

Seasonal and Rotational Influences on Corn Nitrogen Requirements

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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 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 Southeast Research Farm was 1999. The study area was cropped to soybean in 1998, therefore, in the initial year all yields follow soybean. The two rotations were initiated in 1999. The soil at this location is Kalona silty clay loam.

Tillage was fall disk-chisel plowing after corn stalks were chopped and spring field cultivation before planting. Rates of N applied to corn were 0 to 240 lb N/acre in 40 lb increments. Urea-ammonium nitrate solution (28% UAN) 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 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

Yield levels were quite good again in 2008 despite the very wet season (Table 1). Calculated economic optimum N rates for the SC and CC rotations were 182 and 240 lb N/acre, respectively. This is the third year in a row where the applied N requirement has been quite high, an indication of wet spring conditions, soil with slow internal drainage, and the preplant broadcast UAN fertilizer source. For continuous corn, grain yield increased to the maximum N rate applied, 240 lb N/acre, four of the last five years.

Figure 1 shows the variation in corn yield and N response for the rotations across years. The economic optimum N rate (EONR) has been higher each year for CC compared with the SC rotation (2000–2008 average of 198 lb N/acre in CC and 139 lb N/acre in SC). The corresponding average yield for that time period for each rotation was 150 bushels/acre for CC and 185 bushels/acre for SC, with the corn yield in CC averaging 19% lower compared with SC and lower each year. The average soybean yield in 2008 was 58 bushels/acre 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 many 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.

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Table 1. Corn grain yield as influenced by N fertilization rate in 2008, Southeast Research Farm.

N Rate lb N/acre	SC ¹ ----- bu/acre -----	CC ¹
0	114	58
40	133	82
80	175	105
120	176	115
160	211	138
200	220	158
240	225	171

¹SC, corn following soybean; CC, corn following corn.

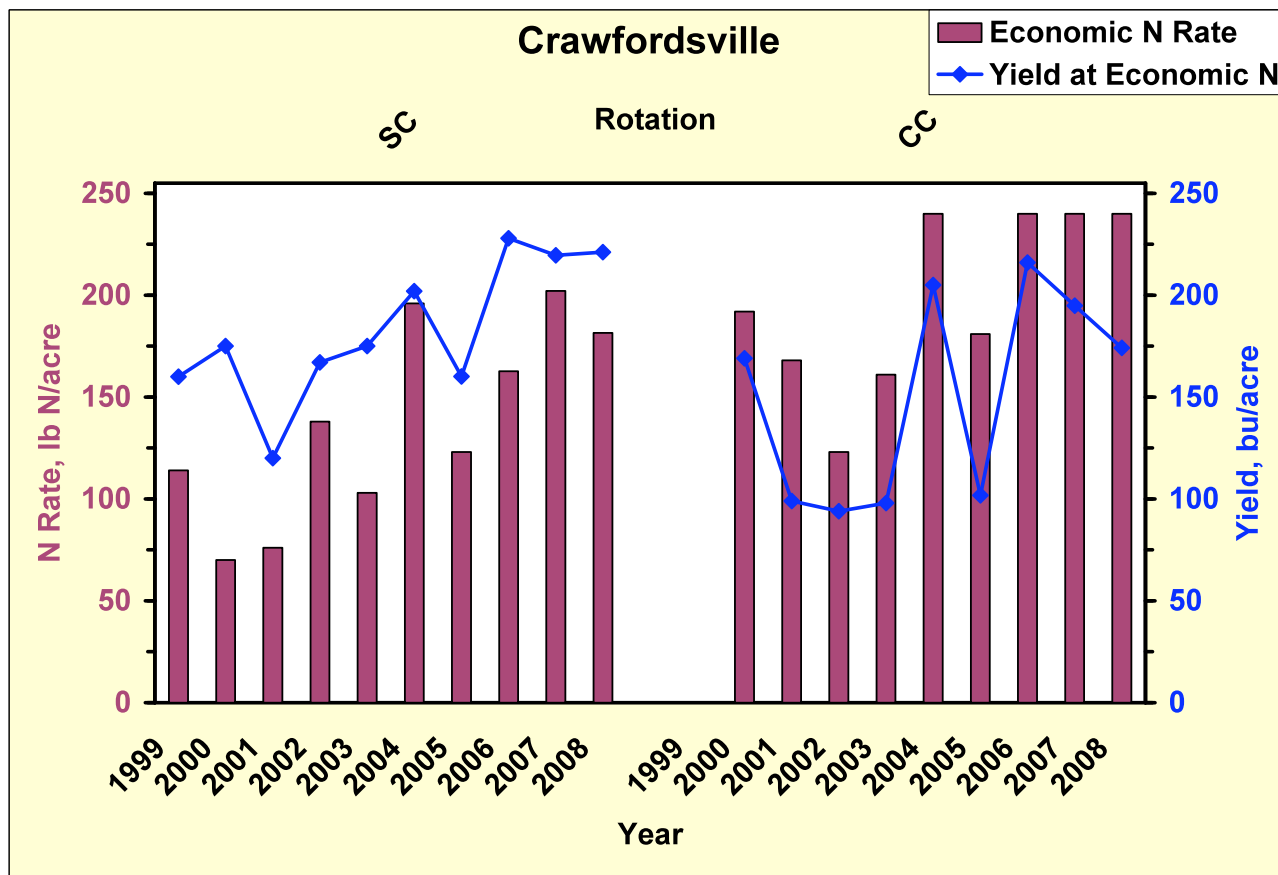


Figure 1. Economic optimum N rate (EONR) and corn yield at the EONR for each rotation and year, Southeast Research Farm, 1999–2008. The EONR was calculated at a 0.10 price ratio (\$/lb N:\$/bu corn grain).