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Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Abstract
This project is designed to study the nitrogen (N) fertilization needs in continuous corn (C-C) and corn rotated with soybean (C-S) as influenced by location and climate. Multiple rates of N fertilizer are applied in the spring, with the intent to measure the yield response to N fertilization within each rotation on a yearly basis at multiple sites across Iowa. This allows the determination of N requirements for each rotation practice, differences that exist between the two rotations, responses to applied N across different soils and climatic conditions, and evaluation of tools used to adjust the N application.

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Introduction

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Materials and Methods

The first year of this research at the Northwest Research Farm was 2000. The study area was planted to corn in 1999. Therefore, in the initial year, all of the plantings followed corn. The two rotations, C-C and C-S, were then initiated in 2000. The soil is Galva silty clay loam.

Tillage is fall chisel plowing and disk/field cultivation before planting. Rates of N applied to corn were 0–240 lb N/acre in 40-lb increments. Urea fertilizer was the N source and was broadcast and incorporated with secondary tillage before planting. No N was applied with the planter. The farm superintendent chose the corn hybrid and soybean variety. Soil was sampled for routine soil tests; phosphorus, potassium, and lime were applied as called for by the soil tests. Corn and soybeans were harvested with a plot combine. Yields were corrected to standard moisture.

Results and Discussion

In 2005, corn grain yield was responsive to applied N (Figure 1). Calculated economic optimum N rates were similar in 2005 for the two rotations, 67 lb N/acre for the C-S rotation and 65 lb N/acre for C-C. The corn yields were the highest measured since the study began. Also, the yield with no N fertilizer applied was quite high in each rotation (143 bu/acre in C-C and 173 bu/acre in S-C). Soybean yield in the C-S rotation averaged 67 bushels/acre. In contrast, the crop yields had been severely reduced in 2004 due to a severe midseason hailstorm—for corn, 66 bushels/acre in C-S and 62 bushels/acre in C-C, and for soybean, 20 bushels/acre. Corn had not been responsive to applied N in the C-S rotation that year.

Beginning in 2001, when direct comparison can be made between the two rotations, corn yield has been higher (average 139 versus 120 bu/acre) and economic optimum N rate lower (average 29 lb N/acre less) in the C-S rotation compared to continuous corn (Figure 1). For both rotations, the economic optimum N rates have been quite low at this site.

This study will continue in the future, and the research will become more useful after the accumulation of multiple years of data. The results presented in this report are for the initial years and therefore are not final N recommendations. They do, however, represent responses for the specific years and rotation.

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Figure 1. Corn yield and economic optimum N rate for each rotation and year, Northwest Research Farm, 1999–2005.