EFFECTS OF NITROGEN RATE AND TIMING OF APPLICATION ON CORN ROOTWORM RESPONSE IN CORN

Farmers today are faced with escalating fertilizer prices, especially for nitrogen (N). A more than five-fold price increase in the last fifty years has not deterred producers from exploring this crucial input in their production[1].

Corn rootworm (CRW) (*Diabrotica* spp.) is one of the most serious crop pests in North America. CRW feeding can cause reduced water and mineral uptake which may result in yield loss, especially when water is limiting. The number of acres planted to CRW-protected corn has increased in recent years. A growing body of evidence suggests that CRW-protected corn may have increased yield potential compared to their non-protected counterparts because of reduced stress from CRW larval feeding resulting in larger root systems and increased N-use efficiency.

Materials and Methods

A replicated trial was conducted in 2012 at the Monmouth Learning Center in Monmouth, Illinois to investigate the effects of nitrogen rate and timing on corn yield in CRW-protected and non-protected corn products. Two products with 105 and 111 day relative maturities (RM) were selected that contained Genuity® SmartStax®, which provides two modes of action for CRW protection, and the respective Roundup Ready® Corn 2 (RR2) isolines with a soil applied insecticide (RR2 + Force 3G). Force® 3G insecticide was applied to the Roundup Ready® Corn 2 product at planting.

Corn products were planted at 36,000 seeds per acre on April 25, 2012. Treatments were replicated two times in a continuous corn field using a conventional tillage system (Table 1).

Weed control for the trial consisted of 2 qt/acre Harness® Xtra preemergence followed by 22 fl oz/ acre Roundup PowerMAX® when weeds were four inches tall or less.

Preplant nitrogen was applied with a ground rig and incorporated. Side-dress nitrogen was applied at the V5 growth stage. All nitrogen was applied as a 32% urea ammonium-nitrate (UAN) solution. Plots were harvested on September 14, 2012 and yield data adjusted to 15% moisture content.

Four Rates of Nitrogen Used	
Rate 1	Half rate Pre-plant
	120 lbs N/Acre
Rate 2	Full rate Pre-plant
	240lbs N/Acre
Rate 3	Full rate—Split application
	120 lbs N/Acre pre-plant followed by 120 lbs N/Acre at V5 stage
Rate 4	Full rate—Split Application
	180 lbs N/Acre pre-plant followed by 60 lbs N/Acre at V5 stage

Table 1. Nitrogen rate and timing treatments.

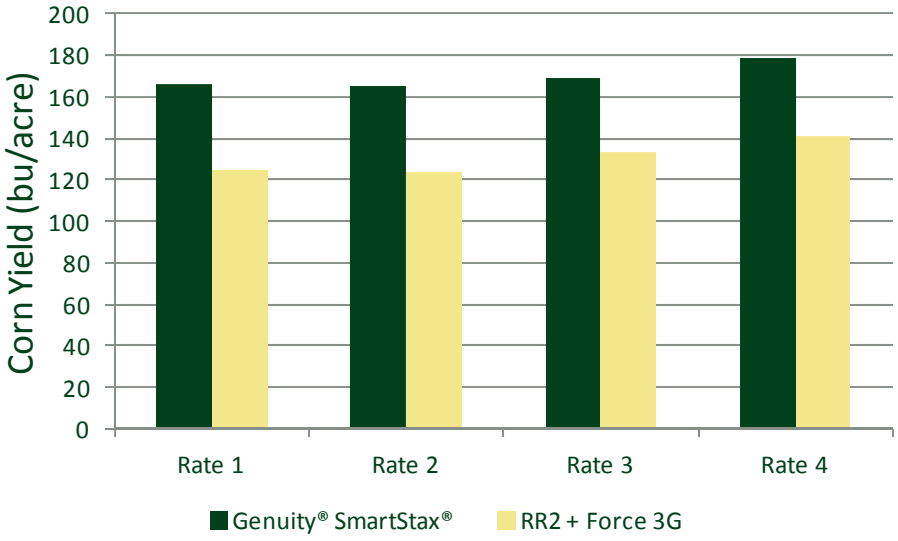

Figure 1. Yield response of CRW-resistant and non-resistant corn traits to nitrogen fertilizer in a drought year.

Results

The trend of yield response was nearly similar in both CRW-protected and non-protected products in all nitrogen treatments (Figure 1). However, CRW-protected products substantially out-yielded non-protected corn. This is due, in part, to the fact that

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insect control traits not only provide effective insect protection, but also enhance plants' ability to assimilate N, P, K, and other micronutrients, such as zinc. They also provide superior drought tolerance over non-protected corn products[2,3]. Thus, at locations with history of CRW infestation and/or water stress conditions, as experienced by the experimental site in 2012, products with at least a single insect control trait should be selected, even if insecticides will be applied. In this study, insecticide application did not provide sufficient protection to non-protected corn products.

Under the high heat and drought conditions of the 2012 growing season, split applications of N offered higher yields than single applications (Figure 2). In this study, Rate 4 offered a higher average yield than Rate 3. This could be due to the higher leaf area index (LAI) provided by the extra N during the vegetative phase of crop growth. Higher LAI coupled with increased leaf area duration effectively results in higher grain yields[4].

Every farming season, growers are faced with challenging decisions in the face of unpredictable weather conditions. Monsanto offers a superior product pool with accompanying agronomic practices to ensure maximum productivity even under great uncertainties.

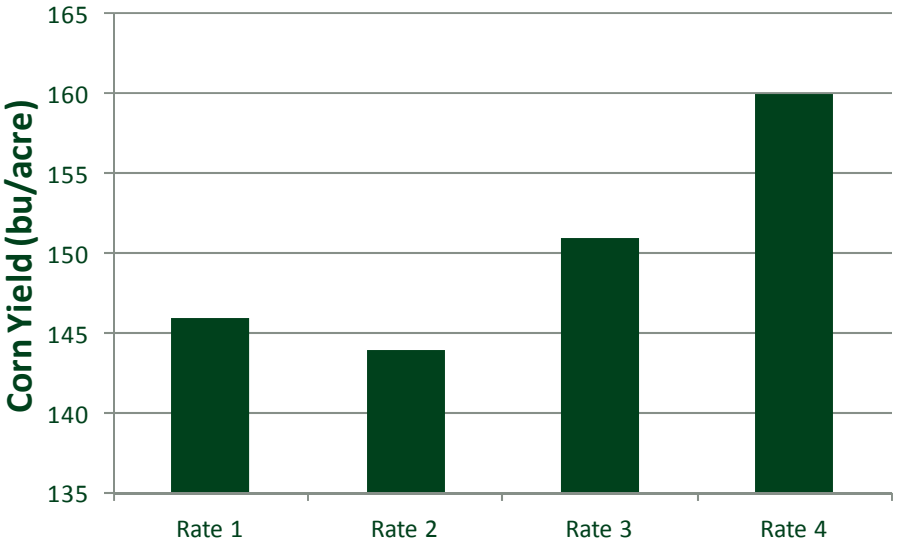

Figure 2. Effect of N timing and rate on corn yield in a dry year.

Resources

[1]*USDA-ERS. Average U.S. farm prices of selected fertilizers 1960-2012. Table 7. Fertilizer Use and Price. Available on-line: http://www.ers.usda.gov.*

[2]*Below, F.E., et al. 2010. Mineral nutrition of rootworm resistant corn. 2010 Illinois Fertilizer Conference Proceedings. Available on-line: http://frec.ifca.com.*

[3]*Thompson, G and Narva, K. 2009. Corn with transgenic insect protection traits utilized in combination with drought tolerance and/or reduced inputs, particularly fertilizer. United States Patent Application Publication. Pub. No.: US 2009/0300980 A1.*

[4]*Khalifa, M. A. 1972. Effects of nitrogen on leaf area index, leaf area duration, net assimilation rate, and yield of wheat. Agronomy Journal, Vol. 65 No. 2, p. 253-256. Crop Science Society of America.*

Additional Resources: Laboski, C.A.M., et al. 2011. Do corn hybrid traits affect nitrogen use efficiency? Proceedings of the 2011 Wisconsin Crop Management Conference, Volume 50. Available on-line: http://www.soils.wisc.edu.

The information discussed in this report is from a single site, one-year demonstration. This informational piece is designed to report the results of this demonstration and is not intended to infer any confirmed trends. Please use this information accordingly.