishment cost and potential benefit, these programs help reduce the economic risk associated with adopting a soil conservation practice.

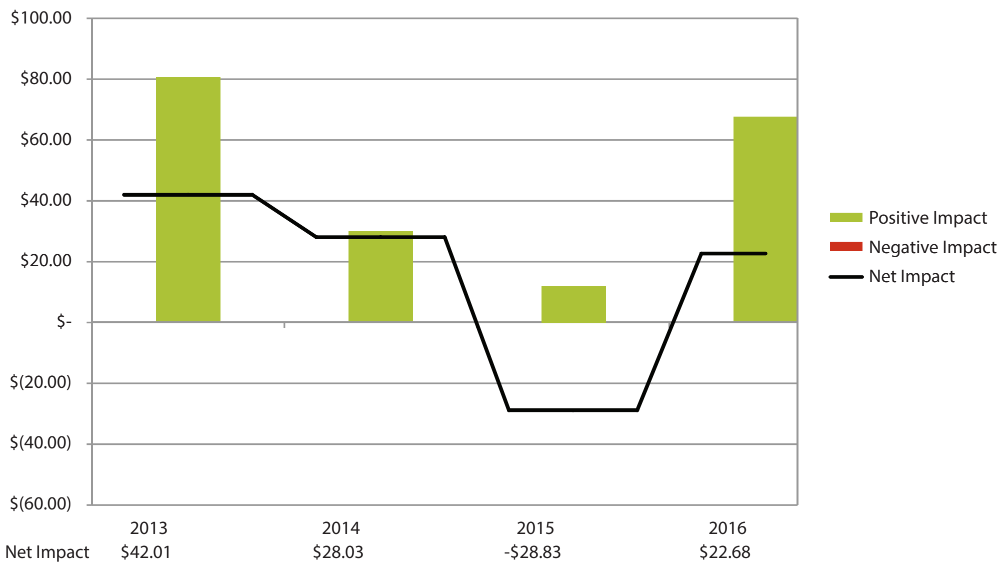
FIGURE 1. 2013-16 Budget Impact of Conservation Incentive Programs on Four Willis Fields, $/acre



Overall Budget Impact

Over his four years of experimentation with cover crops on these four fields, Michael's successes and disappointments contributed to a much better understanding of how to combine his two goals of improved soil conservation and a stronger bottom line. Conservation incentive programs contributed to his bottom line and made it more economically feasible for him to adopt cover crops. Despite a few setbacks along the way, in three of the four study years, the overall impact of cover crops on Michael's budget was positive (see Figure 2).

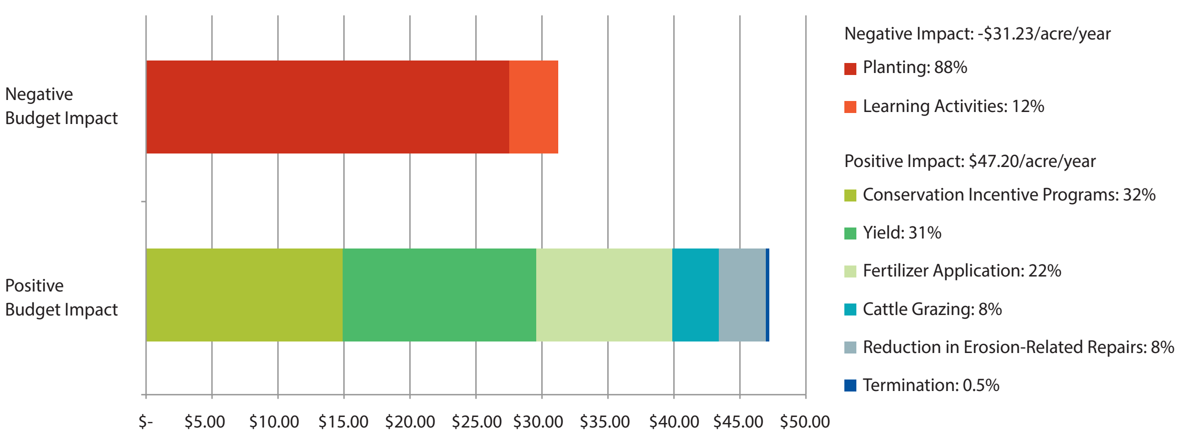
FIGURE 2. 2013-16 Overall Budget Impact of Cover Crops on Four Willis Fields, $/acre



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 Willis Farm's budget, as shown here.

For the four-year period, Michael spent an average of $31.23 per acre on cover crops every year, and received $47.20 per acre, a net budget impact of $15.97 per acre (see Figure 3). As expected, the cost of buying and planting cover crop seed represented the most significant increase in investment. The cost primarily consisted of planting (88%), and additional learning activities (12%). The positive impact consisted of conservation incentive programs (32%), yield increase (31%), and reduced costs of termination, fertilizer, erosion-related repairs, and use of cover crops for cattle grazing.

FIGURE 3. 2013-16 Itemized Budget Impact of Cover Crops on Four Willis 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 Willis Farm's budget, as shown here. Percentages may not add up to 100% due to rounding.

Changes in Yields Over Four Years

As Figure 4 illustrates, when compared to county averages, Michael's soybean yields were robust in three of the four studied years, while corn yields were not as strong against county averages.

All but one of the four years ended with better overall budget returns than in the years before cover cropping began. The disappointing 2015 year was caused by unusually heavy rain, which prevented planting soybean crops. Average soybean yield (without 2015) increased from 38 bushels per acre before cover crop adoption, to 52 bushels per acre after, an increase of 36%. Average corn yield on all four fields increased from 120 bushels per acre before adoption to 153 bushels per acre after, an increase of 28%.

FIGURE 4. 2010-16 Yield Comparisons: Four Willis Farm Fields vs. Gentry County Average, bu/acre

Note: The Willis Farm baseline refers to the average annual yields of 2010-2012 on four fields before adoption of cover crops.

Soil Health and the Environment

Financial gain was important to him, but Michael was primarily interested in more effective management to meet soil conservation goals. In conjunction with other soil health management strategies, Michael saw evidence that four years of experimentation with cover crops helped improve soil health on his fields. He also discovered that, after cover crop adoption, the fields were able to store more water during dry years—when, notably, he observed increased soil stability via reduced erosion and improved water holding capacity.

“Erosion prevention, and organic matter buildup are the soil benefits of cover crops,” says Michael. “You don’t need special analysis from soil testing to show this—you can see it. This place eroded, while the cover crop place didn’t.” This is corroborated by a neighboring farmer, Ron Hillyard, who observed that Michael’s cover cropping seems to have had a positive effect on soil conservation on his property and on nearby public property as well (see Box 1).

BOX 1: Reducing Runoff

Ron Hillyard owns the field adjacent to one of Michaels’ cover cropped fields. He doesn’t use cover crops, but he has noticed decreased storm water runoff across his fields. Now less worried about his fields receiving sudden influxes of water, he credits Michael for the change. Recalling one night when they had a four-inch rain, Ron expected to have to replace the culvert pipes. He was surprised to see that the pipes “handled the rain just fine. Michael’s cover crops slowed the water down and held the volume of water.”

Ron also sees that the whole town of King City is benefitting. Flooding on the road leading into town has become rarer. “Before, the water would run down there and run over the road. But when Michael did the cover crops, the water doesn’t run over the roads anymore. It’s not eroding, and it’s not cutting ditches.”

“You don’t need special analysis from soil testing to show this—you can see it. This place eroded, while the cover crop place didn’t.”

—Michael

MICHAEL'S RECOMMENDATION: "EXPERIMENT WITH IT"

For the Willis Farm, the adoption of cover crops over the four years of this study produced benefits including yield increases, reduction of fertilizers, herbicides, and erosion-related repairs, and savings of hay by using cover crops for cattle grazing. Because he experimented with different methods of management, kept researching and communicating with others, and participated in incentive and cost share programs, he has become confident about the value of cover crops, especially in terms of soil health.

The process of adopting cover crops does add constraints in an already complex farming operation. Cover crops are planted at harvest time, and as Michael points out, "It's an inconvenient time in the year. People don't have the time or staff to maximize benefits for cover crops." The Willis family has found it easier to manage the extra work at that time of year since Michael's brother joined the farm and began to add much-needed labor.

It also helps that the local community understands and encourages management practices that improve soil health. King City Seeds, a local business for whom Michael raised soybean seed, has been a vocal advocate of his use of cover crops. The landowner who leases land to the Willis family, Kendall Coleman, accepted a lower rent because, in his view, their diverse rotation and cover cropping practices protect his most valuable asset—his land. In turn, Michael's soil conservation practices have encouraged his neighbors to adopt cover crops on their fields (see Box 2).

Drawing on his years of experience, Michael concludes that cover crops could ease the transition from conventional tillage to no-till practices by helping soils develop better structure. He encourages no-till beginners to adopt cover crops at the same time.

Michael offers this advice to beginners: start by experimenting with a small field of 20 to 50 acres. He recommends looking for affordable cover crop species, and trying different types.

BOX 2: Strength in Numbers

Brad Law, a neighboring farmer of the Willis Farm who operates a corn, bean, wheat, hay, and cattle operation, started using cover crops in 2013. He notes, "If Michael and Don [another local farmer using cover crops] are doing it, it's worth a try."

Brad values having someone local doing cover crops, because it eases social pressure. "You need strength in numbers. When you're the only one, you're the crazy guy. When there are two of you, it's like, they're not both crazy."

Given the relative novelty of cover crops in the region, experience sharing is crucial. "If I ever have an idea, I have someone local to bounce it off of. What worked in Pennsylvania may not work in Missouri."

> "Start small enough so that it doesn't freak you out, but large enough to matter."
>
> —Michael

NOTE ON METHODOLOGY

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 budget 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 2010-2012 records on four fields of the Willis Farm. The baseline was then validated by Michael Willis 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 Four Willis 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 163 lb/acre of N, 65 lb/acre of P, and 45 lb/acre of K. On soybean fields, applied 14 lb/acre of N, 35 lb/acre of P, and 52 lb/acre of K. Fertilizer machinery cost not affected by cover crop adoption.	118.52	42.19
Erosion-Related Repairs	A normal year of repairs on the four fields required 10 hours of skid-steer loader work for ditches and 5 hours of field cultivator for terraces. Cost included implements, machinery, operator, and fuel.	5.50	
Learning Activities	Michael Willis estimated his hourly wage at $25/hr.	n/a	
Yield	Average yields before cover crop adoption were 119.7 bu/acre for corn and 38.2 bu/acre for soybeans.	451.27	399.19

COUNTY VS. FARM YIELD COMPARISON

Comparing yields on the four Willis Farm fields to Gentry 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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