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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 soybeans(C-S) as influenced by location and climate. Multiple rates of N fertilizer are spring applied, 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 N applied 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 two crop rotations (C-C and C-S) were established in 1999. The study area was cropped to no-till soybeans in 1998; therefore, in the initial year all yields are following soybeans. The soil at this location is Haig silty clay loam.

Tillage is fall chisel plowing (spring chiseling in 1999) and disk/field cultivation before planting. Rates of N applied to corn are 0–240 lb N/acre in 40-lb increments. Ammonium nitrate was the N fertilizer source and was surface sidedress applied. The farm superintendent chose the corn hybrid and soybean variety. Weeds were controlled using practices typical of the region. Soil was sampled for routine soil tests; phosphorus, potassium, and lime were applied as called for by test results. 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. The yield with no applied N was 45 bushels/acre in C-C and 114 bushels/acre in C-S, and the yields at optimal N were just over 200 bushels/acre in each rotation. Figure 1 shows the variation in corn yield and N response for the rotations across years. For 2000–2005, corn in the C-C rotation has averaged 13 bushels/acre lower than corn following soybean (166 versus 179 bushels/acre, respectively). In half of the years, yields in the two rotations were similar, but in the other years yield was greater in the C-S rotation.

Calculated economic optimum N rates for the C-C and C-S rotations were 240 and 130 lb N/acre, respectively in 2005. The average N fertilization requirement has been higher for continuous corn than for corn in rotation with soybean with an average of 192 lb N/acre in C-C and 137 lb N/acre in C-S from 2000–2005, a 55 lb N/acre difference. The soybean yield for 2005 was 58 bushels/acre. That results in a 48 bushels/acre average over the six years from 2000–2005, which showed no influenced by N application to corn in previous years.

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 only a few years; therefore, they are not meant to represent N recommendations. They do, however, represent responses for the specific years.

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