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Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Abstract
This project is designed to study the N fertilization needs in continuous corn (C-C) and corn rotated with soybeans (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, and responses to applied N across different soils and climatic conditions. It will also allow for the evaluation of tools used to adjust N application.

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Introduction

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Materials and Methods

The first year of this research at the Ames Agronomy Research Farm was 1999. The study area was cropped to corn in 1998. Therefore, in the initial year all yields follow corn. The two rotations, C-C and C-S, were initiated in 1999. The soil at this location is Clarion loam.

Tillage is fall chisel plowing and disk/field cultivation before planting. Rates of N applied to corn are 0–240 lb N/acre in 60 lb increments. Urea fertilizer is the N source and is incorporated with secondary tillage before planting. The farm superintendent chooses the corn hybrid and soybean variety. Weeds are controlled using practices typical of the region. Soil is sampled for routine soil tests, and phosphorus, potassium, and lime are applied as called for by the soil tests.

Corn and soybeans are harvested with a plot combine. Yields are corrected to standard moisture. Corn ear leaf greenness, which is an indicator of chlorophyll and nitrogen, is measured with a Minolta SPAD meter at the R1 growth stage. The SPAD meter will not indicate excess N; therefore, readings typically do not increase above a maximum greenness even with additional N.

Results and Discussion

Corn grain yield and ear leaf greenness were responsive to applied N in 2003 (Table 1). Yields were quite high this year. Economic N rates for the C-S and C-C rotations were 77 and 167 lb N/acre, respectively. The Minolta SPAD meter readings increased to approximately 120 lb N/acre in the C-S rotation, and 180 lb N/acre in the C-C rotation. Since 2000, corn in the C-C rotation has yielded less than the C-S rotation and over years required more applied N. Figure 1 shows the variation in yield and N response for the rotations each year. Average soybean yield for 2003 was 56 bushels/acre.

This study will continue in the future, and the most useful results will occur after the accumulation of multiple years of data. The results presented in this report are for only a few years and therefore are not meant to represent N recommendations. They do, however, represent responses for the specific years.

Acknowledgments

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Table 1. Corn ear leaf greenness and corn grain yield as influenced by N fertilization rate, Ames Agronomy Research Farm, 2003.

	C-S				C-C			
N Rate	SPAD Value	Yield	Yield at Econ. N	Econ. N rate	SPAD Value	Yield	Yield at Econ. N	Econ. N rate
lb N/acre		----- bu/acre -----		lb N/acre		----- bu/acre -----		lb N/acre
			187	77			147	167
0	51	135			37	67		
60	59	183			48	106		
120	61	183			56	141		
180	61	187			57	144		
240	62	191			57	150		

Economic optimum N calculated at a 10:1 corn:N price ratio.
Yield at economic N calculated from the fitted response equation.

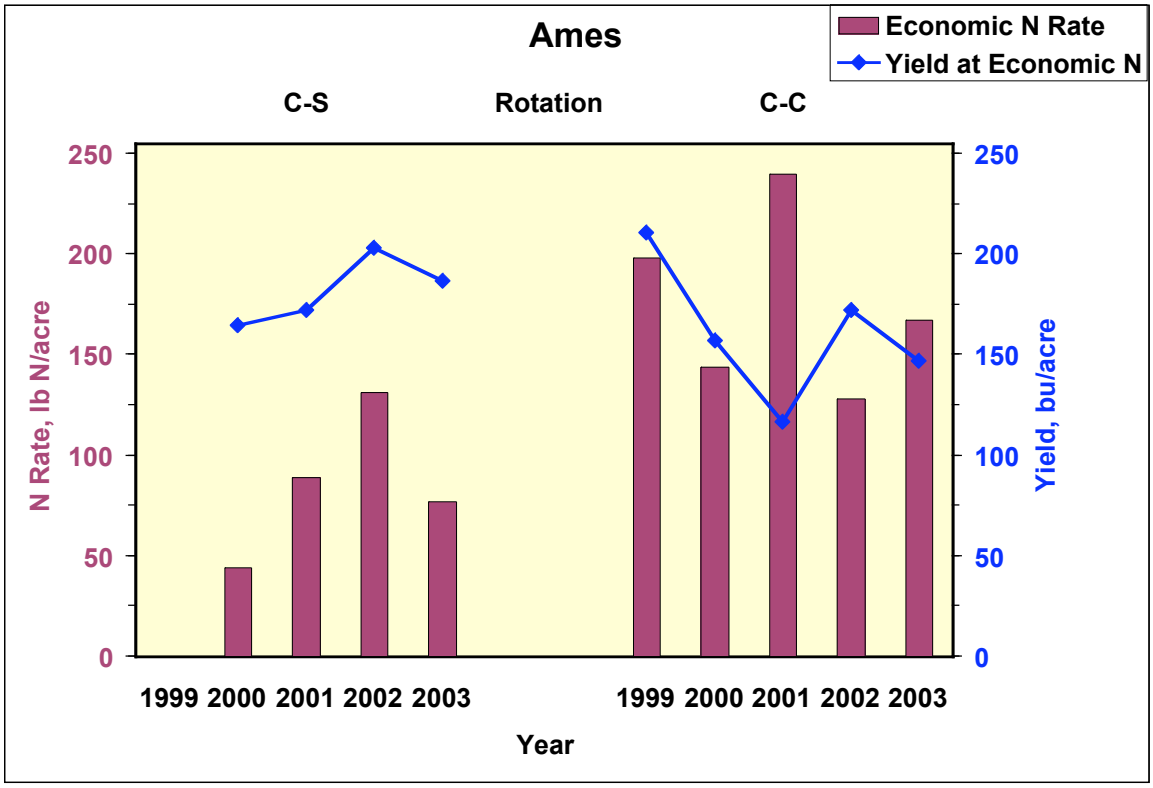

Figure 1. Corn yield and economic optimum N rate for each rotation and season, Ames Agronomy Research Farm, 2003.