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Seasonal and Rotational Influences on Corn Nitrogen Requirements

John E. Sawyer
Iowa State University, jsawyer@iastate.edu

Daniel W. Barker
Iowa State University, dbarker@iastate.edu

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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 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 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 application.

Keywords
Agronomy

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John E. Sawyer, associate professor
Daniel Barker, assistant scientist
Department of Agronomy

Introduction

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 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 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 application.

Materials and Methods

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

Tillage is fall disk-chisel plowing after corn stalks are chopped and spring field cultivation before planting. Rates of N applied to corn are 0 to 240 lb N/acre in 40 lb increments. Urea-ammonium nitrate solution (28% UAN) fertilizer is the N source and is broadcast and incorporated with secondary tillage before planting. No N is applied with the planter. The farm superintendent chose the corn hybrid and soybean variety. Pest control practices are those typical for the region and rotations. Corn and soybeans are harvested with a plot combine. Yields are corrected to standard moisture.

Results and Discussion

In 2006, corn yields were the highest recorded in the study (Figure 1). Grain yield responded positively to applied N in each rotation. Calculated economic optimum N rates for the C-S and C-C rotations were 163 and 240 lb N/acre, respectively. Figure 1 shows the variation in corn yield and N response for the rotations across years. The N fertilization requirement has been higher each year for C-C compared with the C-S rotation (average of 186 lb N/acre in C-C and 124 lb N/acre in C-S from 2000–2006). Corn in the C-C rotation has averaged 35 bushels/acre lower compared with corn following soybean, largely due to four very low yielding years in continuous corn. Yields have been lower each year with continuous corn, but more similar to corn rotated with soybean in the two highest productivity years. The average soybean yield in 2006 was 61 bushels/acre and was not influenced by previous year N application to corn.

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

Acknowledgments

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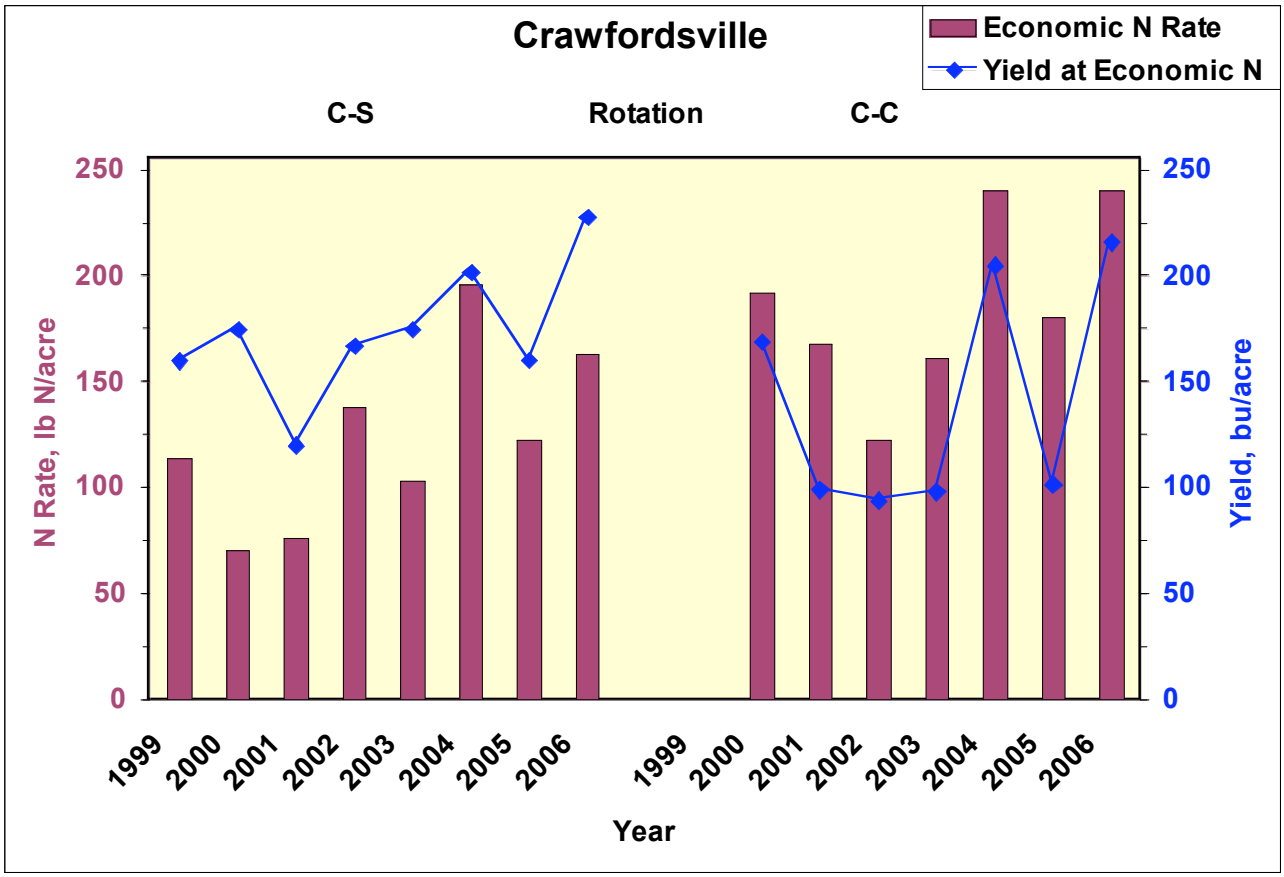

Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Southeast Research Farm, 2006. The EONR was calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).