Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Introduction

This project was designed to study the N fertilization needs in continuous corn (CC) and corn rotated with soybean (SC) as influenced by location and climate. Multiple rates of fertilizer N are 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. This will allow the determination of N requirements for each rotation, 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 application.

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 follow soybean. The two rotations were initiated in 2001. The soil at this location is Marshall silty clay loam.

Tillage was fall chisel/disk corn residue and spring disk/field cultivation before planting. Rates of N applied to corn were 0 to 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 rotations. Corn and soybeans were harvested with a plot combine. Yields were corrected to standard moisture.

Results and Discussion

In 2008, corn productivity was exceptionally high (Table 1), with yields near those in 2004 and 2006 (Figure 1). Grain yield responded positively to applied N in each rotation. Calculated economic optimum N rates (EONR) from fitted response equations were 149 and 174 lb N/acre in the SC and CC rotations, respectively. The corn yield at the EONR was 18 bushels/acre higher in the SC rotation (228 vs. 210 bu/acre). For the past seven years, corn yield averaged 8% higher in the SC rotation.

Figure 1 shows the variation in yield and N response for the rotations across years. The EONR has averaged 31 lb N/acre higher in CC than SC and has been fairly consistent within each rotation despite large differences in corn yield. The EONR has been higher the last several years, likely due to wetter spring conditions, especially in 2008. Soybean yield in the SC rotation averaged 48 bushels/acre in 2008 and was not influenced by previous year 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 not meant to represent N recommendations. They do, however, represent responses for the specific years and rotations at this site.

Acknowledgements

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Table 1. Corn grain yield as influenced by N fertilization rate in 2008, Armstrong Research Farm.

N Rate	SC[1]	CC[1]
lb N/acre	- - - - - - - bu/acre - - - - - - -	
0	121	74
40	170	138
80	202	157
120	219	195
160	233	212
200	223	212
240	232	207

[1]SC = corn following soybean; CC = corn following corn.

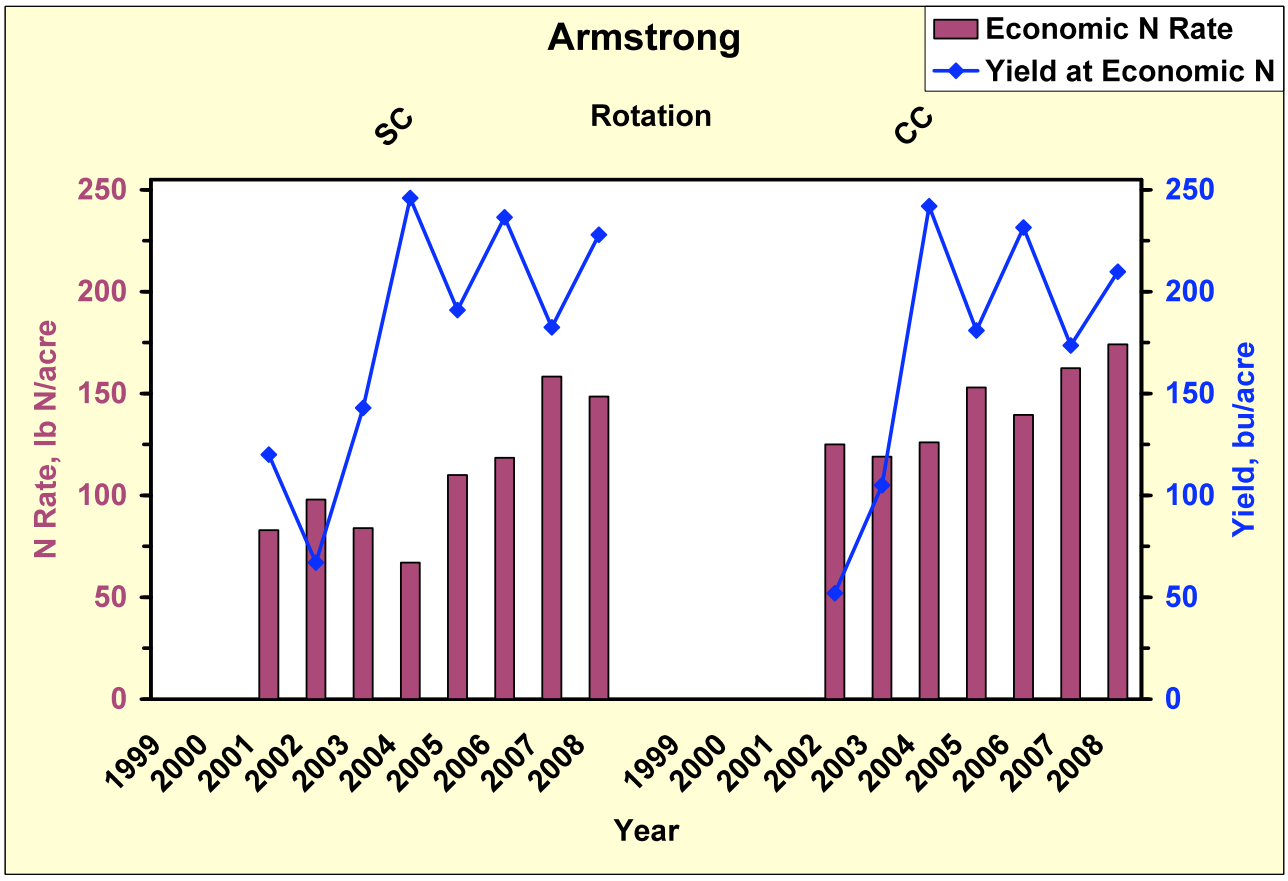

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Armstrong Research Farm, 2008. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).