PRACTICE FACT SHEET

Blanchard River DEMONSTRATION FARMS NETWORK

No-Till Versus Conventional Tillage Project Summary

Objective

To determine the economic, environmental, and agronomic outcomes of a no-tillage (no-till) corn and soybean crop rotation versus a conventional tillage (conventional) corn and soybean crop rotation.

Overview

No-till or minimum tillage agriculture has gained popularity over the last few decades in Ohio. Farmers have transitioned away from annual plowing or deep chiseling farm fields every year to less intensive tillage systems that provide a variety of benefits. These approaches not only lessen the loss of soil but also provide other advantages like reduced labor, equipment and other costs.

In more recent years, many farmers have practiced rotational tillage, which involves chiseling and/or field cultivating before the corn crop is planted, followed by no-tilling soybeans. Sometimes farmers will utilize minimum tillage or vertical tillage, which involves running a piece of equipment across the ground to lightly cut up crop residue and open the top few inches of soil without inverting the soil.

In contrast, no-tillage involves planting crops with no disturbance to the soil. In a no-till situation, fertilizer is spread on top of the ground but doesn't get incorporated into the soil, leaving it vulnerable to being moved by weather. This transition away from turning the soil on a consistent basis over the course of many years can lead to a concentration of nutrients in the top few inches of the soil and can lead to an increase in nutrient stratification (Baker et al., 2017). Water quality researchers have hypothesized that this stratification may have a negative impact on downstream water quality.

This Report Covers:

Agronomic Outcomes

In a two-year trial period (2020-2021), no-till soybeans yielded higher than conventional soybeans and conventional corn yielded higher than no-till corn.

Environmental Outcomes

The no-till site saw a slight increase in tile discharge, an increase in the amount of DRP leaving through the tile and surface runoff, and an increase in the amount of Total Phosphorus leaving the surface runoff. The no-till site also saw a decrease in overall surface runoff, in total phosphorus leaving the surface runoff, and a decrease in both tile and surface nitrate losses. All changes were relatively minor, suggesting the treatment effect is minor.

Economic Outcomes

In 2020, no-till soybeans were more profitable, and in 2021, conventional corn was more profitable. Overall, the conventionally tilled field was $4.24 more profitable per acre than the no-till system for a two-year comparison period.

SUMMARY

For the two-year comparison period, yield results were mixed. In 2020, the no-tillage field had higher soybean yields, but in 2021 the conventionally tilled field had higher corn yields.

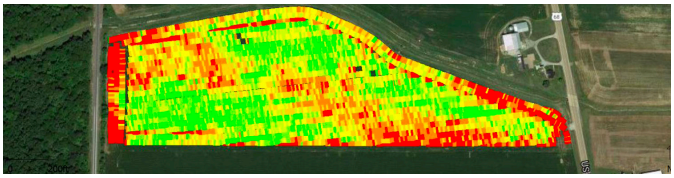
Field History

The first true year of no-till began in 2018 and both (no-till and conventional till) fields were planted in soybeans. The no-till field had a three bushel per acre higher average than the conventional field. In 2019, it was extremely wet, and the farmer had to plant the conventionally tilled field to soybeans because planting stretched into mid-June. The no-till field was planted to corn. Therefore, there was no system comparison for 2019. In crop years 2020 and 2021, both fields were planted with the same crops.

Table 1. Crop Yield 2020

Soybeans	
Treatment	**Yield (bu/A)**
South - No-tillage	73
North - Conventional tillage	65

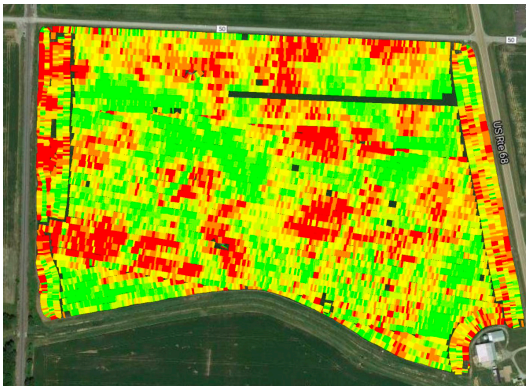
Figure 1. Yield Map Data South No-Tillage Soybeans



≤53 54-64 65-78 79-88 ≥89

Yield in Bushels per Acre

Figure 2. Yield Map Data North Conventional Tillage Soybeans



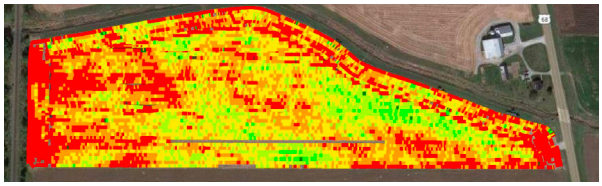
≤53 54-64 65-78 79-88 ≥89

Yield in Bushels per Acre

Table 2. Crop Yield 2021

Corn	
Treatment	**Yield (bu/A)**
South - No-tillage	153
North - Conventional tillage	168

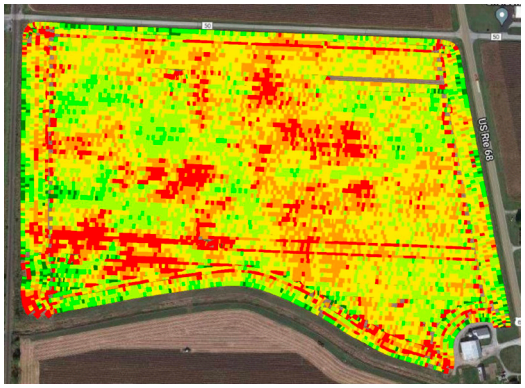
Figure 3. Yield Map Data South No-Tillage Corn



≤140 141-160 161-180 181-220 ≥221

Yield in Bushels per Acre

Figure 4. Yield Map Data North Conventional Tillage Corn



≤140 141-160 161-180 181-220 ≥221

Yield in Bushels per Acre

The yield difference in 2021 can partially be attributed to weed pressure and disease issues. Tar spot was heavily present in these fields and within the region. There was also substantial weed pressure in the no-till field that may have reduced the crop yield.

SUMMARY

The no-till site saw a slight increase in tile discharge, an increase in the amount of DRP leaving through the tile and surface runoff, and an increase in the amount of Total Phosphorus leaving the surface runoff. The no-till site also saw a decrease in overall surface runoff, in total phosphorus leaving the surface runoff, and a decrease in both tile and surface nitrate losses. All changes were relatively minor, suggesting the treatment effect is minor.

Table 3. Estimated Water Quality Results from Monitoring of Surface and Subsurface Drainage Water at the Edge-of-Field

	Subsurface (Tile)			Surface		
Factor	**Annual Loss Conventional Tillage**	**Annual Difference from No-Till**	**% Change**	**Annual Loss Conventional Tillage**	**Annual Difference from No-Till**	**% Change**
Discharge (in)	14.62	4.4	32	0.49	0.2	19
Dissolved Reactive P (lbs/A)	0.07	0.05	60	0.01	0.03	148
Total P (lbs/A)	0.54	0.17	51	0.27	-0.38	-78
Nitrate (lbs/A)	25.86	-5.2	-18	0.21	0.27	28

Negative numbers indicate where no-till reduced the factor compared to conventional tillage.
Conversely, positive numbers show increases in the factor with no-till.

The observed preliminary water quality impacts of no-till compared to conventional tillage for this project were:

- Water leaving the site from no-till slightly increased tile discharge while decreasing surface runoff.
- No-till impact on Phosphorus losses:
  - Tile discharge had increased Dissolved Reactive Phosphorus (DRP) and Total Phosphorus losses
  - Surface runoff DRP losses increased, but the increase was minor, while Total Phosphorus losses decreased
- No-till impact on Nitrate losses:
  - Tile discharge Nitrate losses were reduced
  - Surface runoff Nitrate losses were reduced
- The amount of change between the treatments is relatively small, suggesting the treatment effect is minor.

SUMMARY

For the two-year comparison period, the conventionally tilled system was $4.24 per acre more profitable. In 2020, no-till soybeans were more profitable by $44.43 per acre. However, in 2021, the conventional corn crop was $48.67 more profitable per acre. A detailed listing of key expense differences between the two systems is listed below.

Table 4. Cost Comparison Between No-Tillage and Conventionally Tilled Cropping System for 2020 Soybean Crop

Expense Differences	No-Till	Conventional
Pre-emergent herbicide	$30.65	$0.00
Post-emergent herbicide	$52.55	$31.28
Labor	$5.68	$9.47
Fuel	$3.63	$6.50
Equipment	$58.00	$68.00
All Other Expenses	$172.65	$172.65
Total Expenses	**$323.16**	**$287.90**
Revenue		
Yield (bu/a)	73	65
Price	$10.32	$10.32
Gross Profit	$753.36	$670.80
Less Expenses	$323.16	$287.90
Net Profit	**$430.20**	**$382.90**

Both systems were planted in 15" rows using a Kinze 3500 planter. There were two major differences between the systems that are detailed below.

Increased herbicide cost for the no-till system. A pre-emergent herbicide application was made on the no-till field followed by two post-planting applications. The conventionally tilled system only had one post-emergent herbicide application to control weeds. These additional herbicide applications on the no-till field accounted for a $51.92 per acre increase in expenses for the no-till system over the conventional system in herbicide cost.

Increased equipment and labor expenses for the conventional tillage system. The conventional tillage system required an additional tillage pass in the spring with a John Deere disk to prepare the seedbed. This additional equipment cost along with the additional fuel and labor added $16.66 per acre in expenses for the conventional tillage system versus the no-till system.

Table 5. Cost Comparison Between No-Tillage and Conventionally Tilled Cropping System for 2021 Corn Crop

Expense Differences	No-Till	Conventional
Pre-emergent herbicide	$36.25	$0.00
Post-emergent herbicide	$20.54	$46.25
Repairs and Maintenance	$18.65	$24.86
Fuel	$10.65	$13.01
Labor	$16.67	$28.57
Equipment	$69.00	$85.00
Supplies	$1.83	$2.23
All Other Expenses	$330.41	$330.41
Total Expenses	**$504.41**	**$330.41**
Revenue		
Yield (bu/a)	153	168
Price	$5.00	$5.00
Gross Profit	$765.00	$840.00
Less Expenses	$504.00	$530.35
Net Profit	**$261.00**	**$309.65**

Both systems were planted in 30" rows using a Kinze 3500 planter. There were two major differences between the systems that are detailed below.

Increased herbicide cost for the no-till field. The no-tilled field had a pre-emergent herbicide applied plus a post-planting herbicide applied compared to the conventionally tilled field which just had a post-planting herbicide application. This was an additional $10.54 cost to the no-till field.

Increased expenses for repairs and maintenance, labor, fuel, supplies, and equipment for the conventional field. The conventionally tilled field had additional costs for repairs and maintenance, labor, fuel, supplies, and equipment for the additional tillage passes across the field compared to the no-tilled field. These additional expenses amounted to $36.88 more per acre for the conventional field.

Table 6. Summary of Two-Year Economic Data

	No-Tillage Profit per acre	**Conventional Tillage** Profit per acre
2020 - Soybeans	$430.20	$385.76
2021 - Corn	$261.00	$309.65
Total Profit Per Acre	**$691.20**	**$695.41**
Conventionally tilled field $4.21 more profitable per acre		

Visit **blancharddemofarms.org** to learn more.

This fact sheet was developed in collaboration between the Blanchard River Demonstration Farms and its partners and the Ohio Department of Agriculture.

CREATED IN PARTNERSHIP WITH

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Source:

Baker, D. B., Johnson, L. T., Confesor, R.B., & Crumrine, J. P. (2017). Vertical Stratification of Soil Phosphorus as a Concern for Dissolved Phosphorus Runoff in the Lake Erie Basin. Journal of Environmental Quality.

Contact

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