



2014 DEMONSTRATION REPORT Monsanto Learning Center at Monmouth, IL

Effects of *B.t.* Technology on Corn Yield Under Different Nitrogen Regimes

Background

Corn rootworm (CRW) (*Diabrotica virgifera*) is dubbed the billion dollar pest due to the significant annual yield losses and control costs associated with its infestation.^{1,2}

Crop rotation to a non-host crop, scouting and insecticide applications (soil and/or foliar applied), and corn product selection are major management strategies employed to curtail significant economic losses.² Although these strategies could provide some protection individually, in some limited situations, deploying multiple strategies provides the best hedging (risk management) for yield potential.¹

The goals of this trial were to:

- Determine if below-ground *B.t.* technology and root protection can improve nitrogen use efficiency.
- Investigate the relationship of single and dual MOA corn products with their non-*B.t.* isolines treated with soil-applied insecticides (SAI) in a corn-soybean rotation.

Materials and Methods

On May 9, 2014, corn was planted into soil that was previously soybean at the Monmouth Learning Center near Monmouth, IL. The field had conventional tillage consisting of chisel plow in the fall and soil finisher in the spring. Plot dimensions were 10 ft x 100 ft (0.023 acres)/treatment. Corn was planted at a population of 36,000 seeds/acre in 30-inch single rows with 4 rows per treatment and replicated 3 times.

Corn products included in the study:

- 105 Relative maturity (RM) Genuity® SmartStax® RIB Complete® corn blend product (Dual MOA)
- 105 RM Roundup Ready® Corn 2 + SAI
- 112 RM Genuity® VT Triple PRO® RIB Complete® corn blend product (Single MOA)
- 112 RM Roundup Ready® Corn 2 + SAI

Treatment List

Force® 3G, a SAI, was applied to Roundup Ready® Corn 2 isolines of Genuity® SmartStax® RIB Complete® corn blend and Genuity® VT Triple PRO® RIB Complete® corn blend products at planting.

32% UAN nitrogen fertilizer was applied on May 8, 2014 at three pre-plant incorporation rates of:

- 60 lbs/acre (Low Rate)
- 120 lbs/acre (Medium Rate)
- 240 lbs/acre (High Rate)

Weed Management

Weeds were managed across the trial with a PRE application of Harness® Xtra 5.6L at 2.75 qt/acre on May 19, 2014 and a POST application of Roundup PowerMAX® at 22 fl oz/acre + AMS at 17 lb/100 gal on June 6, 2014. Plots were harvested October 1, 2014, and yield data was adjusted to 15% moisture content.



2014 DEMONSTRATION REPORT Monsanto Learning Center at Monmouth, IL

Effects of *B.t.* Technology on Corn Yield Under Different Nitrogen Regimes

Key Messages

- Corn yield increased with increasing nitrogen rate across all corn products. On average, high N rate yielded 14.1 and 35.5 bu/acre greater than medium and low N rates, respectively. Medium N rate had an average yield 21.4 bu/acre greater compared to low N rate.
- *B.t.* technology improved N use efficiency. Within each N regime, corn products with *B.t.* traits had greater yields compared to their isolines without *B.t.* traits. Exception was at the low N rate where yield was 2.6 bu/acre greater for the non-*B.t.* isolate of the Genuity® SmartStax® RIB Complete® corn blend product.
- Compared to the isolines corn products without *B.t.* traits, corn products with *B.t.* traits yielded 6.6, 10.2, and 9.1 bu/acre greater at the low, medium, and high nitrogen rates, respectively.
- Crop rotation significantly reduces CRW populations. Even under marginal pressure, the *B.t.* corn products had greater average yields compared to their isolines without *B.t.* traits. This could be due, in part, to the close proximity of other corn trials with very high CRW pressure and high adult CRW beetle populations.
- Efficacy of soil-applied insecticides is highly dependent on available soil moisture. The adequate moisture received at the research site during most parts of the growing season provided optimum activation of the SAI for crop protection. Thus, under less than ideal growing conditions, the yield difference observed between corn products with and without *B.t.* traits could be greater.³

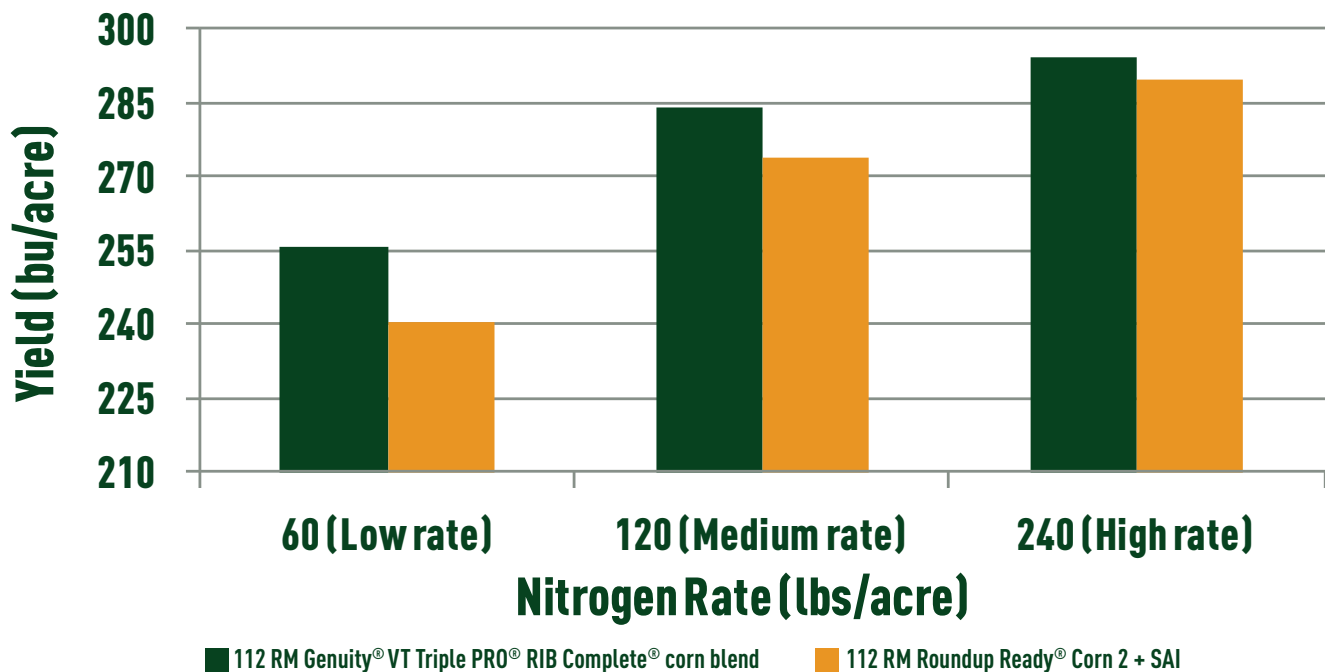


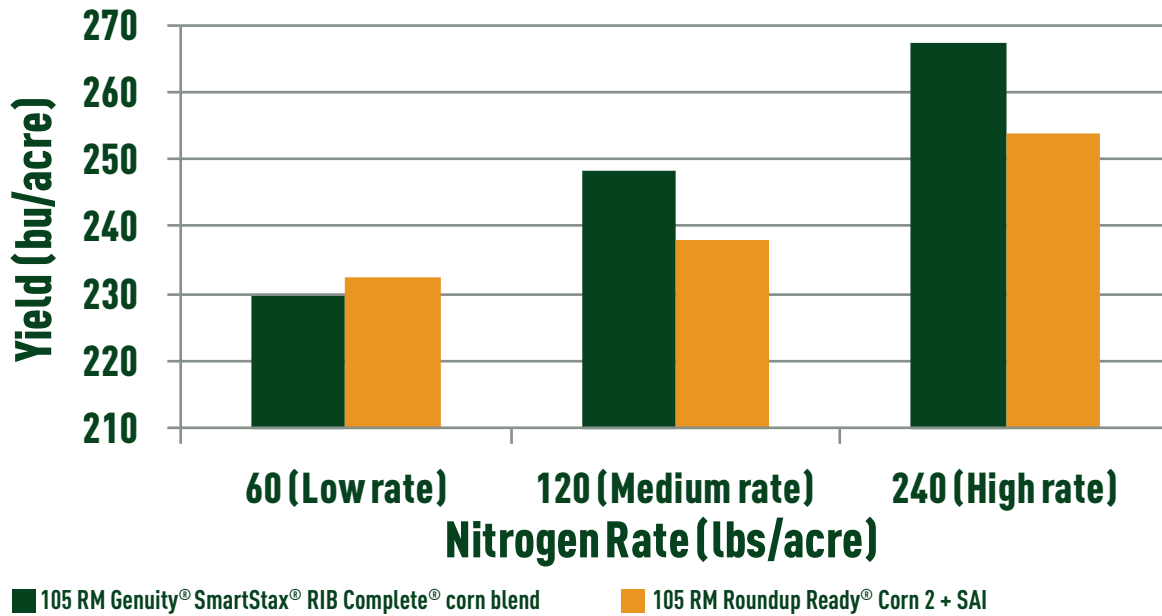
Figure 1. Yield Response of 112 RM Corn Product to Nitrogen Fertilization as Affected by *B.t.* Technology



2014 DEMONSTRATION REPORT

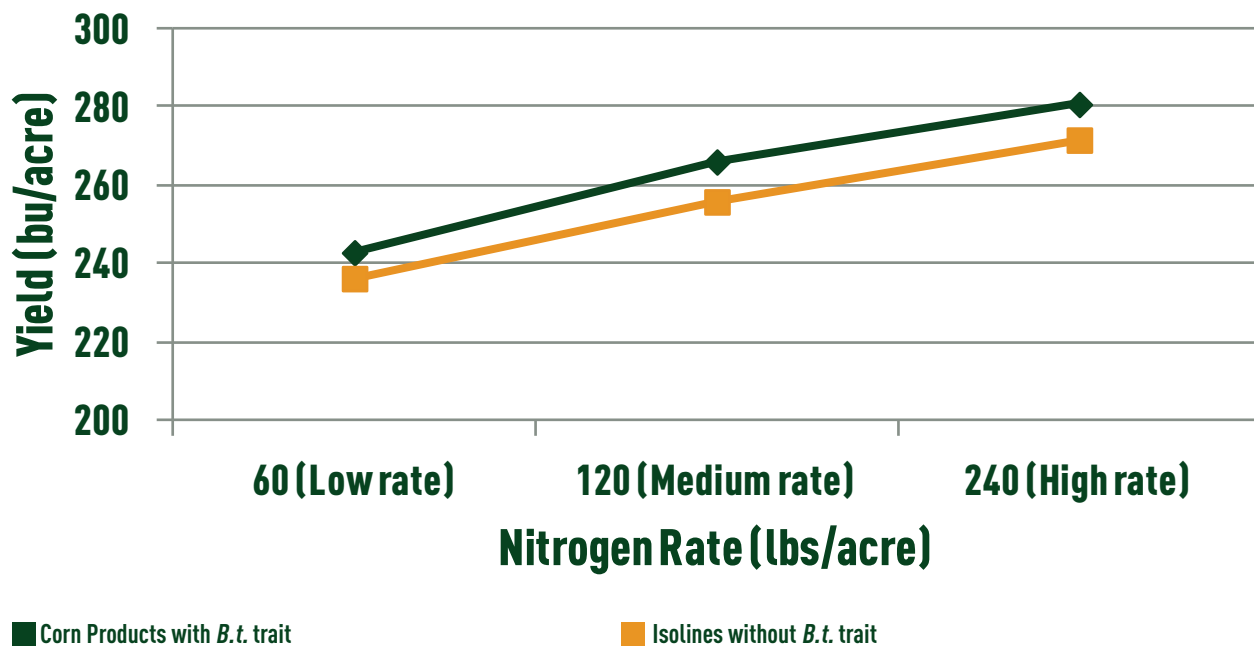
Monsanto Learning Center at Monmouth, IL

Effects of *B.t.* Technology on Corn Yield Under Different Nitrogen Regimes



■ 105 RM Genuity® SmartStax® RIB Complete® corn blend ■ 105 RM Roundup Ready® Corn 2 + SAI

Figure 2. Yield Response of 105 RM Corn Product to Nitrogen Fertilization as Affected by *B.t.* Technology



■ Corn Products with *B.t.* trait

■ Isolines without *B.t.* trait

Figure 3. Yield Response to Nitrogen Fertilization Under Corn Rootworm Management Systems. Yield values represent the average of 4 corn products: 2 *B.t.* corn products and 2 isolines without *B.t.* traits with soil-applied insecticides.



2014 DEMONSTRATION REPORT

Monsanto Learning Center at Monmouth, IL

Effects of *B.t.* Technology on Corn Yield Under Different Nitrogen Regimes

Roundup Ready® Corn 2 trait
(isoline of Genuity® SmartStax® RIB Complete®
corn blend product)

Genuity® SmartStax® RIB Complete®
corn blend product



Figure 4. Under the same nitrogen rate, Genuity® SmartStax® RIB Complete® plants with *B.t.* traits (right 2 rows) exhibit substantial growth advantage over their Roundup Ready® Corn 2 isoline corn products without *B.t.* traits (left 2 rows)

Sources

¹Best Management Practices for Heavy Corn Rootworm Pressure. Genuity. Technology Development & Agronomy, 2013.

²Corn Rootworm Management Guide 2012. Genuity. Technology Development & Agronomy, 2012.

³Effect of corn rootworm control and nitrogen rate on corn yield. Monmouth Learning Center Summary, Monmouth IL. 2013. Technology Development & Agronomy, 2013.

Legals

Monsanto Company is a member of Excellence Through Stewardship® (ETS). Monsanto products are commercialized in accordance with ETS Product Launch Stewardship Guidance, and in compliance with Monsanto's Policy for Commercialization of Biotechnology-Derived Plant Products in Commodity Crops. Commercialized products have been approved for import into key export markets with functioning regulatory systems. Any crop or material produced from this product can only be exported to, or used, processed or sold in countries where all necessary regulatory approvals have been granted. It is a violation of national and international law to move material containing biotech traits across boundaries into nations where import is not permitted. Growers should talk to their grain handler or product purchaser to confirm their buying position for this product.

***B.t.* products may not yet be registered in all states.** Check with your Monsanto representative for the registration status in your state.

Roundup Technology® includes Monsanto's glyphosate-based herbicide technologies.

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Roundup Ready® crops contain genes that confer tolerance to glyphosate, the active ingredient in Roundup® brand agricultural herbicides. Roundup® brand agricultural herbicides will kill crops that are not tolerant to glyphosate. Harness® is a restricted use pesticide and is not registered in all states. The distribution, sale, or use of an unregistered pesticide is a violation of federal and/or state law and is strictly prohibited. Check with your local Monsanto dealer or representative for the product registration status in your state. Genuity®, Harness®, Roundup PowerMAX®, Roundup Ready 2 Technology and Design®, Roundup Ready®, Roundup Technology®, Roundup®, SmartStax® and VT Triple PRO® are trademarks of Monsanto Technology LLC. Leaf Design® is a registered trademark of Monsanto Company. LibertyLink and the Water Droplet Design® is a registered trademark of Bayer. Herculex® is a registered trademark of Dow AgroSciences LLC. Respect the Refuge and Corn Design® and Respect the Refuge® are registered trademarks of National Corn Growers Association. All other trademarks are the property of their respective owners. ©2014 Monsanto Company. 141017120210 103114SEK



Before opening a bag of seed, be sure to read, understand and accept the stewardship requirements, including applicable refuge requirements for insect resistance management, for the biotechnology traits expressed in the seed as set forth in the Monsanto Technology/Stewardship Agreement that you sign. By opening and using a bag of seed, you are reaffirming your obligation to comply with the most recent stewardship requirements.

