Nitrogen Fertilization for Continuous Corn and Corn-Soybean Crop Rotations

Mitch Baum—graduate research assistant, Department of Agronomy

Sotirios Archontoulis—associate professor, Department of Agronomy

In Iowa, nitrogen is often one of the most limiting nutrients to grain yield. For corn, nitrogen uptake is primarily from mineralized soil organic matter and applied fertilizer. Variability of soil supplied nitrogen leads to uncertainty of the amount of nitrogen fertilizer needed to meet crop demand. Historically nitrogen fertilizer has been relatively cheap compared to grain prices, however current markets are increasingly volatile, and over/under application can reduce profit. The objective of this report was to quantify the Economic Optimum Nitrogen Rate (EONR) from Iowa's Northeast crop reporting district per continuous corn and corn following corn crop rotations.

Materials and Methods

Nitrogen application trials were conducted at the Borlaug Learning Center in Nashua, IA. Both corn and soybeans were planted on 5/13/2022 at a rate of 33,700 and 189,400 plants/A. Corn was planted into plots that have been historically under a continuous corn or a corn-soybean crop rotation. Corn was harvested on 11/10/2022 and soybeans on 3/10/2022 and reported at a 15 and 13% grain moisture content. Nitrogen was applied to the corn plots at 7 rates ranging from 0 to 240 (lbs N/A) in 40 lbs N/A increments, while no nitrogen was applied to soybeans. All nitrogen treatments were applied as a single application of urea on 4/27/2022 followed by a pass of field cultivation. The EONR was calculated by fitting a quadratic-plateau statistical model through the yield response to nitrogen and applying a 0.17 ($1.03 of N/lbs to $6.00/bu) price ratio.

Results and Discussion

Soybeans were not affected by the N rate of the previous crop year; on average the soybean yield was 82±3 bu/A across all soybean plots. However, corn yields were significantly impacted by nitrogen rate (Fig 1.) Corn yield ranged from 58 to 285 bu/A across all N rates with an average yield of 195 bu/A. The EONR was 196 and 223 lbs N/A, while yield at the EONR was 264 and 244 bu/A for a corn-soybean and continuous corn crop rotation respectively (Fig. 1). These results show the benefit of growing corn in rotation with soybeans as less N was necessary to produce higher yields.

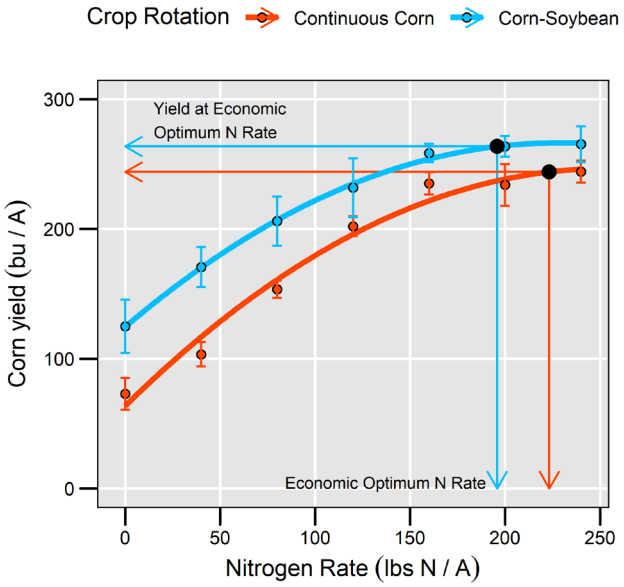

Figure 1. Yield response to nitrogen application per crop rotation. Circles plus error bars represent mean yield ± 1 standard deviation per nitrogen rate and crop rotation. Vertical and horizontal arrows represent the Economic Optimum N rate and the yield at the Economic optimum Nitrogen rate respectively.

Acknowledgements

We would like to thank Ken Pecinovski and the farm staff at the Borlaug Learning Center for conducting these field operations.