

Valuation of Corn Rootworm Control Tactics Under Varying Levels of Pressure

- The extent of corn rootworm (CRW) feeding is difficult to predict and is dependent on a number of environmental and biological factors that are beyond a grower's control.
- In moderate to high CRW pressure situations, Genuity® SmartStax® RIB Complete® corn blend products provided a 20 bu/acre advantage over products without *B.t.* CRW protection and a 10 bu/acre advantage over products without *B.t.* CRW protection used in combination with a soil-applied insecticide (SAI).
- In low pressure situations, Genuity® SmartStax® RIB Complete® corn blend products provided an 8 bu/acre advantage over products without *B.t.* CRW protection.

Importance of Controlling Corn Rootworm Larvae

Historical estimates suggest western corn rootworm (WCR) and northern corn rootworm (NCR) are responsible for nearly 1 billion dollars annually in crop losses and control costs.¹ Larval feeding can decrease yield potential and increase the risk of root



Figure 1. Corn rootworm larvae.

lodging. Although the average yield advantage is 20 bu/acre, data shows there can be an even greater impact of up to 80 bu/acre yield loss due to CRW.² Predicting the extent of CRW damage is very difficult, but the potential for damaging populations is more probable under certain circumstances.

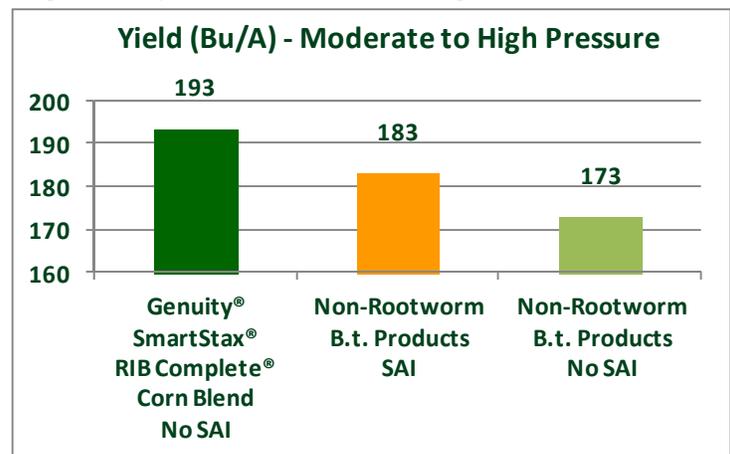
Practices That Can Increase CRW Pressure

In all areas of the Corn Belt, production practices that favor growth in CRW populations include: long-term corn rotations, late-planted fields, and/or planting of late-maturing products. For example, full season products used by many silage growers are often prime targets for escalating CRW beetle populations because they pollinate when other desirable adult CRW food sources have deteriorated.

Management Options

- Crop rotation has been and continues to be a recommended method to effectively control CRW larvae. However, rotation is no longer as effective in specific areas of the Corn Belt due to extended diapause populations of NCR and the soybean variant of WCR.
- Seeds with dual modes of action (MOA), such as Genuity® SmartStax® RIB Complete® corn blend, have proven to be a consistent CRW control tool.
- Soil-applied insecticides labeled for control of CRW larvae can be applied at planting with conventional seed products and along with single MOA *B.t.* seed products to add another MOA.

Figure 2. Expected Yield Over the Long-Term



SAI = Soil-Applied Insecticide

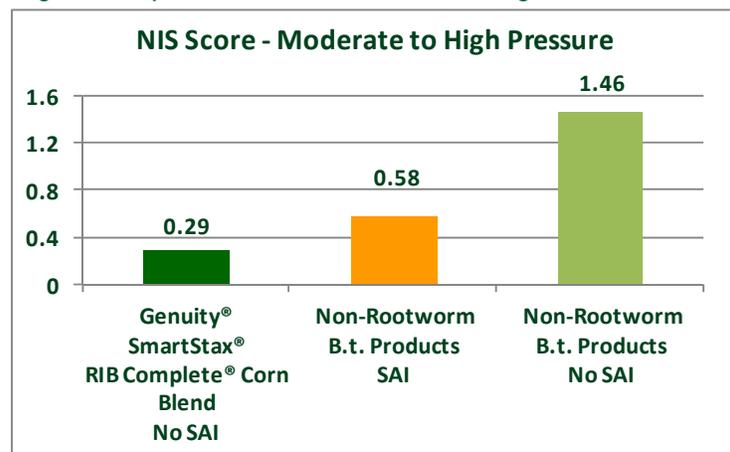
TD Sites in IL, IA, KS, CO, NE, WI, MI, IN, MN, SD, OH, DE (2010-2013)

100-112RM; N = 46 protocol site years under moderate and high CRW pressure

*Moderate Pressure = untreated check averaged > 0.5-1.0

*High Pressure = locations where untreated check averaged > 1.0

Figure 3. Expected NIS Scores Over the Long-Term



SAI = Soil-Applied Insecticide; NIS = Nodal Injury Score

TD Sites in IL, IA, KS, CO, NE, WI, MI, IN, MN, SD, OH, DE (2010-2013)

100-112RM; N = 33 protocol site years under moderate and high CRW pressure

*Moderate Pressure = untreated check averaged > 0.5-1.0

*High Pressure = locations where untreated check averaged > 1.0

Valuation of Corn Rootworm Control Tactics Under Varying Levels of Pressure

Research

In efforts to define the value provided by *B.t.* traits and SAI's, Monsanto Technology Development Representatives conducted CRW control studies from 2010 to 2013 in twelve states to evaluate the rootworm protection efficacy of Genuity® SmartStax® RIB Complete® corn blend products compared to similar corn products without *B.t.* corn rootworm protection.

All products were adapted for the testing area and had their respective seed treatments. Nodal injury scores (NIS) and yield data were collected from the studies.

Results and Discussion

In Moderate to High Pressure Situations² – Genuity® SmartStax® RIB Complete® corn blend products provided an advantage average of 20 bu/acre over non-rootworm *B.t.* protected corn products (Figure 2). When an SAI was used with non-rootworm *B.t.* protected products, there was a 10 bu/acre advantage for Genuity® SmartStax® RIB Complete® corn blend products (Figure 2). Genuity® SmartStax® RIB Complete® corn blend products had an NIS score of 0.29 compared to scores of 0.58 and 1.46 for non-rootworm *B.t.* protected products with and without an SAI respectively (Figure 3). An SAI would add about \$16/acre to the cost of production and should be considered when selecting seed products.

In Low Pressure situations² – Genuity® SmartStax® RIB Complete® corn blend products provided an 8 bu/acre advantage over non-rootworm *B.t.* products that did not have an SAI.⁴ If farmers determine they have a low risk for damage from a rootworm infestation, and decide to plant a non-rootworm *B.t.* product without an insecticide, 8 bu/acre in yield potential could be lost. The use of an SAI with non-rootworm *B.t.* products may provide adequate levels of rootworm control in instances of low pressure. However, due to difficulty of predicting damage levels, growers run an exceptional risk of under estimating damage potential; thereby, incurring substantial loss in yield. In the short-term, growers may realize a modest cost savings. However, the use of non-rootworm *B.t.* products alone or with an SAI will likely to cost growers more in the long-term.

Additional Considerations:

Regardless of high or low rootworm pressure, Genuity® SmartStax® RIB Complete® corn blend products can provide growers a better opportunity to maintain and increase profitability. Along with the \$16/acre cost for an SAI, consideration should be given to:

- Soil-applied insecticides are relatively insoluble and protection is limited to a relatively small portion of the root zone.
- Genuity® SmartStax® RIB Complete® corn blend products offer earworm *B.t.* protection. Lost yield attributable to earworm feeding can be as high as 7%.³
- Genuity® SmartStax® RIB Complete® corn blend products are treated with Acceleron® Corn Seed Treatment Products plus Poncho® 500/VOTIVO® seed treatment, which has shown an increased yield potential of 3.7 bu/acre over other basic seed treatments.⁴
- Farmers, through market research, have placed a value of \$5/acre on refuge in the bag products.⁵

Genuity® Rootworm Management App

iPad® device users can download an app that allows farmers to complete assessments on each field to determine the potential risk of corn rootworm damage. The tool follows proven pest management recommendations for scouting, crop rotation, utilizing dual MOA when planting, and suggesting specific insecticides based on crop type. The app also allows growers to take notes, access scouting reports, set alerts, and share results by email. The app can be downloaded from Genuity.com/RootwormManager or the iTunes® App Store.

Sources:

¹ Croff, C.D. and P.D. Mitchell. 2007. When does it pay to plant RW Bt corn in Wisconsin? Proceedings of the 2007 Wisconsin Fertilizer, Agrilime & Pest Management Conference, Vol. 46.

² TD Sites in IL, IA, KS, CO, NE, WI, MI, IN, MN, SD, OH, DE (2010-2013).

³ Boyd, M. and W. Bailey. 2001. Corn earworm in Missouri. MU Guide, University of Missouri-Columbia. <https://mospace.umsystem.edu> (verified 5/21/14).

⁴ 2011 and 2012 Internal Monsanto Commercial Field Trials.

⁵ 2011 Market probe farmer quantitative study.

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. **IMPORTANT IRM INFORMATION: Genuity® RIB Complete® corn blend products do not require the planting of a structured refuge except in the Cotton-Growing Area where corn earworm is a significant pest. See the IRM/Grower Guide for additional information. Always read and follow IRM requirements. 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. Acceleron®, Genuity®, RIB Complete®, Roundup Ready 2 Technology and Design®, Roundup Ready®, Roundup® and SmartStax® are trademarks of Monsanto Technology LLC. Leaf Design® is a registered trademark of Monsanto Company. LibertyLink and the Water Droplet Design®, Poncho® and VOTIVO® are registered trademarks 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. 140821074508 092814LGM**

