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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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Agronomy

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Introduction

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Materials and Methods

The first year of this research at the Southeast Research Farm was 1999. The study area was planted to soybean in 1998. Therefore, in the initial year, all of the plantings followed soybean. The two rotations, C-C and C-S, were initiated in 1999. The soil at this location is Kalona, a silty clay loam.

The tillage was 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-ammonium nitrate solution (28% UAN) fertilizer was the N source; it 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. Pest control practices were those typical for the region and rotation. 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

Corn grain yield was responsive to N in 2005 (Figure 1). Calculated economic optimum N rates for the C-S and C-C rotations were 123 and 181 lb N/acre, respectively. Figure 1 shows the variation in corn yield and N response for the rotations across years. Since 2000, corn in the C-C rotation has averaged 39 bushels/acre less compared with corn following soybean. Although yields in the two rotations were similar in 2000 and 2004, in other years corn yield was greater in the C-S rotation. With the dry conditions encountered during 2005, corn yield at the economic optimum N rate was 58 bushels/acre more with the C-S rotation. The N fertilization requirement has been higher each year for C-C compared with the C-S rotation (average of 178 lb N/acre in C-C and 118 lb N/acre in C-S from 2001–2005). The average soybean yield for 2005 was 62 bushels/acre and was not influenced by N application to corn during the previous year.

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.

Acknowledgments

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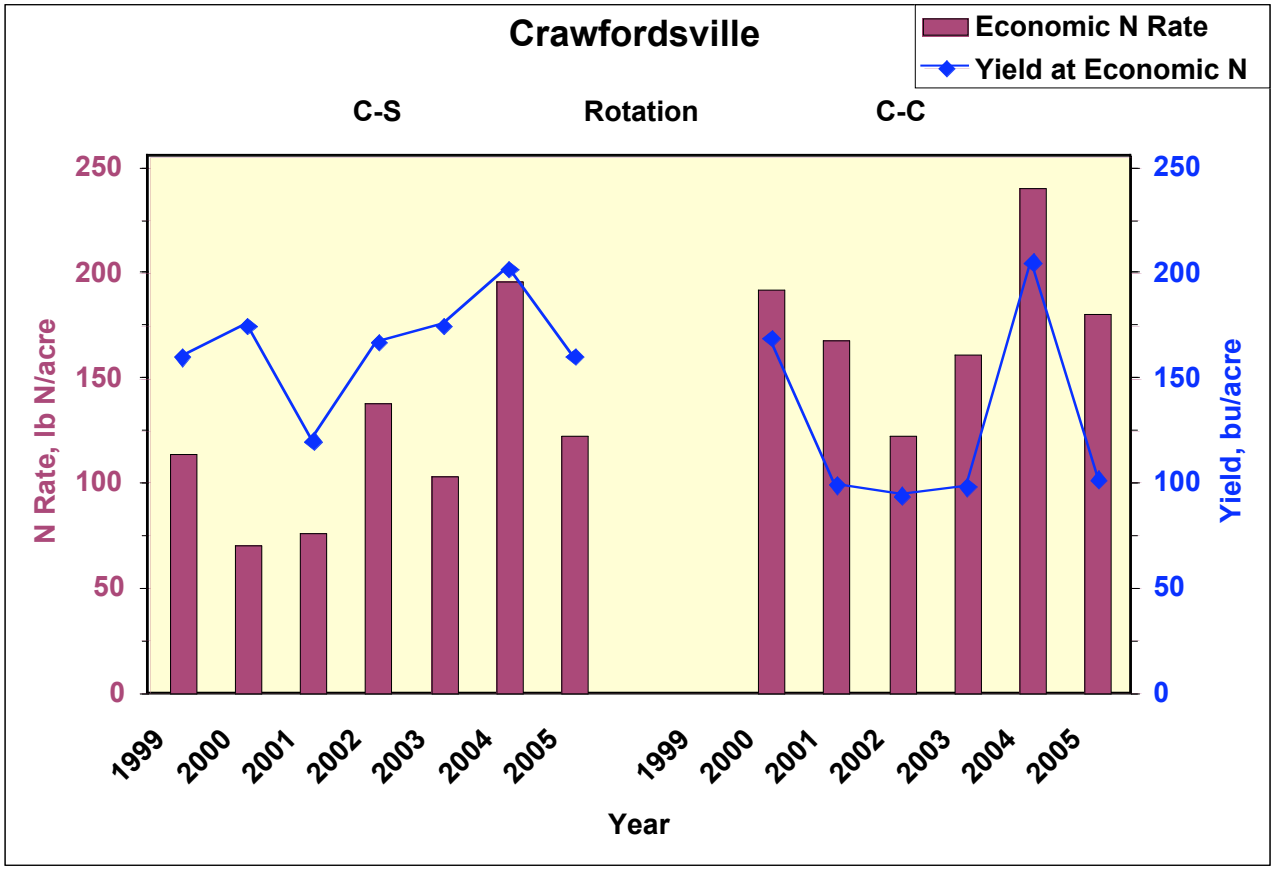

Figure 1. Corn yield and economic optimum N rate for each rotation and year, Southeast Research Farm, 1999–2005.