Corn Yield Response to Nitrogen Fertilizer Application Timing in Southeast Iowa

RFR-A16100

John Lundvall, research affiliate
Dan Barker, assistant scientist
John Sawyer, professor
Department of Agronomy

Introduction

The objective of this project was to measure corn yield response to fertilizer nitrogen (N) application timing (spring pre-plant or at-planting vs. split/side-dress) across multiple N rates (0 to 250 lb total-N/acre). Results were determined through fitting yield response to N-rate regression equations and calculation of economic optimum nitrogen rate (EONR) based on a 0.10 N fertilizer price-to-corn price ratio.

Materials and Methods

The project was conducted in 2015 to 2016 at ISU Research and Demonstration Farms near Sutherland, Kanawha, Nashua, Ames, Lewis, and Crawfordsville. At all sites, corn was in rotation with soybean.

Multiple total-N rates were applied preplant (PRE) or preplant + side-dress at approximately V5 to V6 corn growth stage (SPLIT). Treatments were arranged in a randomized complete block design, with four replications. Preplant fertilizer-N application rates included 0, 50, 100, 150, 200, and 250 lb N/acre and split fertilizer-N application rates included the same total in 0/0, 0/50, 50/50, 50/100, 50/150, and 50/200 lb N/acre splits.

Corn was grown with either no-till management or spring disk-field cultivator tillage for seedbed preparation. Fertilizer-N sources were injected urea-ammonium nitrate solution or surface broadcast/incorporated urea. Adapted corn hybrids were planted in 30-in. row spacing.

Results and Discussion

At the Southeast Research Farm, Crawfordsville, Iowa, urea ammonium nitrate (32-0-0) fertilizer was coulter-injected as the PRE (4/24/15 and 4/20/16) and side-dress (6/4/15 and 5/27/16) N application. Corn was no-till planted April 30, 2015 and April 22, 2016. Results from the Crawfordsville site underscored the effect of growing season precipitation (and timing of precipitation) on corn yield and optimum N fertilizer rate. In 2015, Crawfordsville received an inch of precipitation immediately following the PRE N application and nearly two inches of precipitation in the week following the SPLIT N application. In 2016, approximately two inches of rain accumulated in the 10 days following both the PRE and SPLIT applications. These post-N application rains provided sufficient moisture to move injected UAN into the soil profile and, along with other rainfall, may have resulted in more than normal N loss in 2015. Unfortunately, 2016 corn yield potential was limited by strong winds on June 22 that left some rapidly-growing corn in a green-snap or lodged condition.

Averaged across PRE and SPLIT N application timings with no N applied, corn yielded 103 bushels/acre in 2015 vs. 78 bushels/acre in 2016. The EONR averaged 209 lb N/acre in 2015 (213 lb N/acre PRE and 205 lb N/acre SPLIT) vs. 147 lb N/acre in 2016 (159 lb N/acre PRE and 135 lb N/acre SPLIT). Corn yield at the EONR in 2015 was 225 bushels/acre PRE and 235 bushels/acre SPLIT; and in 2016 was 196 bushels/acre PRE and 193 bushels/acre SPLIT.

Across site-years from multiple studies, the application timing results were grouped according to each site's results for timing within ± 10 lb N/acre of the EONR (Table 1). Response to application timing was mixed, and there was no consistent corn yield or fertilizer rate difference associated with the PRE or SPLIT application. Over all sites, the SPLIT application had a lower EONR (only 6 lb N/acre), with no difference in corn yield at the EONR. For four sites, the calculated EONR for the SPLIT averaged 29 lb N/acre less than the PRE application, however, corn yield was unchanged. For three sites, the EONR for the PRE averaged 18 lb N/acre less than the SPLIT application, however, corn yield was only 3 bushels/acre different and higher with the SPLIT application. For seven sites, the EONR was within 10 lb N/acre for the PRE and SPLIT applications, and the yield at the EONR the same. These results indicate a combination of weather and soil properties can significantly influence corn response to springtime N application timing. One would not expect one or the other timing to always be the best.

Acknowledgements

Appreciation is extended to the farm superintendents and their staff for assistance with this project.

Table 1. Effect of application timing, spring preplant (Pre) or split Pre/side-dress (Split), on calculated economic optimum nitrogen fertilizer rate (EONR) and corresponding corn yield (YEONR) across 14 site-years in 2014 to 2016.

		Mean EONR		Mean YEONR	
Timing Response Category	**Sites**	**Pre**	**Split**	**Pre**	**Split**
		- - - lb N/ac - - -		- - - bu/ac - - -	
Split EONR at least 10 lb N/acre lower than Preplant	4	167	138	202	201
Preplant EONR at least 10 lb N/acre lower than SPLIT	3	108	126	203	206
Preplant and Split EONR within 10 lb N/acre	7	151	147	221	221
Overall Mean	**14**	**146**	**140**	**212**	**212**

Based on N response equations and 0.10 N/corn price ratio. The table includes additional sites from 2014 not discussed for individual research farms (Lundvall, Barker, Sawyer, and Hall, 2014-2016).