Seasonal and Rotational Influences on Corn Nitrogen Fertilization

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Introduction

This project was designed to study the nitrogen (N) fertilization needs in continuous corn (CC) and corn rotated with soybean (CS) as influenced by location and climate. Multiple rates of N fertilizer were spring-applied, with the intent to measure yield response to N within each rotation on a yearly basis for multiple years at multiple sites across Iowa.

In 2017 and 2018 no N was applied to any plot at all sites. Corn was grown in 2017 and 2018 across the entire study area. This allowed the study of corn yield response to the historical N fertilizer rates previously applied across multiple years and crop rotations.

Materials and Methods

There were seven sites on Iowa State University Research and Demonstration farms: Armstrong (Lewis), Northwest (Sutherland), Northern (Kanawha), Northeast (Nashua), Ag Engineering/Agronomy (Boone), McNay (Chariton), and Southeast (Crawfordsville). The first year of N rate application varied by site. Applications began between 1999 and 2005. The historical N rates spring-applied to corn were 40 lb increments from 0 to 240 lb N/acre at six sites, and 60 lb N/acre increments at the Ames site. The last year of N application was 2016. The Boone site is not included in the overall yield results because of the different rate increments. Tillage each year was fall chisel and spring disk/field cultivation before planting.

Results and Discussion

In the first residual year (no N applied in 2017), the corn yield response to the historical N fertilizer rates was different between the CC and CS rotations (Figure 1). For the six-site summary, there was no yield response to any of the historical N rates in the CS rotation following soybean. However, in CC and CS after corn, there was a yield increase after approximately the 65 to 95 lb N/acre historical rate. In CC, yields increased from approximately 55 bushels/acre to 110 bushels/acre. In all cases, yields were low as no N fertilizer was applied, and a residual rate effect only with N applied the prior year. At the Boone site, yields and N response for each rotation were similar as the across-site summary.

In the second residual year (no N applied in 2017 or 2018) corn yield was the same in both the prior CC and CS rotations (Figure 2). There was a yield increase with the historical N fertilizer rates, but the increase was only 9 bushels/acre.

Interestingly, the effect of soybean in the rotation was gone after one year of corn. This has been shown in other research with second year corn. At the Boone site, yield response to the historical N rates was the same as the other sites, with no difference between rotations.

Overall, this study of historical N rates shows that N application is typically needed every corn year in CC and CS rotations to produce optimal yield, with surprisingly little difference in crop-available N supply after many years of N application.

Acknowledgements

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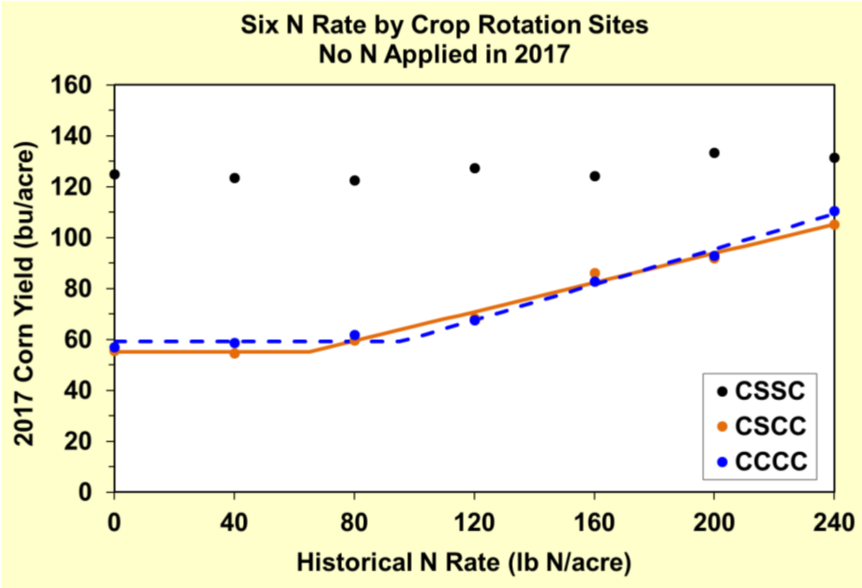

Figure 1. Effect of historical N rate on corn yield in 2017 (across six sites). The rotation codes stand for the rotation and the crop preceding the 2017 corn year (CSSC is CS rotation, with soybean before the 2017 corn; CSCC is CS rotation with corn before the 2017 corn; and CCCC is continuous corn).

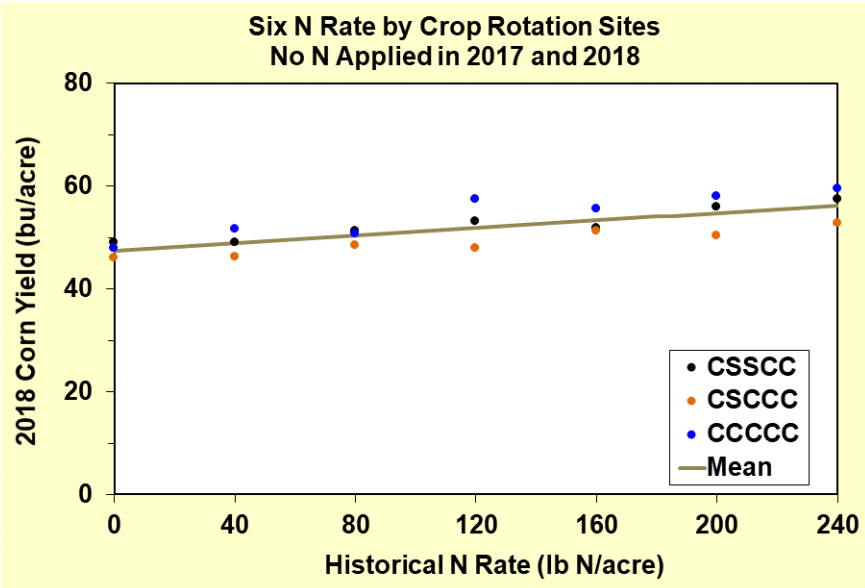

Figure 2. Effect of historical N rate on corn yield in 2018 (across six sites). The rotation codes stand for the rotation and the crops preceding the 2018 corn year (CSSCC is CS rotation, with one year of corn before the 2018 corn; CSCCC is CS rotation with two years of corn before the 2018 corn; and CCCCC is continuous corn).