

Effects of Long-Term Tillage and Crop Rotation on Yield and Soil Carbon

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Introduction

Tillage system and crop rotation have significant long-term effects on soil productivity and soil quality components such as soil carbon and other soil physical, biological, and chemical properties. In addition, both tillage and crop rotation have effects on weed and soil disease control. There is a definite need for well-defined long-term tillage and crop rotation studies across the different soils and climate conditions in Iowa. The objective of this study is to evaluate the long-term effects of different tillage systems and crop rotations on soil productivity.

Materials and Methods

This study was conducted on eight Iowa State University Research and Demonstration Farms in 2002. At the Western Research Farm, treatments included one crop rotation of corn-soybean across five tillage systems (no-tillage, strip-tillage, chisel plow, deep ripper, and moldboard plow) and several soil types. The experimental design was a randomized complete block design with four replications. Initial soil samples were collected in 2002 prior to implementing the tillage treatments. The soil samples were collected from all sites for depths of 0–6, 6–12, 12–18, and 18–24 in. and will be analyzed for total carbon and total nitrogen. Subsequent soil samples were collected in 2004 from all sites for depths 0–6, 6–12, 12–18, and 18–24 in. and will also be analyzed for total carbon and total nitrogen. The plot size was 8 rows × 55 ft. Yield would be determined from the center 4 rows of each plot. Long-term

effects of tillage and crop rotation on total soil carbon and total nitrogen will be monitored on a biannual basis or more often. Seasonal measurements such as nitrogen use efficiency, soil bulk density, and infiltration rate were taken on selected sites depending on availability of funding.

Results and Discussion

The average corn yield across all tillage systems for the corn-soybean rotation in 2004 was 175.5 bushels/acre, (Table 1). Corn yields for no-tillage and strip-tillage were significantly lower than those for deep rip, chisel plow, and moldboard plow tillage.

The average soybean yields for the corn-soybean rotation across all tillage systems in 2003 and 2005 were 28.4 and 48.1 bushels/acre, respectively (Table 1). In both years, no-tillage yield was significantly greater than yields for deep rip, chisel plow, and moldboard plow tillage.

Low soybean yields in 2003 were likely due to dry weather conditions when precipitation was 10.51 in. less than normal.

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Table 1. Corn and soybean yields under a corn-soybean rotation at the ISU Western Research Farm. Yields are corrected to 15.5 and 13.0% for corn and soybean, respectively.

	Corn (<u>C</u> -s)	Soybean (c- <u>S</u>)	
	2004	2003 ^b	2005
	----- bushels / acre -----		
No-tillage	166.4	31.2	52.1
Strip-tillage	167.7	28.6	51.0
Deep rip	180.5	27.4	45.7
Chisel plow	184.3	28.3	46.5
Moldboard plow	178.7	26.8	45.2
LSD _(0.05) ^a	7.5	2.4	3.3
5-tillage average	175.5	28.4	48.1

^aLeast significant differences (LSD_(0.05)) are based on a Fisher test.

Yield differences greater than the least significant difference are significantly different.

^bPrecipitation in 2003 was 10.51 in. below normal.