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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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Seasonal and Rotational Influences on Corn Nitrogen Requirements

Abstract

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 were 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.

Keywords

Agronomy

Disciplines

Agricultural Science | Agriculture | Agronomy and Crop Sciences

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 fertilizer N were 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 ISU Northern Research Farm was 2005. The study area was cropped to soybean in 2004. The two rotations were initiated in 2005. The soil is Canisteo clay loam.

Tillage is fall chisel plow and spring disk/field cultivation before planting. Rates of N applied to corn are 0 to 240 lb N/acre in 40-lb increments. Urea fertilizer was the N source and 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 are those typical for the region and rotations. Corn and soybean are harvested with a plot combine and yields corrected to standard moisture.

Results and Discussion

In 2012, with the dry growing season, grain yield responded positively to applied N in each rotation, although the N response was low (Table 1). The calculated economic optimum N rate (EONR) for each rotation, however, was not low for each rotation in 2012; 104 lb N/acre for SC and 209 lb N/acre for CC. Also, the average EONR (2006-2012) for both rotations is fairly typical; 172 lb N/acre for CC and 138 lb N/acre for SC.

The corn yield in 2012 at the EONR was 28 bushels/acre higher in the SC rotation compared with CC. For the past seven years, corn yield has averaged 21 percent higher in the SC rotation (170 vs. 135 bu/acre). Soybean yield in the SC rotation averaged 43 bushels/acre in 2012.

Figure 1 shows the yield response to N rate each year for the SC and CC rotations. In addition, the graphs show the yearly yield at the EONR and yield if a constant Maximum Return To N (MRTN) rate were applied each year. Despite the large variation in yield between years, and N response, the MRTN rate resulted in corn yields close to the yearly EONR yield and maximum yield. These results indicate that the MRTN rate provides for optimal corn grain production, and like EONR, yields close to the maximum yields each year.

Acknowledgements

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Table 1. Corn grain yield as influenced by N fertilization rate in 2012, Northern Research Farm.		
N Rate	SC	CC
lb N/acre	----- bu/acre -----	
0	112	59
40	125	76
80	128	87
120	133	91
160	140	99
200	126	97
240	142	112

SC, corn following soybean; CC, corn following corn.

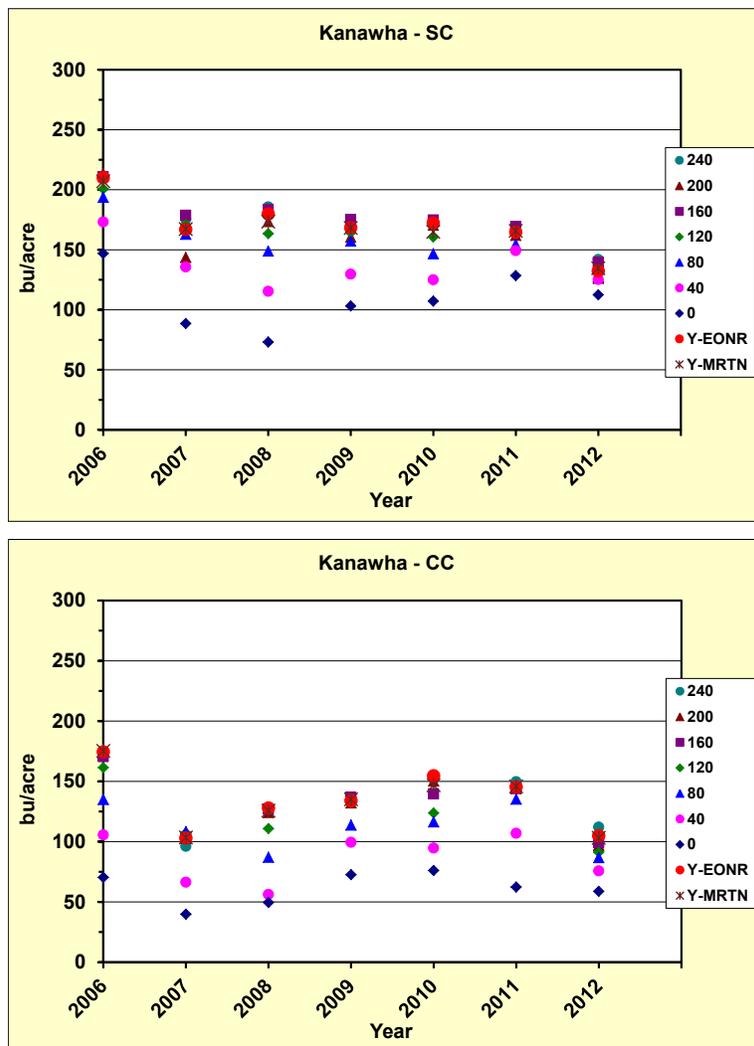


Figure 1. Nitrogen rate effect on corn yield over time for each rotation, yield at the economic optimum N rate (Y-EONR) each year, and corn yield if a constant Maximum Return To N (Y-MRTN) rate was applied each year, Northern Research Farm, 2006–2012. The MRTN rate used was 135 lb N/acre for SC and 192 lb N/acre for CC (rates from the 2012 Corn N Rate Calculator web site at a 0.10 price ratio, \$/lb N:\$/bu corn grain).