

# Crop Rotation and Tillage Effect on Crop Yield

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## Objective

To evaluate the effect of crop rotation and tillage on corn, soybean, and wheat yield.

## Background

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Cooperator:	O.A.R.D.C. NW Branch	Soil test:	see below
County:	Wood	Fertilizer:	see below
Nearest Town:	Hoytville	Planting Date:	see below
Drainage:	tile, well-drained	Planting Rate:	see below
Soil type:	Hoytville, clay	Row Width:	see below
Tillage:	no-till & conservation	Herbicides:	see below
Previous Crop:	see below	Harvest Date:	see below
Variety:	see below		

## Methods

Treatments were replicated eight times in a randomized complete block design. Plot size- 10 x 70 feet each entry. Harvest data was collected from center rows from eight strips for each rotation. All systems compared no-till to conservation tillage which left 30% surface residue. Conservation tillage consisted of a shallow field cultivator in soybean residue and disk chisel and finish tool in corn residue. The same crop was planted on all treatments on the same day, using the same variety, fertility, and herbicide. In 2002 the entire plot area was no-till planted to soybeans, experiment began in 2003.

2008 Corn system – Becks 5244 at 30,000 plants/acre on May 23, 2008, 30-inch row spacing. Fertilizer- 100 lb/ac 0-46-0 and 150 lb/ac 0-0-60, 17 gal/ac 28% preplant, 50 gal/ac sidedress nitrogen. Herbicide- Lexar, Honcho Plus. Harvest date – October 14, 2008.

2008 Soybean system – Pioneer 93M11 at 200,000 plants/ac on May 24, 2008, 7-inch spacing. Herbicide- post spray- Roundup Weathermax-22 oz/ac, AMS 48 oz/ac. Harvest on September 29, 2008.

2008 Wheat system – Hopewell planted October 5, 2007. Fall 2007, 10 gal/ac 28% N, April 17, 2008 topdress 20 gal/ac 28% N. Harvest July 7, 2008.

**Results****2008 Crop Yields bushels / acre**

Rotation				Tillage	2008 Corn Yield bu/ac
2005	2006	2007	2008		
Corn	Soybean	Corn	Corn	No-till	90.6 a
Corn	Corn	Corn	Corn	Tillage	92.8 a
Corn	Corn	Corn	Corn	No-till	93.0 a
Corn	Soybean	Corn	Corn	Tillage	95.8 a
Corn	Corn	Soybean	Corn	No-till	105.4 b
Corn	Soybean	Wheat	Corn	No-till	110.7 b
Corn	Corn	Soybean	Corn	Tillage	112.1 b
Soybean	Corn	Soybean	Corn	No-till	113.2 bc
Soybean	Corn	Soybean	Corn	Tillage	116.1 c
Corn	Soybean	Wheat	Corn	Tillage	125.9 d
				LSD (0.05)	8.41

Rotation				Tillage	2008 Soybean Yield bu/ac
2005	2006	2007	2008		
Corn	Soybean	Corn	Soybean	No-till	24.5 a
Corn	Soybean	Corn	Soybean	Tillage	25.2 a
Soybean	Corn	Corn	Soybean	No-till	28.1 b
Soybean	Corn	Corn	Soybean	Tillage	32.1 c
Soybean	Wheat	Corn	Soybean	No-till	33.1 cd
Wheat	Soybean	Wheat	Soybean	No-till	34.3 de
Soybean	Wheat	Corn	Soybean	Tillage	35.7 e
Soybean	Soybean	Soybean	Soybean	Tillage	38.8 f
Wheat	Soybean	Wheat	Soybean	Tillage	39.7 f
Soybean	Soybean	Soybean	Soybean	No-till	39.7 f
				LSD (0.05)	1.49

Rotation				Tillage	2008 Wheat Yield bu/ac
2005	2006	2007	2008		
Soybean	Wheat	Soybean	Wheat	No-till	61.3 a
Wheat	Corn	Soybean	Wheat	Tillage	64.5 b
Soybean	Wheat	Soybean	Wheat	Tillage	65.7 b
Wheat	Corn	Soybean	Wheat	No-till	67.0 b
				LSD (0.05)	2.87

## Economic Analysis

The following chart summarizes 2003 to 2008 rotation and tillage economic analysis. Each year the average of eight yields per rotation per tillage were calculated. Then yields were entered into the 2009 Ohio Enterprise Crop Budgets. Return above variable costs ( including machinery costs) were then computed. Receipts included prices at: corn - \$4.00/bushel ; wheat - \$5.00/bushel; soybeans - \$9.00/bushel. Budgets were calculated using mid-range expenses. Rotation economics were combined which had different harvest years of the same rotation.

### Yearly Return above Variable Costs

Rotation	No-till	Con. Tillage
Soybean/corn/corn	\$178.06	\$178.76
Soybean/wheat	\$154.32	\$126.94
Soybean/corn	\$201.80	\$188.02
Soybean/corn/wheat	\$157.34	\$143.12
Corn/corn/corn	\$110.59	\$150.68
Soybean/soybean/soybean	\$240.99	\$231.78
Average Return	\$173.85	\$169.88

## Summary

This experiment has been conducted for six years. In 2008 corn yield was significantly better with the soybean, wheat, corn rotation with conservation tillage. Continuous soybeans produced significantly better yield regardless of tillage compared to all other soybean systems except wheat:soybean tillage rotation. The soybean:wheat no-till system was significantly lower in yield compared to the other wheat systems.

The economic analysis suggests that a continuous soybean production system has the highest return above variable costs. This was possible because of low input costs (especially fertilizer) and no reduction of yield after six years of continuous soybeans. Soybean cyst nematode levels are also very low at this location due to the clay loam soil and no movement of equipment off the farm. No foliar fungicides have been applied on this plot.

The type of tillage is a less important factor compared to rotation choice. No-till showed better return above variable cost compared to conservation tillage in all rotations except continuous corn. In clay loam soil, tillage improves yield in a continuous corn system.

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