# Long-Term Tillage and Crop Rotation Effect on Yield and Soil Carbon in Northern Iowa

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Mahdi Al-Kaisi, professor
David Kwaw-Mensah, research associate
Department of Agronomy

## Introduction

Tillage systems and crop rotation systems have significant long-term effects on soil productivity and the soil quality components of soil carbon and other soil physical, biological, and chemical properties. Additionally, soil tillage and crop rotation control weeds and soilborne diseases. There is need for a well-defined, long-term tillage and crop rotation study across the different soil types and climate conditions in the state. The objective of this study was to evaluate the long-term effects of different tillage systems and crop rotations on soil productivity and quality.

## Materials and Methods

This study started in 2002 on eight Iowa State University Research and Demonstration Farms including the Northern Research Farm, Kanawha. Treatments include five tillage systems: no-tillage (NT), strip-tillage (ST), chisel plow (CP), deep rip (DR), and moldboard plow (MP). Crop rotations include corn-corn-soybean (C-C-S), corn-soybean (C-S) and continuous corn (C-C) across the five tillage systems. The experimental design is a randomized complete block design with four replications. The plot size is 12 rows by 90 ft. Initial soil samples were collected in 2002 prior to implementing the tillage treatments. The soil samples were collected from depths 0–6, 6–12, 12–18, and 18–24 in. and will be analyzed for total carbon and nitrogen. Subsequently, soil sampling has been done bi-annually at the same depths and analyzed for total carbon and nitrogen. Yields are determined from the center three rows of each corn plot and five rows of each soybean plot. The long-term effect of tillage and crop rotation on total soil carbon and nitrogen have been monitored bi-annually. Seasonal measurements such as nitrogen use efficiency, soil bulk density, and infiltration rate have been conducted depending on availability of funding.

## Results and Discussion

The results of corn yield in 2017 at the Northern Research Farm are presented in Figure 1.

In C-S and C-C-S rotations, corn yields were not significantly different (Figure 1). However the highest corn yields in C-S (206.2 bu/acre) and C-C-S (194.3 bu/acre) rotations were with CP. In the C-C rotations, corn yields with NT (196.2 bu/acre), ST (170.7 bu/acre), and CP (171.1 bu/acre) were not significantly different. Similarly, corn yields in NT (196.2 bu/acre), DR (199.7 bu/acre), and MP (186.5 bu/acre) were not significantly different (Figure 1). In the C-C rotation, the highest corn yield (199.2 bu/acre) was with DR. The average corn yields in the C-S, C-C-S, and C-C rotations were 202.3 bushels/acre, 180.2 bushels/acre, and 184.8 bushels/acre, respectively. In 2017, the overall average corn yield at the Northern Farm was 189.1 bushels/acre, which was 4.5 percent higher than the average yield in the C-C-S (180.2 bu/acre), and 2.6 percent higher than the yield in C-C (184.8 bu/acre), but 7 percent lower than the average yield in C-S (202.3 bu/acre).

## Acknowledgements

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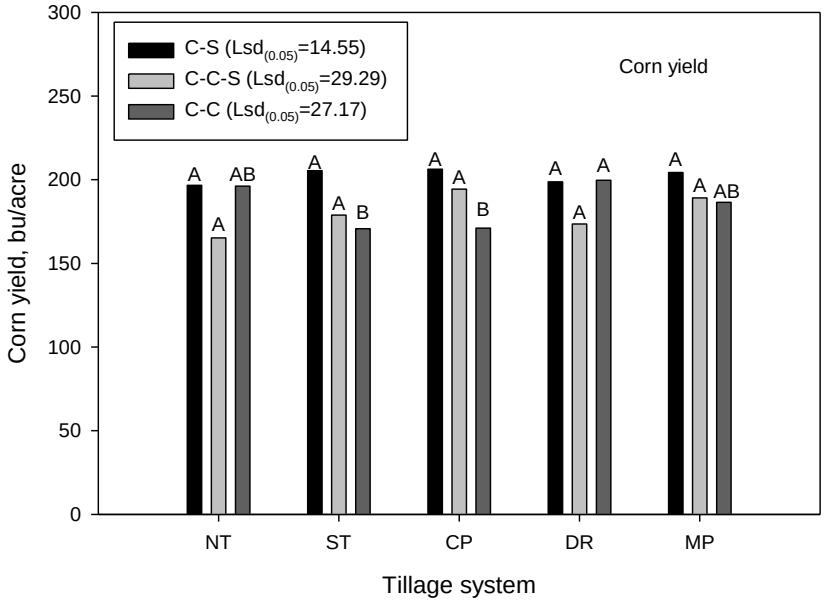


**Figure 1. Corn yield in three rotations (C-S, C-C-S, and C-S) with five tillage systems at the Northern Research Farm in 2017. Corn yields within each rotation system with the same uppercase letter are not significantly different at P = 0.05.**