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# Effects of Long-term Tillage and Crop Rotation on Soil Carbon and Soil Productivity

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**Abstract**
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 was to evaluate the long-term effects of different tillage systems and crop rotations on soil productivity.

**Keywords**
Agronomy

**Disciplines**
Agricultural Science | Agriculture | Agronomy and Crop Sciences

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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 was to evaluate the long-term effects of different tillage systems and crop rotations on soil productivity.

## Materials and Methods

This study was originated on eight Iowa State University Research and Demonstration Farms in 2002. At the McNay Research Farm, five tillage systems (no-tillage, strip-tillage, chisel plow, deep ripper, and moldboard plow) and two crop rotations (corn-corn-soybean and corn-soybean) were established in the fall of 2002 over corn residue. The two crop rotations were utilized in three blocks, two blocks with corn-corn-soybean and one with corn-soybean. The two corn-corn-soybean blocks were started in different years in the rotation to make possible having the same crop in all growing seasons for each rotation. Initial soil samples were collected in the fall of 2002 prior to implementing the tillage treatments. The soil samples were collected from all sites for depths 0–6, 6–12, 12–18, and 18–24 in. and will be analyzed for total carbon and total nitrogen. The experimental design was a completely randomized block design with four replications. The plot size is 12 rows × 114 ft. Corn yield was determined from the center eight rows of each corn plot. Long-term effects of tillage and crop rotation on total soil carbon and total nitrogen will be monitored on a biyearly basis or more often as needed. Seasonal measurements such as nitrogen use efficiency, soil bulk density, infiltration rate, will be taken on selected sites depending on availability of funding.

## Results and Discussion

In 2003, the five tillage systems under the corn-corn-soybean rotation did not show a significant difference in corn yields, averaging 168 and 159 bushels/acre from both blocks (Figures 1 and 2). Similar to the corn-corn-soybean rotation, the corn-soybean rotation did not show significant yield differences due to tillage systems, averaging 164 bushels/acre (Figure 3). The corn-soybean rotation obtained similar yields compared with the corn-corn-soybean rotation.

In 2004, there were no significant differences due to tillage system on second-year corn of a corn-corn-soybean rotation with an average of 136 bushels/acre (Figure 4). Soybeans in both the corn-corn-soybean and corn-soybean rotations were not significantly different for any of the tillage systems, yielding 66 and 66 bushels/acre, respectively (Figures 5 and 6).

It is too early to conclude that tillage or crop rotation had effects on yield since these systems have only been in place for two growing seasons.

## Acknowledgments

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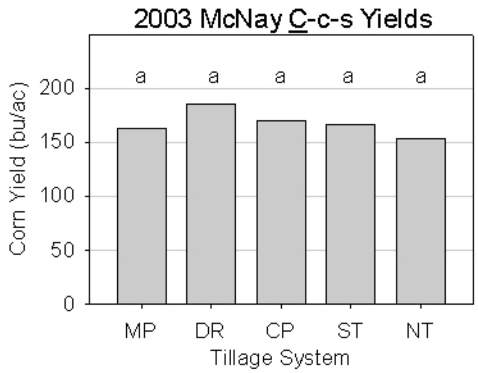


**Figure 1. Effect of tillage system on corn yield in a corn-corn-soybean rotation for 2003 near Chariton, IA.**

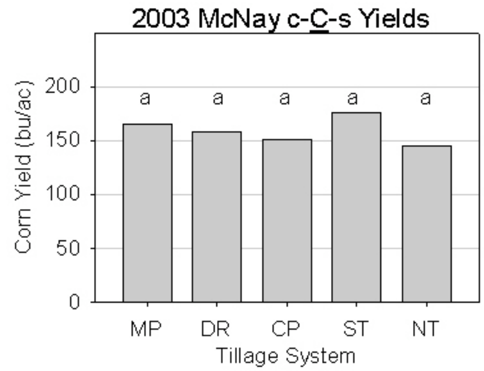


**Figure 2. Effect of tillage system on second year corn yield in a corn-corn-soybean rotation for 2003 near Chariton, IA.**

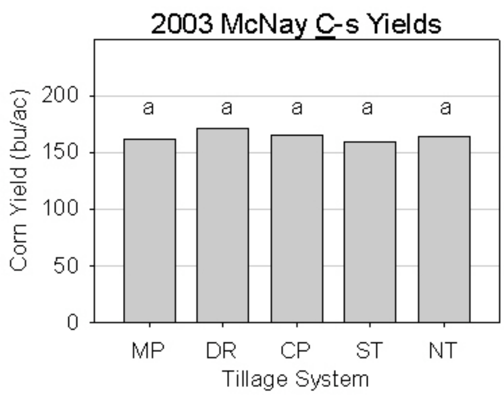


**Figure 3. Effect of tillage system on corn yield in a corn-soybean rotation for 2003 near Chariton, IA.**

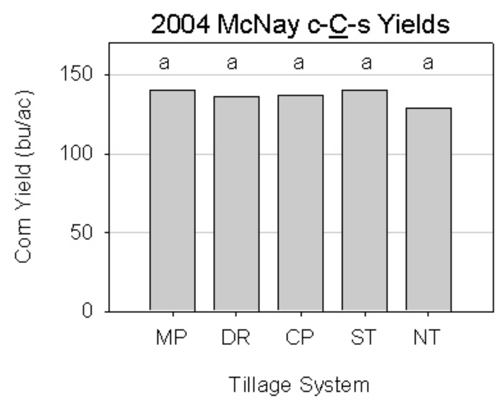


**Figure 4. Effect of tillage system on second year corn yield in a corn-corn-soybean rotation for 2004 near Chariton, IA.**

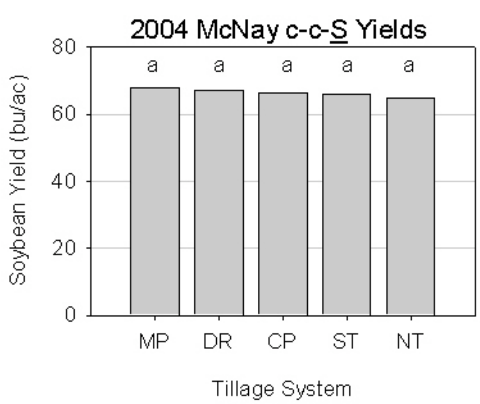


**Figure 5. Effect of tillage system on soybean yield in a corn-corn-soybean rotation for 2004 near Chariton, IA.**

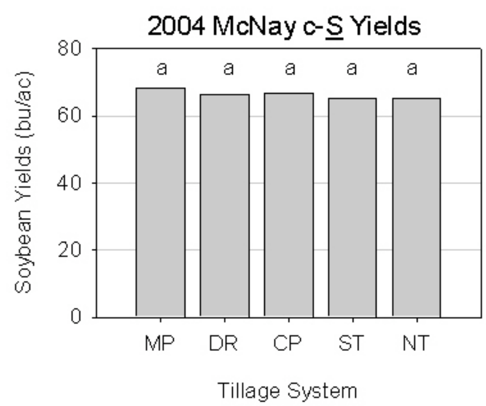


**Figure 6. Effect of tillage system on soybean yield in a corn-soybean rotation for 2004 near Chariton, IA.**