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# Seasonal and Rotational Influences on Corn Nitrogen Fertilization in Northwest Iowa

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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 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 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 Northwest Research Farm, Sutherland, Iowa, was 2000. The study area was cropped to corn in 1999, with the two rotations initiated in 2000. The soils are Galva silty clay loams.

Tillage is fall chisel plowing after chopping corn stalks and spring disk/field cultivation. Rates of N applied to corn are 40 lb increments from 0 to 240 lb N/acre. In 2016, urea-ammonium nitrate solution (28% UAN) was sidedress injected after planting June 7. 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.

## Results and Discussion

Corn yields in 2016 were the highest measured in this study for both SC and CC, 246 and 245 bushels/acre, respectively. The calculated economic optimum N rate (EONR) in 2016 was 103 lb N/acre for SC and 151 lb N/acre for CC. These fertilizer N application requirements are lower than the long-term average for each rotation.

Soybean yield in the SC rotation averaged 81 bushels/acre in 2016, the highest measured in the study. The next highest yield was 72 bushels/acre in 2013.

An interesting trend is that corn yields have increased over time in both rotations, but the optimum N rates have not. This also is seen in 2016, where the high yields had low optimal N rates. This relationship is common, that is, optimum N rate does not relate directly to corn yield level. Across the years, if the current Maximum Return To N Rate (MRTN) from the Corn Nitrogen Rate Calculator (CNRC, http://cnrc.agron.iastate.edu/) had been applied each year, the corn yield would typically be the same as the yield at the yearly EONR (Figure 1).

Figure 2 shows the mean corn yield response to N rate across all years. The calculated mean EONR is 122 lb N/acre in SC and 161 lb N/acre in CC, N rates within or slightly below the most profitable N rate range from the CNRC. Corn yield at those mean N rates are 186 and 166 bushels/acre in SC and CC, respectively. At this Northwest Research Farm site, the SC rotation produced a higher average corn yield (20 bu/acre, 11%) and a lower N fertilizer application requirement (39 lb N/acre) compared with CC.

**Acknowledgements**

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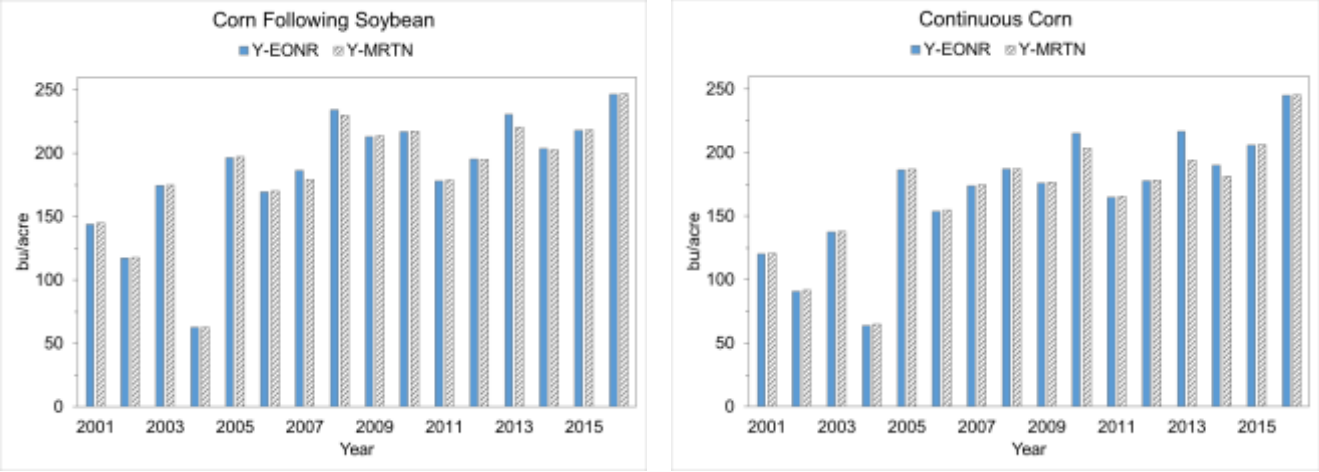


**Figure 1. Corn yield at the yearly EONR and corn yield at the MRTN rate if applied each year for each rotation (134 lb N/acre MRTN rate for corn following soybean and 184 lb N/acre for continuous corn), Northwest Research Farm, 2001–2016. The EONR and MRTN calculated at a 0.10 price ratio ($/lb N:$/bu corn grain).**

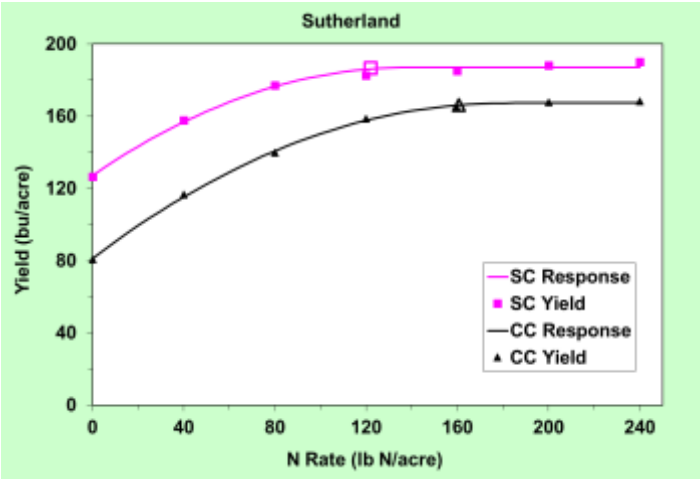


**Figure 2. Mean corn yield response to N fertilizer rate for each rotation across all years (2001-2016), Northwest Research Farm. The EONR for each rotation is indicated by the open symbols (EONR at a 0.10 price ratio, $/lb N:$/bu corn grain).**