

Long-Term Tillage and Crop Rotation Effect on Yield and Soil Carbon

RFR-A1549

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Introduction

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

Materials and Methods

This study started in 2002 at seven Iowa State University Research and Demonstration Farms including the Northern Research Farm (NRF) at Kanawha. Treatments include five tillage systems: no-till (NT), strip-tillage (ST), chisel plow (CP), deep rip (DR), and moldboard plow (MP) and three crop rotations: corn-soybean (C-S), corn-corn-soybean (C-C-S) and a continuous corn (C-C) system. The experimental design is a randomized complete block design with four replications. Each plot size is 30 ft wide (12 rows) and 90 ft long. Prior to establishing the study, baseline soil sampling was done in 2002 at 0–6, 6–12, 12–18, and 18–24 in. soil depths and analyzed for total carbon and total nitrogen. Subsequent soil sampling after establishing the experiment has been done bi-

annually at the same soil depths and analyzed for total C and total N. Seasonal measurements such as nitrogen use efficiency, soil bulk density, and infiltration rate have been conducted depending on availability of funding.

Corn and soybean yields were determined from the center four and six rows of the corn and soybean plot, respectively.

Results and Discussion

The results of corn and soybean yields in 2015 are presented in Figure 1 and Figure 2, respectively.

Corn yield with NT in the C-s system was significantly different from the yields with ST, CP, DR, and MP. Similar results of corn yields were obtained in C-C system. When averaged across all tillage systems, corn yield in the C-s system (220.7 bu/acre) was 17.0 percent higher than the average (188.7 bu/acre) in the C-C system. Overall, corn yield at the NRF in 2015 averaged across all tillage treatments and crop rotations was 204.7 bushels/acre.

Soybean yields with NT and MP were not significantly different. Similarly, soybean yields with ST, CP, DR, and MP were not significantly different. The average soybean yield in 2015 was 70.9 bushels/acre.

Acknowledgements

We would like to thank Matt Schnabel and Karl Nicolaus for conducting and managing this study.

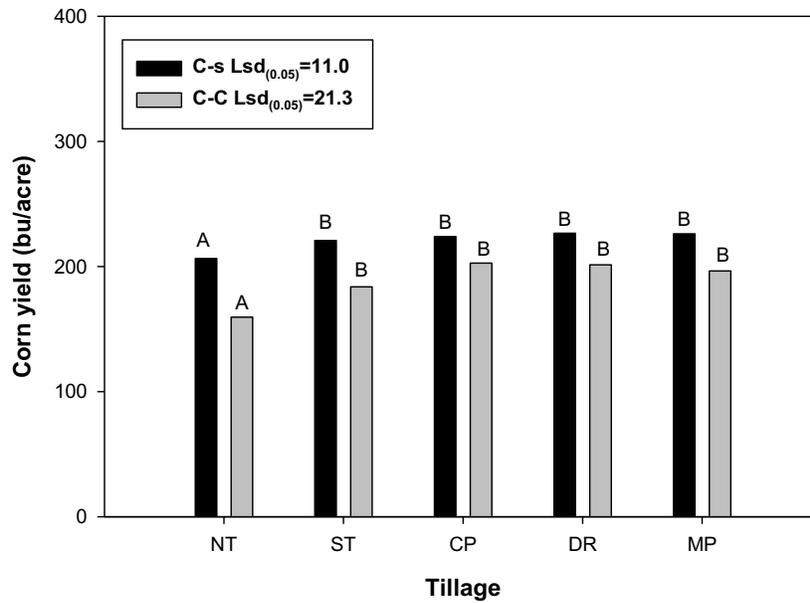


Figure 1. Corn yields in two rotations (C- c and C-C) with five tillage systems at the ISU Northern Research Farm in 2015. Corn yields in each rotation system with the same uppercase letter are not significantly different at $P = 0.05$.

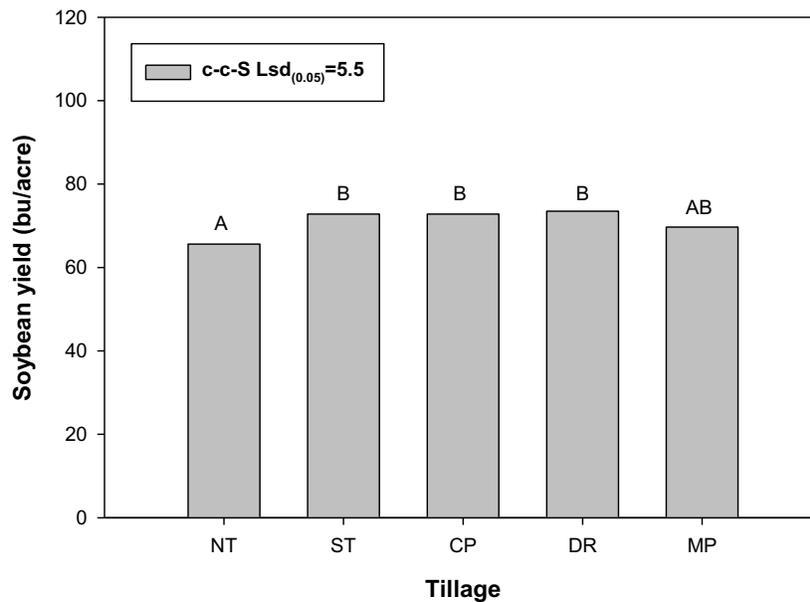


Figure 2. Soybean yield with five tillage systems at the ISU Northern Research Farm in 2015. Soybean yields with the same uppercase letters are not significantly different at $P = 0.05$.