Nitrogen Fertilization for Corn Following Corn

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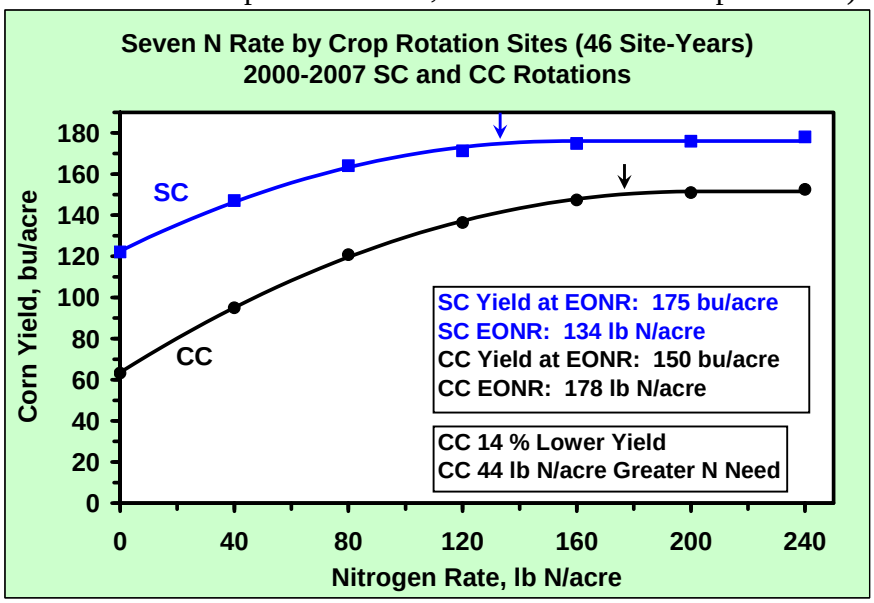
Introduction

Increasing demand for corn grain to meet ethanol production in Iowa has continued interest in growing corn following corn. What is the nitrogen (N) fertilization rate for continuous corn (CC), how does it compare to rates with corn following soybean (SC), and what rates are needed for second (CCS) or third-year corn (CCCS) in rotation with soybean?

Nitrogen Application Rate

Soybean in the cropping rotation results in a soil system that supplies greater crop-available N. There are several reasons, but mainly is due to amount of crop residue, residue N content and time of return to soil, and soil microbial mineralization rate. Results of research in Iowa indicate that the N fertilizer rate requirement is approximately 45 to 60 lb N/acre higher with CC than SC (Figure 1). The emphasis today is not on determining a "soybean credit", which is really a misnomer, and trying to equate a N rate for SC from CC, but instead the emphasis is on determining the N rate required for corn in a specific rotation.

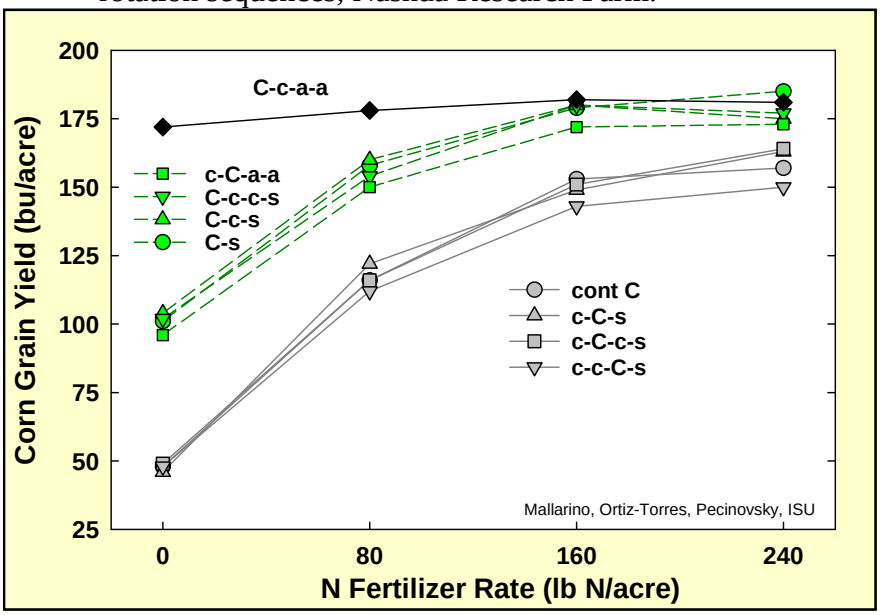
Figure 1. Corn grain yield response to fertilizer N application rate with continuous corn (CC) and corn following soybean (SC) at seven ISU research farms in 2000 to 2007 (EONR is the economic optimum N rate, determined at a 0.10 price ratio).



In recent years there has been a wide fluctuation in both N fertilizer and corn prices. The most economical application rate is influenced by the ratio of these prices (i.e., the $/lb N:$/bu corn grain price ratio). To aid in determination of suggested N rates, the Corn Nitrogen Rate Calculator web based tool was developed so that different N and corn prices, as well as crop rotation, could be used in choosing a N application rate (see the web address listed below for the

site). Research in Iowa has also shown that second (CCS) or third year (CCCS) corn after soybean has a N fertilizer rate requirement similar to that for CC (Figure 2). Therefore, N rates for CC can be used when fertilizing second or third year corn.

Figure 2. Corn grain yield response to fertilizer N application rate across time with various corn rotation sequences, Nashua Research Farm.



Yield

Nitrogen fertilization rate should be based on expected maximum economic return to N application rather than trying to achieve maximum production. It is just not possible to pay for the relatively large N rate increase required to grow the last small yield increase from an economic optimum rate to a maximum yield producing rate. Current N and corn prices result in recommended rates that produce yields quite close to maximum production (average 96 to 99% of maximum yield). Unless N prices increase and/or corn prices decline dramatically, recommended rates will not hinder productivity and will allow expression of yield potential for the growing season. Using economic derived rates also helps reduce nitrate loss to water systems.

Summary

1. Based on current N fertilizer and corn prices (price ratio of about 0.10; $0.50/lb N:$5.00/bu for example), recommended N application for corn following soybean is approximately 125 lb N/acre (range 110 to 140 lb N/acre) and for continuous corn is 180 lb N/acre (range 165 to 195 lb N/acre). See Table 1 for N rates at other price ratios. Because of variation in N fertilization requirement between locations and years, and uncertainty in an exact maximum economic return to N (MRTN) rate, a range in suggested N rates is provided that gives similar economic return and is usually ± 15 to 25 lb N/acre within the MRTN rate.

2. Second or third year corn in rotation with soybean has a N fertilizer rate need similar to continuous corn.

Table 1. Nitrogen rate guidelines in Iowa for different N and corn grain prices.

Price	Corn Following Soybean		Corn Following Corn	
Ratio[1]	Rate[2]	Range[3]	Rate	Range
$/lb:$/bu	- - - - - - - - - - - - - - - - - lb N/acre - - - - - - - - - - - - - - - - -			
0.05	145	133 - 161	205	191 - 221
0.10	124	113 - 137	181	168 - 193
0.15	110	100 - 121	158	147 - 172
0.20	97	88 - 107	145	134 - 154

[1] Price per lb N divided by the expected corn price. For example, N at $0.50/lb N and corn at $5.00/bu is a 0.10 price ratio. In this table, corn grain was held constant at $5.00/bu.

[2] Rate is the lb N/acre that provides the maximum return to N (MRTN). All rates are based on results from the Corn N Rate Calculator as of March 1, 2008 (http://extension.agron.iastate.edu/soilfertility/nrate.aspx).

[3] Range is the range of profitable N rates that provides a similar economic return to N (within $1.00/acre of the MRTN).

Resources for N Application Decisions
Corn Nitrogen Rate Calculator web tool:
http://extension.agron.iastate.edu/soilfertility/nrate.aspx.

Regional Nitrogen Rate Guidelines for Corn publication can be ordered through any ISU county office, on the web through the ISU Extension Distribution Center at https://www.extension.iastate.edu/store/, or by calling (515) 294-5247. An electronic copy of the publication is available at www.extension.iastate.edu/Publications/2015.pdf.

Soil Fertility Web Site is located at: http://www.agronext.iastate.edu/soilfertility/.