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Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Abstract
This project was 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 yield response to N within each rotation on a yearly basis for multiple years 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 N applications.

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Introduction

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Materials and Methods

The first year of this research at the Armstrong Research Farm was 2001. The study area was cropped to soybeans in 2000. Therefore, in the initial year, all yields followed soybean. The two rotations, C-C and C-S, were initiated in 2001. The soil at this location is Marshall silty clay loam.

The tillage was 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 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; and phosphorus, potassium, and lime were applied as called for by the soil tests. Corn and soybeans were harvested with a plot combine, and yields were corrected to standard moisture.

Results and Discussion

In 2005, corn productivity was high. Grain yield responded positively to applied N in each rotation (Figure 1). Calculated economic optimum N rates from fitted response equations were 111 lb N/acre in the C-S rotation and 153 lb N/acre in the C-C rotation. The corn yield in 2005 was about 10 bushels/acre higher in the C-S rotation. For the past four years, the corn yield has been about 12% higher in the C-S rotation. Figure 1 shows the variations in yield and N response for the rotations across years. Economic optimum N rates have been fairly consistent within each rotation despite large differences in corn yield, although the economic optimum N rate was somewhat higher in 2005 than in prior years. Soybean yield in the C-S rotation averaged 56 bushels/acre in 2005 and was not influenced by the previous year's N application to corn.

This study will continue in the future, and the best value will occur after the accumulation of multiple years of data. The results presented in this report are for the first five years and therefore are not meant to represent N recommendations. They do, however, represent responses for the specific years and rotations.

Acknowledgments

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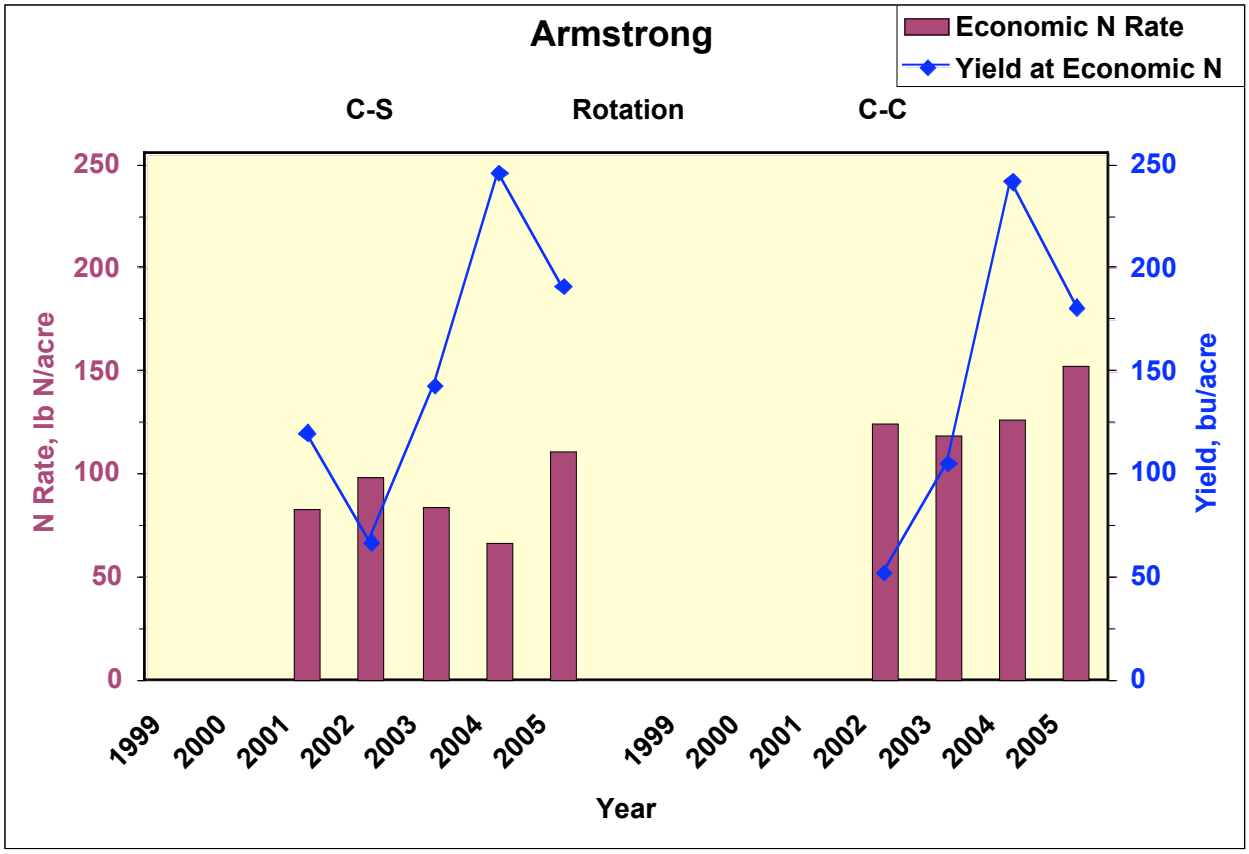

Figure 1. Corn yield and economic optimum N rate for each rotation and year, Armstrong Research Farm, 2005.