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Seasonal and Rotational Influences on Corn Nitrogen Requirements

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Abstract
This project is 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 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 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
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Introduction

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Materials and Methods

The first year of this research at the Armstrong Research Farm was 2001. The study area was planted to soybeans in 2000. Therefore, in the initial year all yields follow soybeans. The two rotations, C-C and C-S, were initiated in 2001. The soil at this location is Marshall silty clay loam.

Tillage is disk/field cultivation before planting. Rates of N applied to corn are 0–240 lb N/acre in 40-lb increments. Urea fertilizer is the N source and is broadcast and incorporated before planting. No N is applied with the planter. The farm superintendent chooses the corn hybrid and soybean variety. Pest control practices are those typical for the region and rotation. 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 N, 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

In 2004, corn productivity was very high. Corn ear leaf greenness (SPAD readings) and grain yield responded positively to applied N in each rotation (Table 1). Calculated economic N rates from fitted response equations were 67 lb N/acre in the C-S rotation and 126 lb N/acre in the C-C rotation. The yields were similar for both rotations this year. Figure 1 shows the variation in yield and N response for the rotations across years. Economic optimum N rates have been fairly consistent within each rotation despite large differences in corn yield. Soybean yield in the C-S rotation averaged 65 bushels/acre in 2004 and was not influenced by the previous year N application to corn.

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 the first four years and therefore are not meant as long-term N recommendations. They do, however, represent responses for the specific years and rotations.

Acknowledgments

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Table 1. Corn ear leaf greenness and corn grain yield as influenced by N fertilization rate, Armstrong Research Farm, 2004.

	C-S				C-C			
N Rate	SPAD value	Yield	Yield at Econ. N	Econ. N rate	SPAD value	Yield	Yield at[2] Econ. N	Econ.[1] N rate
lb N/acre		---- bu/acre ----		lb N/acre		---- bu/acre ----		lb N/acre
			246	67			242	126
0	52	188			45	125		
40	59	235			55	189		
80	60	244			58	224		
120	61	249			59	233		
160	60	250			60	237		
200	62	244			60	247		
240	61	245			61	249		

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

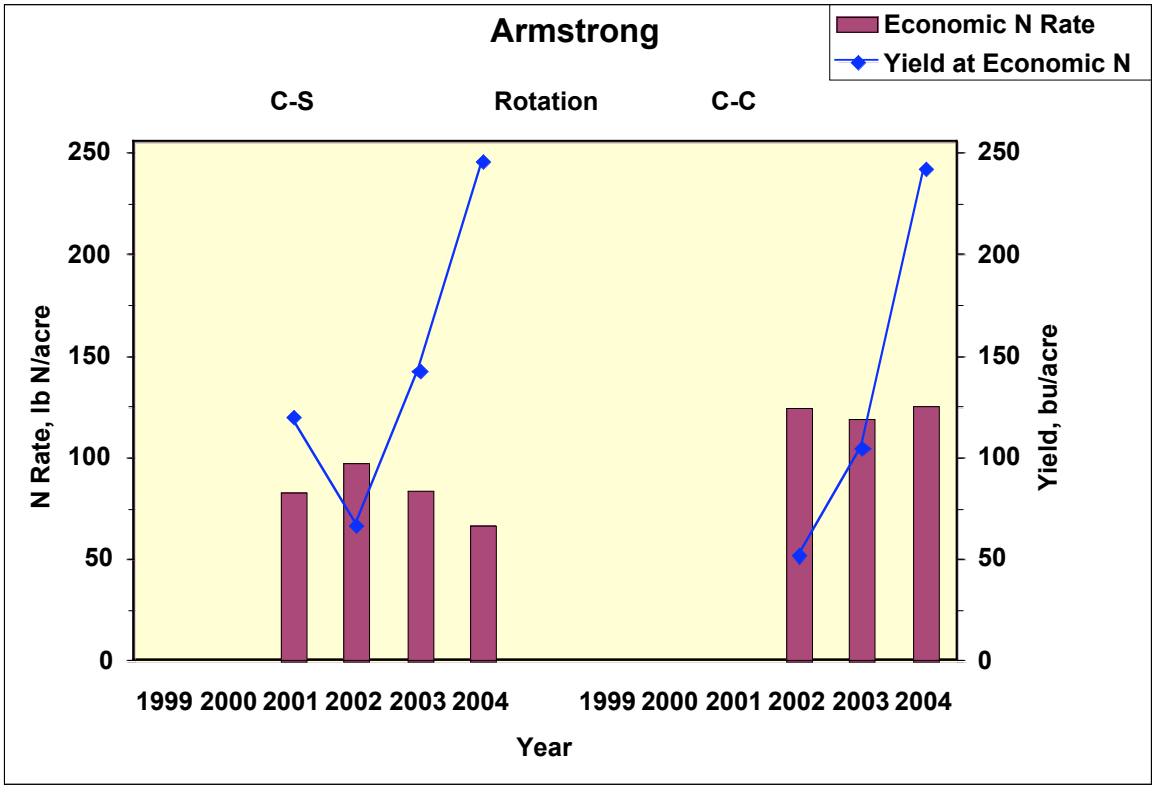

Figure 1. Corn yield and economic optimum N rate for each rotation and season, Armstrong Research Farm, 2004.