

DATU CASE STUDY

Kuhns Family Farm

Effingham County, Illinois



Average winter 31°F



Average summer 75°F



Average annual precipitation 44 inches



1,800 acres of row crops



Corn-soybean rotation



Silt loam soils, flat with slopes ranging from 1% to 10%



23 years of no-till



Farrow-to-finish hog operation



Study of first year (1994), midpoint year (2004), and most recent year (2016) of no-till



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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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Mike and Stan Kuhns

SUMMARY

This case study tracks the economic effects of 23 years of no-till farming on the Kuhns Family Farm in central Illinois. The Kuhns family grows corn and soybeans in rotation on 1,800 acres, and has a farrow-to-finish hog operation. We focus on 1994, the first year of no-till; 2016, the most recent year; and 2004, the midpoint. Using the average of the farm's 1992 and 1993 budgets as the baseline, we trace the negative and positive changes in income, by each budget category affected by the practice.

The Kuhns family decided to switch to no-till to improve the poor condition of their soil, hoping also to save time and money. Their decision was confirmed when they saw that no-till farming improved both the health of their soil and their bottom line. Our analysis of the three selected years confirms the positive economic impacts of no-till, showing increases each year ranging from \$54.72 to \$107.81 per acre above the baseline. The main savings in the first year and midpoint year were accounted for by fertilizer reduction (which includes all machinery, fuel and labor costs associated with fertilizer application), while the primary positive income change in the most recent year (2016) was an increase in yield.

Although the adoption of no-till required additional investments in machinery, termination, and continued learning, the Kuhns family's economic gains outweighed the costs. In the 23 years of adoption, the farm realized 14 years of corn yields and 19 years of soybean yields above the baseline. Farm yields also outperformed the county average, especially in years of bad weather, implying that no-till improved their yield stability. Stan concluded that no-till made his farm more successful, producing higher yields while improving the soils over 20 years.

Key Lessons from Stan's Experiment

- The time saved by switching to no-till can be devoted elsewhere, including to his hog operation and his family.
- During stressful years, the effects of increases in organic matter and the reservoir of water in his soils returned significant benefits.
- Starting the no-till transition on soybean fields made it easier than on corn fields because soy requires fewer changes in machinery and management.

K.F. FARM DESCRIPTION

The Kuhns Family Farm (K.F. Farm) is in western Effingham County, Illinois, east of the Mississippi River, where average farm size is 592 acres.¹ It was founded in 1948 by Stan's grandfather on 120 acres, and has since expanded to include 38 fields on about 1,800 acres. It has always been family operated. Stan Kuhns, his father, and his brother manage the entire farm together. Corn and soybeans are the two main crops. The K.F. Farm also has a hog operation, which began with 2,100 hogs in 1994 and is raising 2,500 hogs in 2017.



The Kuhns family members' strong conservation ethic is reflected in farm management decisions. In the early 1990s, the farm's soil was in poor condition and required regular erosion-related repairs. In response, they decided to switch to no-till, which they also calculated would ultimately save money and time. At that point, Stan recalled, commodity prices were low, and the Kuhnses were aware that machinery use and labor were a strain on their budget. Switching to no-till was intended to allow the Kuhnses to "work smarter, not harder."

The transition from conventional tillage to no-till farming took two years. To develop his understanding of the logistics of no-till farming and to prepare for this transition, Stan subscribed to the magazine *No-Till Farmer*. He attended field days and farm shows to learn how to operate no-till machinery and to make related decisions. Determining which equipment to use proved challenging for the Kuhnses. Stan remembers spending hours talking to equipment manufacturers to work this out.



The Kuhnses experimented with no-till on their planting of soybeans in 1992, and continued to use conventional tillage in their corn fields. In 1994, the Kuhnses made the switch to a no-till system for corn as well. These methods continue to be a mainstay of their operations. So far, the 23-year commitment to no-till has improved soil conditions and resulted in a more productive and profitable operation for the K.F. Farm. Over the years, the practice has become increasingly common as more U.S. farmers realize it improves their soil and has economic benefits. The 2012 USDA Ag Census reports that nearly 30% of farm acres in Illinois are now under no-till operation.²

The following analysis looks closely at three budget years, comparing them with a baseline based on Stan's adjusted average of the farm's 1992 and 1993 budget data. Years of study include 1994, the first year of full no-till operation, which reflects the existing conditions at the beginning of the transition; 2004, the midpoint year of no-till; and 2016, the most recent year. The analysis breaks down the budgets by category of expenditure related to no-till, discusses the methods of operation Stan and his family adopted and managed in the years of study, and presents the lessons they learned along the way.

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.

² *IBID.*

YEAR-BY-YEAR FARM DATA

This analysis focuses on the K.F. Farm operation for the three years of study, analyzing negative and positive income changes attributed to no-till on eleven budget categories. We traced changes in quantities of inputs (e.g. ounces, bushels, hours, etc.), then used standard valuation to monetize them, then adjusted the dollar amounts to their equivalents in 2015 dollars.

Negative income changes attributed to no-till included changes in planting and fertilizer machinery, increased use of herbicides, fungicides, and insecticides; ongoing learning activities and additional scouting; and added insurance necessitated by new regulations. Positive income changes came from reduction or elimination of the expenses of tillage, including machinery and time; reductions in fertilizer and in erosion-related repairs; an expanded hog operation made possible by the time savings; and yield increases.



Year 1 (1994): Economic Benefits Make Up for a Difficult Transition

Two previous years of trying no-till on their soybean fields prepared the Kuhnses for the 1994 conversion of corn as well as soybean fields to no-till. Though they faced some challenges on the corn fields, the transition saved \$49.34 per acre in the cost of fertilizer at the start of this first year, which significantly improved the bottom line. Together with savings in tillage and erosion-related repairs, positive income changes attributed to no-till outweighed negative changes, for a positive net change in income of \$52.61 per acre (see Table 1).

Because the Kuhns family had already converted most of their soybean acres to no-till, the bulk of 1994 adoption costs were borne on the corn acres (see Table 2). This time, Stan scouted each corn field carefully, which took him about one more hour per acre. He read *No-Till Farmer* magazine, and attended farm shows and field days specifically to gain more information about the practice on corn fields. Based on their previous two years of experience on soybeans and what their research taught them, Stan and his family proceeded with no-till on 682 acres of corn fields and 474 acres of soybean fields in 1994.

The primary adjustment in the Kuhnses' method of planting corn was in the change of machinery. The Kuhnses switched from a standard 12-row planter to a minimum-till 12-row planter on the corn fields, and used their existing no-till drill to plant soybeans. The new machinery required Stan to spend 24 hours setting up the row cleaners and the closing wheels of the minimum-till row planter. Since he was already using the no-till drill to plant soybeans, it required no additional time.

To control weeds, herbicide generally substituted for tillage. Stan increased glyphosate application by 10 ounces per acre for termination on no-tilled fields. Because corn fields had a larger portion of no-till than soybean fields, the increase in no-till acreage raised agrochemical costs by \$3.24 per acre on corn fields, compared to \$2.20 per acre on soybean fields.

The Kuhns family also decided to use a row fertilizer instead of a fertilizer truck for application out of concern that the broadcasting method would be less efficient under no-till conditions. This plan was an economic success on the corn acres, since more precision in the application reduced nitrogen by 23 pounds per acre, phosphorus by 73 pounds per acre, and potassium by 105 pounds per acre. Although the machinery change added \$0.55 per acre to their cost, fertilizer savings amounted to \$49.34 per acre, becoming the most important factor in the year's positive net change in income of \$52.61.

Stan realized that this equipment change returned an additional benefit. "The real savings are not on the person's time, but on the depreciation of your tractor." The no-till areas also had less silting in pipes, and the Kuhns family was able to save 5.5 hours in standpipe repairs.

Despite its obvious benefits, the first year of no-till was not easy. Purchasing the new planter required defining new calibration and planting timelines. When the spring was wetter than anticipated, the Kuhnses did not have the option to work the soil to make it dry out more quickly. They had to learn to be patient. Stan also recalled experiencing a bit of operator fatigue that first year. "I was standing in residue, struggling at times to see the marker to make sure it was on course."

TABLE 1. 1994 Changes in Income Attributed to No-till, K.F. Farm, Effingham County, Illinois, \$/acre

Category	\$/acre	
Planting Machinery	-2.10	
Fertilizer Machinery	-0.55	
Agrochemicals	-2.82	
Learning Activities	-0.86	
Additional Scouting	-0.02	
Insurance	0.00	
Sub-total	-6.35	
Tillage	9.51	
Fertilizer	49.34	
Erosion-Related Repairs	0.11	
Hog Operation	0.00	
Sub-total	58.96	
Changes in Yield	\$/acre	
	Corn Yield	0.00
	Soybean Yield	0.00
Change in Combined Yield	0.00	
1994 NET CHANGE IN INCOME	52.61	

Note: This table represents average income and yield changes across the K.F. Farm. 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.

TABLE 2. 1994 Negative Changes in Income Attributed to No-till in the First Year of Adoption on K.F. Farm: Corn vs. Soybeans, \$/acre

Category	\$/acre	
	Corn on 682 acres	Soybeans on 474 acres
Planting Machinery	-3.55	0.00
Fertilizer Machinery	-0.94	0.00
Agrochemicals	-3.24	-2.20
Learning Activities	-1.46	0.00
Additional Scouting	-0.03	0.00
Insurance	0.00	0.00
Cash Crop Total	-9.22	-2.20
K.F. Farm Total*	-6.35	

Note: *K.F. Farm total = (corn negative income changes x corn acreage + soybean negative income changes x soybean acreage) / (corn acreage + soybean acreage).

This new way of farming created some anxiety. In 1994, very few other farmers were doing no-till, and the Kuhnses' operations and timeline were atypical. These differences led to considerable social pressure. No-till methods often result in later starting times, and the neighbors kept asking, "Why aren't the Kuhnses farming?" (see Box 1). Also, at that time technology had not yet caught up with the technical details of no-till farming. For example, Stan found funguses to be a bigger issue in no-till than in conventional farming, and many of the fungicides available now were not out in the early 90s. But as time went by, no-till as a soil health practice became common, and the Kuhns family grew more and more confident about having made the no-till decision so early.

BOX 1: Showing the Community What No-till Can Achieve

Steve Robinson, a neighboring farmer, has been operating soybeans under no-till and corn under minimum till for about as long as the K.F. Farm. Like the Kuhnses, Steve vividly remembers the social pressure he felt as an early adopter.

"Farmers take a lot of flak for doing things differently from those around them. People were saying, 'That will not work.'" Because no-till fields tend to take longer to dry out in the spring, no-till farmers are generally behind schedule for planting compared to conventional farmers. Waiting comes with social pressure. "It is human nature. It is hard to sit on your hands. Your neighbors are out—and your landlords are saying, 'Well, so and so is almost done.'"

Impressed with the improvements he has seen in the K.F. Farm's soil over the years, Steve concludes that resisting social pressure is sometimes necessary. "I knew they were doing something right. You could see the ground—it got good, it got mellower, it got more loamy-like. You didn't have to take a screwdriver and pry it out."

Steve thinks the mere presence of the K.F. Farm has had a positive impact on the community. "I would almost assume that they have had an influence on others, because they have been doing it so long and they have been successful."



Year 11 (2004): Substantial Benefits and Technology Support

In 2004, the K.F. Farm had similar acreages of corn and soybean under no-till operation. In this 11th year of adoption, the farm's no-till-related budget showed a net income of \$54.73 over the pre-adoption baseline (see Table 3). Results were comparable to the 1994 results in similar budget categories. Income increased with the expansion of the Kuhnses' hog operations made possible by the time saved by no-till. In addition, Stan did not need to do extra scouting or invest as much time and money in learning, after more than 10 years of experience. Insurance costs increased in the wake of the Agricultural Risk Protection Act of 2000.

Once the Agricultural Risk Protection Act became effective in 2000, the K.F. Farm's previous no-till adoption made it necessary to purchase \$0.50 per acre in re-plant insurance, which Stan thought was reasonable. "When you're not tilling the soil, the ground is a bit cooler. Then it's a bit harder for plants to come out if you get more adverse conditions."

By 2004, the K.F. Farm had expanded to 1,586 acres, up from 1,156 acres in 1994. Almost all corn and soybean fields were now under no-till operation. No-till on corn fields was still more expensive than on soybeans, mainly because of higher machinery costs for planting and fertilizer application (see Table 4).

The family continued to use the minimum-till 12-row planter for planting corn. They upgraded the soybean planter to a split row planter in 2000, but because the upgrade was not related to no-till, it was not included in the budget comparison. They continued to use their 12-row planter with fertilizer attachment to apply fertilizer for corn, and did not change the soybean fertilizer machinery.

In 2004, the Kuhnses tweaked the application of herbicide in response to weather conditions. Stan also found that no-till created increased insect pressure. “The residue that you get from no-till makes a better habitat than clean dirt, so you have a higher population of insects.” He added insecticide to the chemical pass, including 11 pounds of cyfluthrin to corn fields, and one pound of lambda-cyhalothrin to soybean fields.

Stan also found fungus risks associated with no-till to be more manageable. Fortunately, the technology available for no-till had improved over time, and in 2004, seed treatments to address fungus became the industry standard. Thanks to this technology, only 40 of the farm’s 802 soybean acres required fungicide treatment in 2004.

Throughout the first 10 years of no-till, Stan continued his subscription to *No-Till Farmer* and attended a national no-till conference. He studied the practice for both corn and soybeans, instead of focusing only on corn as he had in 1994. These learning activities kept him up to date on the latest developments, and enabled him to apply this soil health practice effectively on the farm.

No-till continued to reduce the expenditures in tillage, fertilizer and erosion-related repairs as more organic matter built up in the soil. The Kuhns family also invested the time savings wisely. Stan reports that he was able to dedicate more time to his hog operation, growing it from 2,100 hogs in 1994, to 2,500 hogs in 2004, for a benefit of more than \$6,000 in that one year.

TABLE 3. 2004 Changes in Income Attributed to No-till, K.F. Farm, \$/acre

Category	\$/acre	
Planting Machinery	-1.44	
Fertilizer Machinery	-0.46	
Agrochemicals	-1.64	
Learning Activities	-0.49	
Additional Scouting	0.00	
Insurance	-0.50	
Sub-total	-4.53	
Tillage	9.63	
Fertilizer	45.71	
Erosion-Related Repairs	0.12	
Hog Operation	3.80	
Sub-total	59.26	
Changes in Yield	\$/acre	
Corn Yield	0.00	
Soybean Yield	0.00	
Change in Combined Yield	0.00	
2004 NET CHANGE IN INCOME	54.73	

Note: See note for Table 1.

TABLE 4. 2004 Negative Changes in Income Attributed to No-till in the 11th Year of Adoption on K.F. Farm: Corn vs. Soybeans, \$/acre

Category	\$/acre	
	Corn on 783 acres	Soybeans on 802 acres
Planting Machinery	-2.92	0.00
Fertilizer Machinery	-0.94	0.00
Agrochemicals	-1.82	-1.48
Learning Activities	-0.49	-0.49
Additional Scouting	0.00	0.00
Insurance	-0.50	-0.50
Cash Crop Total	-6.67	-2.47
K.F. Farm Total*	-4.53	

Note: See note for Table 2.

Year 23 (2016): Decreased Cost and Increased Yield

By 2016, the K.F. Farm had expanded to about 1,800 acres, with 896 acres of no-till corn and 883 acres of no-till soybean. Over the course of 23 years, the farm witnessed improvements in both soil health and crop yields. The 2016 no-till-related net change in income, compared to the baseline, was \$107.81 per acre, including \$76.01 in yield increases (see Table 5). Stan attributed the greater income increase than previous no-till years to his growing experience with no-till and to the family's intense management of no-till methods and practices.

Even after more than 20 years of no-till experience, Stan continued to read every issue of *No-Till Farmer*, to discuss no-till farm operations with other farmers, and to attend seminars to stay current. Once he had mastered the fundamentals, he did not need to spend as much time to keep up, which lowered his learning cost in 2016 to an average of \$0.17 per acre, which was less than 20% of the first year. His commitment to continuing education kept Stan informed on current research and information, and helped him improve farm management.

By 2016, the K.F. Farm had upgraded their planting and fertilizer machinery. They maintained the split row planter for soybean, but replaced the minimum till 12-row planter with a 16-row model for corn, which made planting less expensive. The row fertilizer attachment continued to be used for applying fertilizer on corn fields. In addition, they started using a self-propelled broadcast spreader for soybeans. These changes in planting and fertilizer machinery lowered the related expenditures on corn fields, and raised the fertilizer machinery costs for soybeans (see Table 6). As a result, negative income changes for soybeans were higher than those in 1994 and 2004.

No-till had no impact on termination costs in 2016. Although Stan began using helicopters to spray fungicide and insecticide on corn acres, soil test results led him to reduce fertilizer on both his corn and soybean fields. This reduction contributed a positive change of \$22.58 per acre, which Stan attributed to no-till.

Because of the wet weather in 2016, the family spent six hours blading 2.5 acres of terrace to control erosion. Still, 2016's expenditure on erosion control was less than the baseline, which required eight hours of operating a chisel plow on five acres.

TABLE 5. 2016 Changes in Income Attributed to No-till in the 23rd Year of Adoption, K.F. Farm, \$/acre

Category	\$/acre
Planting Machinery	-0.53
Fertilizer Machinery	-1.68
Agrochemicals	0.00
Learning Activities	-0.17
Additional Scouting	0.00
Insurance	-0.50
Sub-total	-2.88
Tillage	10.38
Fertilizer	22.58
Erosion-Related Repairs	0.03
Hog Operation	1.69
Sub-total	34.68
Changes in Yield	\$/acre
Corn Yield	42.98
Soybean Yield	109.52
Change in Combined Yield	76.01
2016 NET CHANGE IN INCOME	107.81

Note: See note for Table 1.

TABLE 6. 2016 Negative Changes in Income Attributed to No-till in the 23rd Year of Adoption on K.F. Farm, Corn vs. Soybeans, \$/acre

Category	\$/acre	
	Corn on 896 acres	Soybeans on 883 acres
Planting Machinery	-1.05	0.00
Fertilizer Machinery	-0.94	-2.43
Agrochemicals	0.00	0.00
Learning Activities	-0.17	-0.17
Additional Scouting	0.00	0.00
Insurance	-0.50	-0.50
Cash Crop Total	-2.66	-3.10
K.F. Farm Total*	-2.88	

Note: See note for Table 2.

The K.F. Farm maintained a herd of 2,500 hogs in 2016. In addition to the time saved by no-till adoption, other developments including new buildings in recent years and improved efficiency to the hog raising process contributed to his operation's success. Thus, Stan attributed only half of the variation from the baseline of 2,100 hogs to no-till this year. The yield improvement in 2016 was the best evidence of no-till economic benefits.

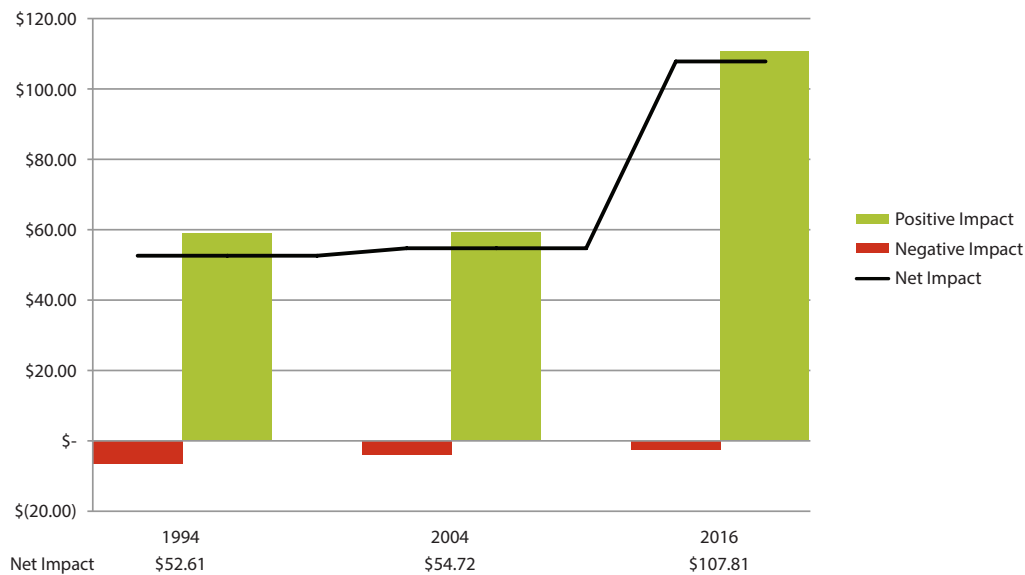
This year the farm did better than the baseline by 46 bushels of corn per acre and 26 bushels of soybeans per acre. Stan attributed 25% of the corn increase and 40% of the soybean increase to no-till, concluding that years of genetic improvements by seed companies had accounted for the remaining yield improvement. In this 23rd year, yield increase attributed to no-till added \$76.01 per acre to K.F. Farm's net income. This impressive growth was no surprise to Stan.

THE BOTTOM LINE

Overall Budget Impact

Over more than 20 years of no-till, the Kuhns family saw that this practice clearly had helped them achieve their goals of improved soil quality and increased profit. Switching to no-till not only saved in machinery cost, which Stan expected at the beginning, but also significantly reduced fertilizer application and improved yields. In the three years studied, K.F. Farm's overall no-till budgets were positive. Negative impacts related to no-till were relatively small (see Figure 1). Year by year, the cost decreased while benefits continued to grow.

FIGURE 1. Overall Budget Impact of No-till in 1994, 2004, and 2016, K.F. Farm, \$/acre



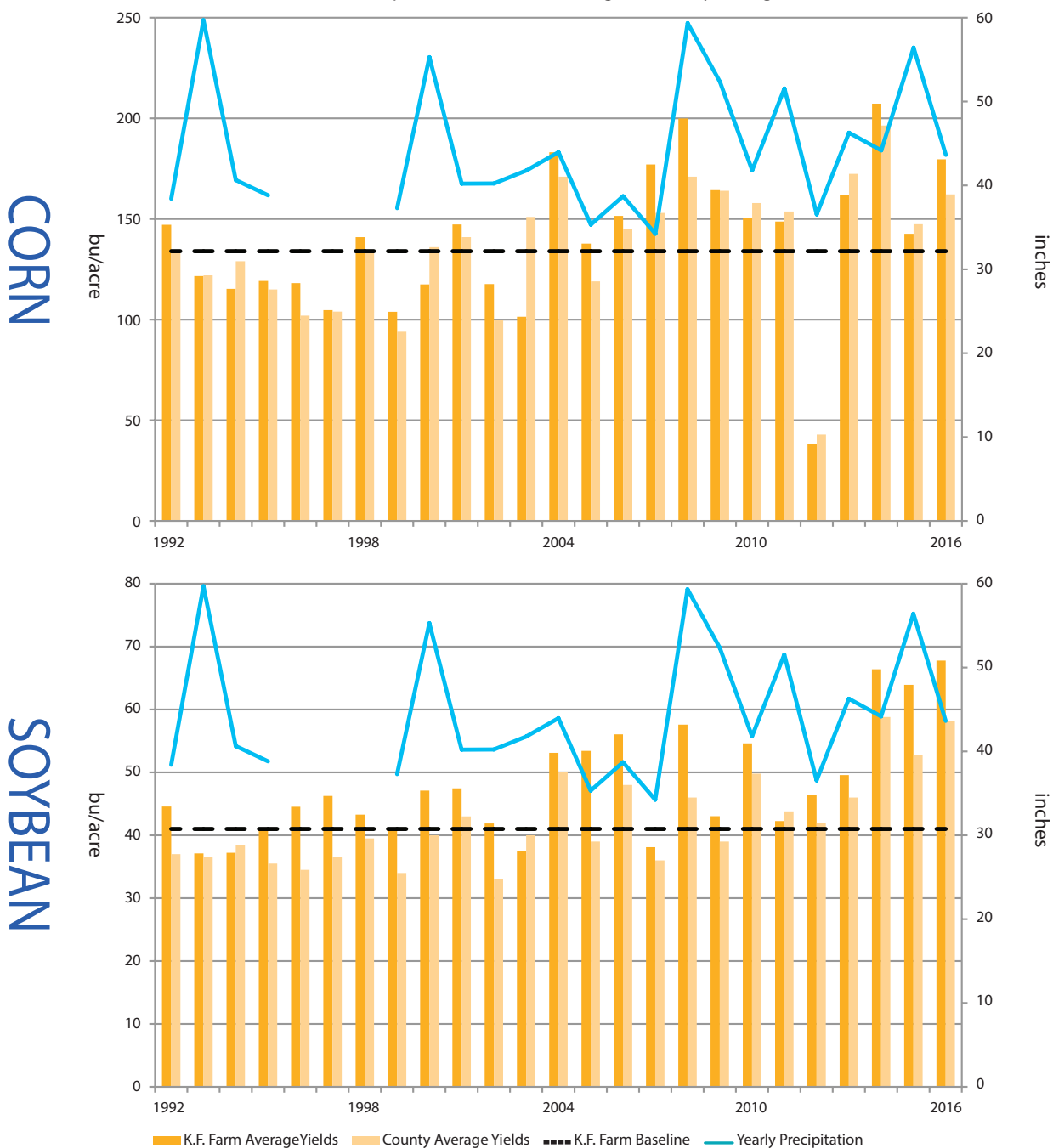
In the three years of study, the largest expenses were generated by changes in machinery (for planting and fertilizing), agrochemicals, continued learning, and time scouting. Machinery accounted for over 40% of negative changes in income in 1994 and 2004, and 93% of negative changes in 2016. Agrochemicals accounted for 40% of negative changes in income in 1994 and 2004, but made no budget impact in 2016. Fertilizer reduction and yield improvement comprised the main positive changes in income.

Fertilizer reduction accounted for 84% of no-till-related positive changes in 1994, and 77% in 2004, while yield increase accounted for 69% of those changes in 2016. In addition, no-till led to savings via reductions in time and machinery cost of both tillage and erosion-related repairs. The time saved by no-till was applied to improvements in other areas, including the hog operation. Those investments of time and attention also contributed positive changes in income.

Changes in Yields Over 23 Years

The K.F. Farm's average yields were consistently above county average (see Figure 2). When combined with other intrinsic characteristics of the farmland, no-till improved the whole farm's resistance to drought, according to Stan. In 2004 and 2016, both low precipitation years, the farm's yields suffered less than other farms in the area, and were well above county averages. Stan was certain that no-till contributed to soil health improvements and led to better yields.

FIGURE 2. 1992-16 Yield Comparisons: K.F. Farm vs. Effingham County Average, bu/acre



Note: The K.F. Farm baseline refers to typical yields before no-till, based on average annual yields in 1992-1993 and adjusted by Stan. Yearly precipitation data for 1995-1997 are not available.

Across 23 years of practicing this method, the K.F. Farm saw 14 years of corn yields and 19 years of soybean yields above the baseline. After adoption, average annual corn yield was higher by six bushels per acre, while average annual soybean yield was higher by eight bushels per acre. Genetic improvements to seed and better chemicals likely contributed to large portions of the yield increases in Stan’s field. Although Stan did not attribute all of the yield increases to no-till, he reported that the choice to adopt proved his biggest success. “I’ve been producing higher yields on the same soils for almost 25 years, and my soils continue to improve.”

Soil Health and the Environment

In evaluating his more than 20 years of no-till practice, Stan points out that results were not immediate. “The benefits are abstract at the beginning, but you need to make investment and gear up to do it.”

Seeing the increases in organic matter served as constant encouragement, with soil organic matter (SOM) levels consistently above 2% after 2001, while the pre-adoption SOM level was only 1.89% (see Table 7). Stan witnessed significant improvements in water infiltration and absorption capacity. “You have a reservoir of moisture that, without no-till, would not be there. If you get an ideal year, you don’t see the increase, but if you get a stressful year, that’s when organic matter and no-till make the difference.”

TABLE 7. 2001-16 Levels of Soil Organic Matter on K.F. Farm After No-till

Year	Years After No-Till	Soil Organic Matter (SOM)
2001	7	1.99%
2004	10	2.46%
2007	13	2.41%
2010	16	-
2013	19	2.33%
2016	22	2.32%

Note: The K.F. Farm conducted soil tests on one-third of all fields every year, so the same fields were tested every three years. For better comparison, we illustrate three-year interval data here. The pre-adoption SOM level was 1.89% in 1992. SOM data before 1992 were unavailable.

He stressed that the family’s no-till experience reinforces the importance of making a long-term commitment to soil health practices. “Keep doing it,” he says, “until you find some benefits. I would say the fourth or fifth year you start seeing the benefits.”

“You have a reservoir of moisture that, without no-till, would not be there. If you get an ideal year, you don’t see the increase, but if you get a stressful year, that’s when organic matter and no-till make the difference.”

— Stan

STAN'S RECOMMENDATION: "TAP INTO MULTIPLE RESOURCES"

To reinforce the benefits of adopting no-till, the Kuhns family put significant effort into balancing soil health and economic profitability. Stan regularly assessed whether yield improvement brought by healthier soil covered the additional fungicide costs associated with the no-till practice. He continually tried new technologies and management practices to further minimize costs, including using a dry fertilizer applicator on the planter, which enabled them to save one machinery pass, noting, "This balance is crucial for sustainability."

It is clear that adopting no-till generated significant economic benefits for the K.F. Farm. But Stan considers another benefit to be even more worthwhile. No-till has enabled him to spend more time with his family. "You're not sitting behind a tractor. You can spend more time with your family, or whatever you want."

Stan advises future adopters to start no-till with soybeans first. Because in his experience it is easier than with corn, he believes it will help farmers avoid being overwhelmed by the change. Having the right equipment for planting is also important, because the process differs between till and no-till operations. "There is a lot of specialized equipment now, from row cleaners to closing wheels. If you're going to do no-till, the right equipment will make you more efficient."

Collaborative groups can share experiences, and university extension services are helpful, he says. "They have done a lot of research and have sound advice to help the transition to no-till."

The Kuhns family, having long understood the importance of healthy soil, has been diligent in investigating new technologies. By the 1990s, their long experience made them quickly see that no-till had the potential to reinforce their three generations of deep connection to this land. "There are always opportunities to improve, and continue to improve, the soils."

“There are always opportunities to improve,
and continue to improve, the soils.”

—Stan

PARTIAL BUDGET ANALYSIS

This study uses partial budget analysis, tracing changes in relevant farm-level income categories after no-till 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 no-till-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 1992-1993 records on the K.F. Farm and adjusting them according to Stan's validation to ensure it was representative of a normal year before no-till. 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 K.F. Farm Fields, \$/acre

Change Category	Description	Corn \$/acre	Soybean \$/acre
Planting Machinery	Cost included implements, machinery, operator, and fuel.	9.34	18.70
Fertilizer Machinery	Cost included implements, machinery, operator, and fuel.	5.10	5.10
Agrochemicals	The K.F. Farm used a boom sprayer to spray 1.5 pints of Roundup per acre for the burndown application on one-third of the farm every year. Fungicide and pesticide application were not parts of the normal farm management plan before no-till.	2.18	2.18
Learning Activities	Stan Kuhns estimated his hourly wage at \$20/hr.	n/a	
Additional Scouting	No additional scouting before no-till.	n/a	
Insurance	No re-plant insurance before no-till.	n/a	
Tillage	Cost included implements, machinery, operator, and fuel.	21.70	27.30
Fertilizer	On corn fields, farm applied 196 lb/acre of N, 76 lb/acre of P, and 112 lb/acre of K. On soybean fields, farm applied 24 lb/acre of N, 61 lb/acre of P, and 101 lb/acre of K. Fertilizer machinery cost not affected by no-till.	164.12	77.40
Erosion-Related Repairs	A normal year of repairs on the four fields required 8 hours of tractor work on 5 acres. Cost included implements, machinery, operator, and fuel.	0.12	
Hog Operation	The K.F. Farm had 2,100 hogs before no-till.	27.37	
Yield	Average yields before cover crop adoption were 134 bu/acre for corn and 41 bu/acre for soybeans.	505.18	428.45

COUNTY VS. FARM YIELD COMPARISON

Comparing yields on the K.F. Farm to Effingham 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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