Seasonal and Rotational Influences on Corn Nitrogen Requirements

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John Sawyer, professor
Daniel Barker, assistant scientist
Department of Agronomy

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 N fertilizer 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 Northwest Research Farm was 2000. The study area was cropped to corn in 1999, therefore, in the initial year all yields follow corn. The two rotations were initiated in 2000. The soil is Galva silty clay loam.

Tillage was fall chisel plowing after corn stalks are chopped 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 is the N source and is 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 2009, corn productivity was high (Table 1), but yields were less than in 2008, the year with highest corn yields measured (Figure 1). Grain yield responded positively to applied N in each rotation. Calculated economic optimum N rates (EONR) from fitted response equations were 124- and 158-lb N/acre in the SC and CC rotations, respectively. The corn yield at the EONR was 37 bushels/acre higher in the SC rotation (213 vs. 176 bu/acre). For the past nine years, corn yield averaged 14% higher in the SC rotation.

Figure 1 shows the variation in yield and N response for the rotations across years. The EONR has averaged 22-lb N/acre higher in CC than SC, with most years the N response greater with CC than SC despite large differences in corn yield. The EONR has been higher the last four years (146- and 160-lb N/acre average for SC and CC), likely due to wetter spring conditions. Soybean yield in the SC rotation averaged 58 bushels/acre in 2009 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 2009, Northwest Research Farm.

N Rate	SC[1]	CC[1]
lb N/acre	- - - - - - - bu/acre - - - - - - -	
0	136	67
40	173	112
80	205	139
120	204	174
160	213	177
200	215	176
240	218	175

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

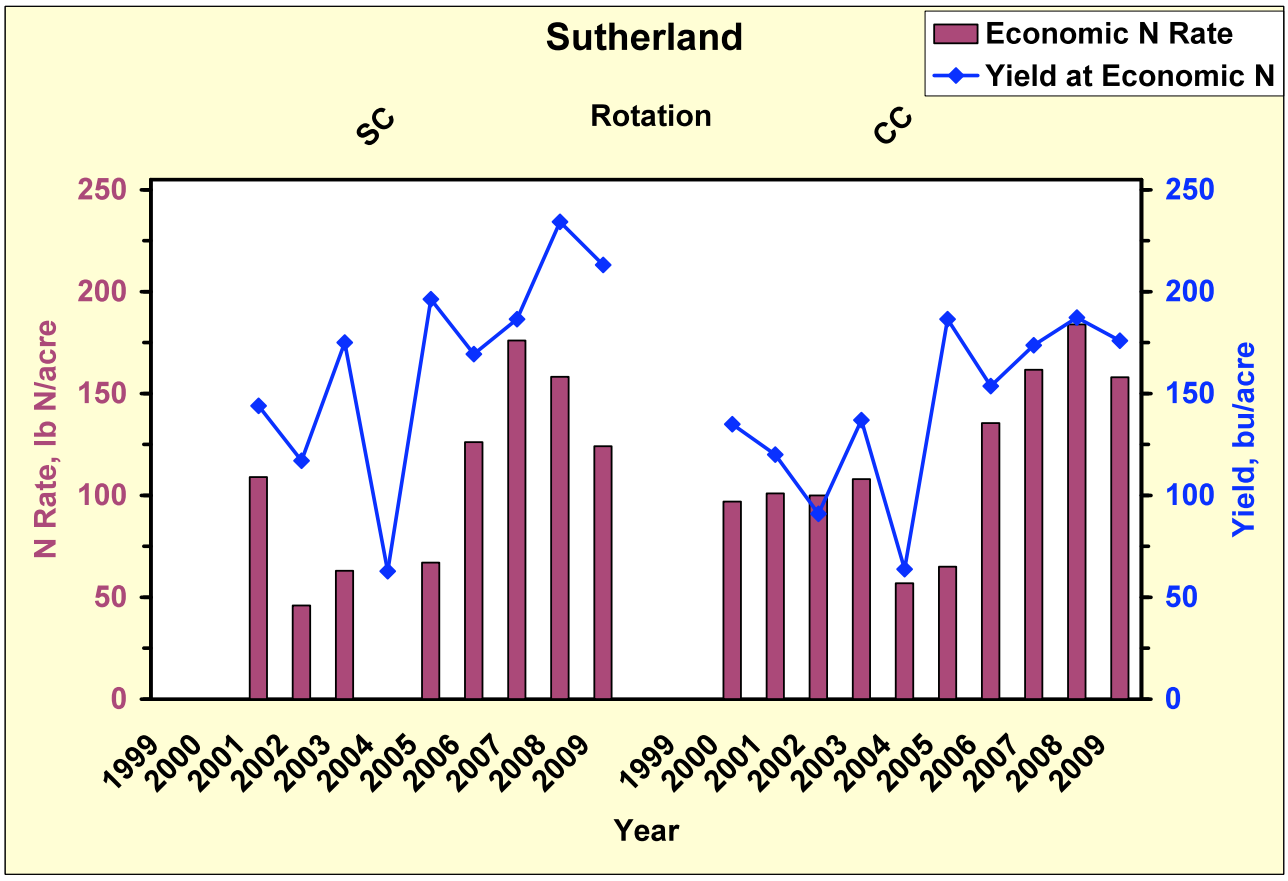

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Northwest Research Farm, 2009. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).