

IOWA STATE UNIVERSITY

OF SCIENCE AND TECHNOLOGY

2015 IOWA EVALUATION OF INSECTICIDES  
AND  
PLANT-INCORPORATED PROTECTANTS

CORN PESTS RESEARCH PROJECT

DEPARTMENT OF ENTOMOLOGY  
AMES, IOWA 50011-3140  
SUE BLODGETT, CHAIR

INSECT INVESTIGATED

Corn Rootworm

*Diabrotica virgifera virgifera* and *Diabrotica barberi*

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# IOWA STATE UNIVERSITY

## 2015 IOWA EVALUATION OF INSECTICIDES AND PLANT INCORPORATED PROTECTANTS

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CORN PESTS RESEARCH PROJECT

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## **INTRODUCTION**

In Iowa, the species of corn rootworm (CRW) include western corn rootworm *Diabrotica virgifera virgifera* LeConte and northern corn rootworm *D. barberi* Smith and Lawrence, and these two species are the most damaging pests of corn, *Zea mays*, in the United States Corn Belt. Eggs are laid in the soil during the fall and hatch the following spring. Larval feeding on corn roots in June may diminish yield by reducing plant growth and drought tolerance, and by imposing harvest losses due to plant lodging. Adult emergence from the soil is underway by early July and continues through late summer. Additional crop losses may be caused by adult beetles feeding on the corn silk and on soft doughy kernels. In Iowa, crop rotation, where it fits cropping practices, remains the preferred method of management. However, it is also economically feasible to protect corn roots with soil-applied insecticides and plant-incorporated protectants, which are transgenic corn hybrids that produce insecticidal toxins derived from *Bacillus thuringiensis* (Bt).

In addition to corn rootworm, several aboveground lepidopteran pests feed on corn in Iowa. These include the European corn borer *Ostrinia nubilalis*, black cutworm *Agrotis ipsilon*, fall armyworm *Spodoptera frugiperda*, and corn earworm *Heliothis zea*. Over the last decade, Bt corn varieties have been made commercially available to protect corn from these pests.

## **OBJECTIVE**

The goal of this research program is to serve the agricultural community of Iowa by monitoring and evaluating the performance of registered and pre-

commercial insecticides and transgenic corn hybrids. To achieve this goal, we maintain a viable, proactive, progressive and scientifically sound product evaluation program.

## **TESTING PROCEDURES AND EVALUATIONS**

**Field Sites:** Research plots were established at five Iowa locations in 2015. Four research locations were on Iowa State University farms: 1) Johnson Farm (Ames), 2) Bruner Farm (Boone), 3) Northeast Research and Demonstration Farm (Nashua) and 4) Southeast Research and Demonstration Farm (Crawfordsville). One research location was at a commercial field in northeastern Iowa. At the Johnson Farm, Bruner Farm, Northeast Iowa and Southeast Iowa Research and Demonstration Farms, two sections are rotated annually as either research location or late-planted trap crop. The seed planted for the trap crop is a mixed maturity blend with a greater proportion of late-maturing varieties. This trap crop constitutes a favorable environment for adult female CRW late in the season when other fields are maturing. The other research location had a history of continuous corn production, which is conducive to a high abundance of CRW, and high levels of feeding injury to mCry3A corn. Table 1 lists the studies conducted at each location.

## **METHODS**

**Field plot design:** The experimental design was a randomized complete block with either four or six replications. Plot lengths and the number of blocks per study are provided in Table 1.

**Planting:** Seeds were pre-bagged and planted with a four-row John Deere Max Emerge™ 7100 integral planter that had 30 inch row spacings. The standard planter fiberglass seed hoppers with attached finger-pickup mechanism were replaced with modified units. On the new units, the metal plate that covered the fingers had been replaced with a 7/8 inch clear Plexiglas plate. Inserted through the Plexiglas was a small stainless steel cylinder. The cylinder was positioned to deliver seed to the pickup fingers. At the beginning of each replication, pre-bagged seeds were dumped into the steel cylinder. At the beginning of each replication, a hydraulic motor (attached to the planter's drive shaft) was activated to deliver seed immediately into the ground. At the end of each replication, this same hydraulic motor was activated to expel any unplanted seed, and the finger pickup mechanism was visually inspected through the clear Plexiglas plate to ensure that no seed was present.

For the planting of all five FMC studies, seeds were planted with a two-row, John Deere planter that had 30 inch row spacings and outfitted with bulk seed hoppers.

**Plant-incorporated protectants:** Plant-incorporated protectants were evaluated in corn hybrids producing insecticidal toxins derived from the bacterium *Bacillus thuringiensis* (Bt), and these are described in Appendix III.

**Seed treatments:** All the DeKalb hybrids were treated with Poncho 500. All the Mycogen hybrids were treated with Cruiser Extreme® 250. All the Syngenta hybrids were treated with

Cruiser 250 or 1250. All the Pioneer hybrids were treated with either Cruiser 250 + Maxim Quattro + Poncho1250/Votivo + PPCT12/13, or Cruiser 250 + Maxim Quattro + PPCT2013. These seed treatments target secondary pests, such as wireworm and seed corn maggot but may have some, limited efficacy against CRW at levels higher than 250 mg active ingredient per kernel.

**Granular soil-applied insecticides:**

The granular insecticides Aztec 2.1G, Precept 3G and Force 3.0G were applied with modified Noble® metering units mounted on the planter. The Noble units were calibrated in the laboratory to accurately deliver material at a tractor speed of 4 mph. Aztec 2.1G insecticide was applied with in-furrow placement. Precept 3G insecticide was applied with both in-furrow and T-band placement. Force 3.0G insecticide was applied with T-band placement.

**Liquid soil-applied insecticides:**

Capture LFR 1.5SC was applied in-furrow and Force 250CS insecticide was applied T-Band at planting with a compressed-air system built directly into the planter by Almaco manufacturing (Nevada, IA). Capture LFR and Force CS were applied as ounces per 1000 row feet using Teejet XR80015EVS spray nozzles at 21 psi to deliver 5 GPA of finished spray at a tractor speed of 4 mph. Both were applied using water as the carrier.

Liquid products applied in the FMC studies included Capture LFR 1.5SC, Capture 3RIVE 3D 1.6SC, Ethos LFR 2SC, Ethos XB 1.5SC, Force 250CS, VGR 2.0WP. All these were applied as fluid ounces per 1000 row feet except

the VGR 2.0WP product, which was applied as grams per acre. Capture 3RIVE 3D and Force used water as the carrier and all other products used fertilizer (Nucleus Hyperlink HP 8-24-4) as a carrier. All these products were applied In-furrow at a tractor speed of 3 mph.

**SmartBox™ application of soil-applied insecticides:** The Aztec-SB 4.67G, insecticide treatments were applied with modified SmartBox™ metering units mounted on the planter. The commercial SmartBox™ units were removed from their large-base containers and sandwiched between a flat metal plate on the bottom and a custom-made, threaded plastic cap on the top. The bottom plate had been fabricated so that it could slide in and out of the same planter mounting brackets used for the noble units. An inverted 1 L Nalgene bottle attached to the top provided a secure and sealed container for insecticide for the SmartBox™ units. Clear plastic tubes directed the granular insecticides to both the in-furrow and T-band placement. One controller mounted in the tractor cab was used to operate all the SmartBox™ metering units. These units were set-up for proper applications and managed using the AMVAC SmartBox System Manager. All treatments were applied at 4 mph using the “fixed speed mode” on the SmartBox™ controllers. These SmartBox™ metering units were accurately calibrated before going to the field to deliver ounces of product per 1000 row feet.

**General methodology:** For all applications of soil-applied insecticides, 11-inch poly-bristle skirts were attached to a frame and positioned so the bristle

tips touched the ground. Each row was constantly monitored to ensure that insecticides were applied correctly. Final incorporation was accomplished with drag chains mounted behind the closing wheels.

## **Evaluations**

**Stand counts:** The number of plants in 17.5 row-ft was recorded. This was done early and late in the growing season and then averaged to provide one value for stand counts for each treatment in each block.

**Root injury:** After the majority of corn rootworms had finished feeding, roots were dug to assess feeding injury. This took place from July 21 to August 19, 2015. Prior to leaving the field, excess soil was removed from roots and all roots were labeled with study name, plot number and row number using a permanent marker. Roots were transported to the Insectary Building at Iowa State University where they were soaked in water and then washed with a pressurized hose to remove any remaining soil. Roots were evaluated for rootworm feeding injury following the Iowa State Node-Injury Scale (0-3):

### **Node-Injury Scale (0-3):**

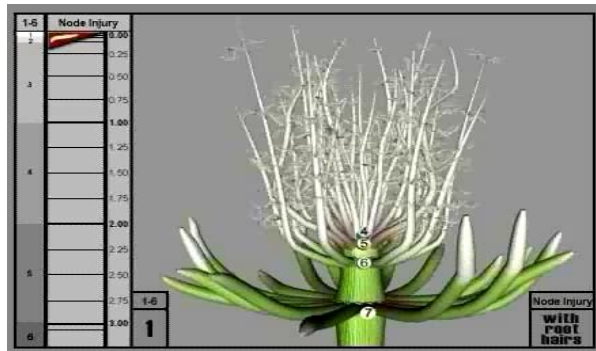
- 0.00 - No feeding injury (lowest rating that can be given).
- 1.0- One node (circle of roots), or the equivalent of an entire node, pruned to within 1.5 inches of the stalk or soil line.
- 2.00 - Two nodes pruned.
- 3.00 - Three or more nodes pruned.  
(Highest rating that can be given)



Injury in between complete nodes pruned is noted as the percentage of the node missing (e.g., 1.50 = one and a half nodes pruned and 0.25 = one quarter of one node pruned).

The linear node-injury scale allows injury to be expressed intuitively and has proved useful in evaluating minor injury. For an interactive guide to the Node-injury scale, see the web site for the Department of Entomology at Iowa State University.

<http://www.ent.iastate.edu/dept/faculty/gassmann/rootworm>



**Product consistency:** Percent product consistency was calculated as the percentage of times a treatment limited feeding injury to 0.25 node or less (greater injury can result in economic yield loss, especially when plants are moisture stressed).

**Lodging counts:** A plant was considered lodged if it was leaning at least 30 degrees from vertical. These data were taken at harvest time along with final stand count numbers.

**Yields:** Studies that were taken to yield were machine harvested with either a modified John Deere 9450 plot combine or Haldrup brand plot combine, Model C85. Weight (pounds) and percent

moisture were recorded from either a Harvest Manager system, Harvest Master brand or Shivers brand 5010 moisture meter harvest data collection system. These measurements were converted to bushels per acre of No. 2 shelled corn (56 lbs. per bushel) at 15.5% moisture in Microsoft Excel.

All data were analyzed with analysis of variance (ANOVA) procedures using SAS 9.4. When a significant treatment effect was present pairwise comparisons made among means with an experimentwise error rate of  $P < 0.05$ .

### **CALIBRATION INFORMATION**

All Noble® units were laboratory calibrated and units were spot-checked in the field prior to planting. SmartBox™ units were calibrated on the planter in accordance with instructions in the SmartBox Operator's Manual. During calibration and planting, the flowability of each formulation was noted, as well as any other calibration problems. There were no calibration or delivery problems with any treatment.

### **RESULTS AND DISCUSSION**

Generally, the economic injury level for root feeding by corn rootworm larvae ranges from 0.25 to 0.5 nodes depending on the level of environmental stress, in particular stress from high heat and low soil moisture. When feeding exceeds the economic injury level it is typically profitable to institute additional or alternative management efforts to reduce root injury.

In Iowa during 2015, rootworm populations continued to rebound after occurring at very low levels during the summer of 2014. Overall, rootworm

pressure ranged from moderate to low across study locations, with the exception of northeastern Iowa, where heavy pressure was observed at research locations. Untreated checks tended to range from half a node to a node and a quarter at the Johnson and Bruner research farms in central Iowa near Ames. However, in some cases only a quarter node of injury was observed for the untreated check. In southeastern Iowa at the Crawfordsville location, pressure was very light with less than a quarter node of injury observed for the untreated check. By contrast, in northeastern Iowa at both Nashua and a commercial farm, injury to the untreated check was above two nodes.

Some general patterns from 2015 include the persistence of resistance to Cry3Bb1 and mCry3A Bt traits by western corn rootworm. This was especially apparent in the northeastern Iowa where more than a node of injury was noted to VT3 and Agrisure 3000GT (Tables 36 and 40). Additionally, at the on-farm study, substantial feeding injury to VT3 was observed (Tables 44). In all of these studies, adequate root protection was observed when corn was planted that contained the Cry34/35Ab1 trait pyramided with a Cry3 trait, such as Cry3Bb1 or mCry3A. In all cases, root injury to these pyramided hybrids tended to be very low and there was no added benefit of layering soil-applied insecticide on-top of this pyramided Bt corn. When soil-applied insecticide was applied to non-Bt, root injury was reduced significantly compared to the untreated check, and tended to be below the economic threshold of 0.50 (Tables 40 and 44), although a few

instances of injury above 0.50 nodes were noted (Table 36). In central Iowa, we found that either corn pyramided with Cry34/35Ab1 and a Cry3 Bt trait, or non-Bt corn with soil-applied insecticide was sufficient to reduce injury below the economic threshold (Tables 2, 12, 15 and 18).

For management of corn rootworm in Iowa, general recommendations continued to include a diversified approach involving crop rotation, pyramided Bt corn containing the Cry34/35Ab1 trait, and soil-applied insecticide on corn that does not contain a Bt trait targeting corn rootworm.

#### **AGRONOMIC INFORMATION, WEATHER DATA AND MATERIALS TESTED AND PICTURES OF RESEARCH ACTIVITIES**

Agronomic information and field history are listed in **Appendix I**. Weather data from the test site or the nearest Iowa climatological station are listed in **Appendix II**. Information on materials tested is listed in **Appendix III**. Pictures of various research activities are in **Appendix IV**.

#### **RESEARCH SUPPORT**

Support for this research was provided by the Iowa State University Agriculture and Home Economics Experiment Station and by the following companies: AMVAC, Dow AgroSciences, DuPont-Pioneer, FMC, LidoChem, Monsanto, Syngenta and Valent.

**WAIVER OF ENDORSEMENT**

*This report deals with the relative ability of each treatment to protect corn from damage by soil insects. This information is not presented to endorse the use of any product and the name of Iowa State University should not appear in any advertising without prior written consent. Iowa State University, their respective officers, agents, or employees, have not made, and do not hereby make, any representation, warranty or covenant with respect to the use of these test results, nor will they be liable for any damages, losses, or claims, including those of an incidental or consequential nature, arising out of the use of these test results.*

Table 1. Iowa evaluation of insecticides and plant-incorporated protectants.

Test Location	Type of Studies <sup>1</sup>	Table Numbers	Entries/ Test	Rows/ Plot	Experimental Unit Size	
					Row Length (ft)	# Reps
Ames-Johnson Farm	1)Comparison among Multiple Products	2-5	11	2	75	4
	2)Valent Ampex 1.73SC Efficacy and Yield	6-8	5	4	25	4
	3)LidoChem Experimental M-1 Efficacy and Yield	9-11	3	2	25	4
	4)FMC Experimental Capture 3RIVE3D on non-RW Bt	12-14	7	4	40	4
Boone-Bruner Farm	1)Bt Rootworm Traits and Insecticides	15-17	10	4	25	6
	2)Monsanto Traits and Insecticides	18-20	15	2	25	4
	3)FMC Experimental Capture 3RIVE3D on non-RW Bt	21-23	7	4	40	4
	4)FMC Experimental Capture 3RIVE3D on Traited Corn	24-26	5	4	40	4
Crawfordsville	1)Monsanto Traits and Insecticides	27-29	15	2	25	4
	2)FMC Experimental Capture 3RIVE3D on non-RW Bt	30-32	7	4	40	4
	3)FMC Experimental Capture 3RIVE3D on Traited Corn	33-35	5	4	40	4
Nashua	1)Bt Rootworm Traits and Insecticides	36-39	10	4	25	6
	2)Comparison among Multiple Products	40-43	18	2	75	4
Northeastern Iowa	1)Bt Rootworm Traits and Insecticides	44-47	10	4	25	6

<sup>1</sup> All studies were conducted in either a continuous cornfield or following corn rootworm trap crop, to ensure the presence of rootworm larvae in the study.

**Table 2. Node injury and product consistency for Comparison among Multiple Products: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	0.22a	80a
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	0.26ab	70a
DeKalb VT3 RIB	-----	-----	-----	0.27ab	60a
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	0.38ab	70a
Pioneer OAM1	-----	-----	-----	0.39ab	70a
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	0.42ab	60a
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	0.46ab	40ab
Agrisure 3111	-----	-----	-----	0.49 b	45ab
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	0.50ab	40ab
Pioneer non-RW Bt	-----	-----	-----	1.56 c <sup>10</sup>	3 c
Agrisure non-RW Bt	-----	-----	-----	1.73 c	15 bc

<sup>1</sup> Planted May 4, 2015; evaluated August 12 & 13, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure non-RW Bt = Syngenta Agrisure GT (Agrisure N68B-GT, Glyphosate Tolerant); Agrisure 3111 = Syngenta Agrisure (Agrisure N68B-3111)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>6</sup> Iowa State Node-Injury scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>9</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>10</sup> This check mean based on 40 observations

**Table 3. Stand counts for Comparison among Multiple Products: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	37.75a
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	37.50ab
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	37.00ab
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	37.00ab
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	37.00ab
Pioneer OAM1	-----	-----	-----	36.25ab
DeKalb VT3 RIB	-----	-----	-----	36.00ab
Pioneer non-RW Bt	-----	-----	-----	36.00ab <sup>7</sup>
Agrisure non-RW Bt	-----	-----	-----	35.75ab
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	35.00ab
Agrisure 3111	-----	-----	-----	34.50 b

<sup>1</sup> Planted May 4, 2015; evaluated May 29 and September 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure non-RW Bt = Syngenta Agrisure GT (Agrisure N68B-GT, Glyphosate Tolerant); Agrisure 3111 = Syngenta Agrisure (Agrisure N68B-3111)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 16 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> This check mean based on 32 observations

**Table 4. Lodging for Comparison among Multiple Products: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Lodging <sup>5,6</sup>
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	0
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	0
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	0
Pioneer OAM1	-----	-----	-----	1
DeKalb VT3 RIB	-----	-----	-----	1
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	3
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	3
Agrisure 3111	-----	-----	-----	12
Pioneer non-RW Bt	-----	-----	-----	19 <sup>7</sup>
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	20
Agrisure non-RW Bt	-----	-----	-----	23

<sup>1</sup> Planted May 4, 2015; evaluated September 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure non-RW Bt = Syngenta Agrisure GT (Agrisure N68B-GT, Glyphosate Tolerant); Agrisure 3111 = Syngenta Agrisure (Agrisure N68B-3111)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 8 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications)

<sup>6</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

<sup>7</sup> This check mean based on 16 observations

**Table 5. Yield for Comparison among Multiple Products: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
DeKalb VT3 RIB	-----	-----	-----	226
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	221
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	219
Agrisure 3111	-----	-----	-----	213
Pioneer OAM1	-----	-----	-----	212
Agrisure non-RW Bt	-----	-----	-----	211
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	192
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	191
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	191
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	187
Pioneer non-RW Bt	-----	-----	-----	180 <sup>8</sup>

<sup>1</sup> Planted May 4, 2015; machine harvested October 14, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure non-RW Bt = Syngenta Agrisure GT (Agrisure N68B-GT, Glyphosate Tolerant); Agrisure 3111 = Syngenta Agrisure (Agrisure N68B-3111)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 4 observations (2-row treatment x 68 row-feet/treatment x 4 replications)

<sup>6</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

<sup>8</sup> This check mean based on 8 observations

**Table 6. Average root injury and product consistency for the Valent Ampex 1.73SC Efficacy and Yield: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
DeKalb VT3 + Aztec-SB	4.67G	0.14	Furrow	0.03a	100
DeKalb VT3 + Ampex	1.73SC	0.20	Furrow	0.03a	100
DeKalb VT3 + Force	3G	0.12	Furrow	0.04a	100
DeKalb VT3 + Capture LFR	1.5SC	0.10	Furrow	0.12a	85
DeKalb VT3	-----	-----	-----	0.43 b	70

<sup>1</sup> Planted May 1, 2015; evaluated August 13, 2015<sup>2</sup> DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 62-97)<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = Insecticide applied at planting time<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)<sup>6</sup> Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten<sup>7</sup> Chemical and check means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less<sup>9</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )**Table 7. Stand counts for the Valent Ampex 1.73SC Efficacy and Yield: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
DeKalb VT3 + Force	3G	0.12	Furrow	35.50a
DeKalb VT3 + Capture LFR	1.5SC	0.10	Furrow	33.75ab
DeKalb VT3 + Ampex	1.73SC	0.20	Furrow	33.25ab
DeKalb VT3 + Aztec-SB	4.67G	0.14	Furrow	32.75 b
DeKalb VT3	-----	-----	-----	31.50 b

<sup>1</sup> Planted May 1, 2015; evaluated May 29 and September 22, 2015<sup>2</sup> DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 62-97)<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = Insecticide applied at planting time<sup>5</sup> Chemical and check means based on 16 observations (2 rows/ treatment x 17.5 row-ft/treatment x 4 replications x 2 evaluations)<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

**Table 8. Average yields for the Valent Ampex 1.73SC Efficacy and Yield: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
DeKalb VT3 + Ampex	1.73SC	0.20	Furrow	276
DeKalb VT3 + Force	3G	0.12	Furrow	269
DeKalb VT3 + Capture LFR	1.5SC	0.10	Furrow	265
DeKalb VT3	-----	-----	-----	253
DeKalb VT3 + Aztec-SB	4.67G	0.14	Furrow	251

<sup>1</sup> Planted May 1, 2015; machine harvested October 14, 2015

<sup>2</sup> DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 62-97)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = Insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 4 observations (2-rows/ treatment x 19 row-feet/treatment x 4 replications)

<sup>6</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

**Table 9. Average root injury and product consistency for the experimental LidoChem M-1 Study: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Placement <sup>3</sup>	Node- Injury <sup>4,5,6</sup>	Product Consistency <sup>7,8</sup>
DeKalb non-RW Bt + Adjuvant	Furrow	0.58	40
DeKalb non-RW Bt + High concentration rate-M-1	Furrow	0.74	35
DeKalb non-RW Bt + Low concentration rate-M-1	Furrow	0.80	25

<sup>1</sup> Planted May 18, 2015; evaluated August 13, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR2 Isoline (DKC 62-98 RR2); M-1 and adjuvant applied on May 18, 2015 by hand pouring into the open seed furrow

<sup>3</sup> Furrow = Insecticide applied at planting time

<sup>4</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>5</sup> Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten

<sup>6</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

<sup>7</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>8</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

**Table 10. Stand counts for the experimental LidoChem M-1 Study: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Placement <sup>3</sup>	Stand Counts <sup>4,5</sup>
DeKalb non-RW Bt + Low concentration rate-M-1	Furrow	34.25a
DeKalb non-RW Bt + High concentration rate-M-1	Furrow	30.75ab
DeKalb non-RW Bt + Adjuvant	Furrow	29.50 b

<sup>1</sup> Planted May 18, 2015; evaluated June 8 and September 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR2 Isoline (DKC 62-98 RR2); M-1 and adjuvant applied on May 18, 2015 by hand pouring into the open seed furrow

<sup>3</sup> Furrow = Insecticide applied at planting time

<sup>4</sup> Means based on 16 observations (2 rows/ treatment x 17.5 row-ft/treatment x 4 replications x 2 evaluation dates)

<sup>5</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )



**Table 11. Average yield for the experimental LidoChem M-1 Study: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Placement <sup>3</sup>	Bushels/ Acre <sup>4,5,6</sup>
DeKalb non-RW Bt + Low concentration rate-M-1	Furrow	224
DeKalb non-RW Bt + High concentration rate-M-1	Furrow	214
DeKalb non-RW Bt + Adjuvant	Furrow	189

<sup>1</sup> Planted May 18, 2015; machine harvested October 14, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR2 Isoline (DKC 62-98); M-1 and adjuvant applied on May 18, 2015 by hand pouring into the open seed furrow

<sup>3</sup> Furrow = Insecticide applied at planting time

<sup>4</sup> Means based on 4 observations (2 rows/ treatment x 19 row-feet/treatment x 4 replications)

<sup>5</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

<sup>6</sup> Yields converted to 15.5% Moisture

**Table 12. Node injury and product consistency for FMC Experimental Capture 3RIVE3D on non-RW Bt: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node- Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	0.08a	95
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	0.09a	95
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	0.09a <sup>10</sup>	100
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	0.12a	90
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	0.22ab <sup>10</sup>	80
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	0.22ab	65
Pioneer non-RW Bt				0.61 b <sup>10</sup>	70

<sup>1</sup> Planted May 1, 2015 (Treatments 1,2, 5-10); Planted May 19, 2015 (Treatments 3,4); evaluated August 17, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>6</sup> Iowa State Node-Injury scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>9</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

<sup>10</sup> These chemical and check means based on 19 observations

**Table 13. Stand counts for FMC Experimental Capture 3RIVE3D non-RW Bt: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
Pioneer non-RW Bt				35.50
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	35.00
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	34.75
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	34.25
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	33.75
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	33.75
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	33.50

<sup>1</sup> Planted May 1, 2015 (Treatments 1,2, 5-10); Planted May 19, 2015 (Treatments 3,4); evaluated May 29 and September 22, 2015 (Treatments 1,2 5-10); evaluated June 8 and September 22, 2015 (Treatments 3,4)

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 16 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)

<sup>6</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

**Table 14. Yield for FMC Experimental Capture 3RIVE3D on non-RW Bt: Johnson Farm, Ames<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	242a
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	236ab
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	227ab
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	223ab
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	218ab
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	216ab
Pioneer non-RW Bt				196 b

<sup>1</sup> Planted May 1, 2015 (Treatments 1,2, 5-10); Planted May 19, 2015 (Treatments 3,4); Machine harvested October 14, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 4 observations (4-row treatment x 34 row-feet/treatment x 4 replications)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

**Table 15. Average root-injury and product consistency for Bt Rootworm Traits and Insecticides: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>7,8</sup>
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	0.03a	100a
DeKalb Smartstax	-----	-----	-----	0.14ab	90ab
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	0.20ab	83ab
DeKalb VT3	-----	-----	-----	0.20ab	83ab
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	0.22ab	83ab
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	0.23ab	87ab
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	0.44 bc	77ab
Mycogen-HXX	-----	-----	-----	0.54 c	50 b
DeKalb non-RW Bt	-----	-----	-----	0.61 c	43 b
Mycogen non-RW Bt	-----	-----	-----	1.18 d	7 c

<sup>1</sup> Planted May 21, 2015; evaluated August 11 & 12, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 30 observations (5 roots/2 rows x 6 replications)

<sup>6</sup> Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

**Table 16. Average stand count for Bt Rootworm Traits and Insecticides: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	32.25a
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	32.00a
Mycogen-HXX	-----	-----	-----	30.75ab
DeKalb non-RW Bt	-----	-----	-----	30.75ab
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	30.50abc
DeKalb VT3	-----	-----	-----	30.00abc
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	30.00abc
DeKalb Smartstax	-----	-----	-----	29.00 bc
Mycogen non-RW Bt	-----	-----	-----	28.75 bc
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	28.00 c

<sup>1</sup> Planted May 21, 2015; evaluated June 5 and September 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = Insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 24 observations (2 rows/ treatment x 17.5 row-ft/treatment x 6 replications x 2 evaluation dates)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

**Table 17. Average yield for Bt Rootworm Traits and Insecticides: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
DeKalb VT3	-----	-----	-----	239
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	236
DeKalb non-RW Bt	-----	-----	-----	227
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	227
DeKalb Smartstax	-----	-----	-----	227
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	224
Mycogen-HXX	-----	-----	-----	224
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	222
Mycogen non-RW Bt	-----	-----	-----	218
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	208

<sup>1</sup> Planted May 21, 2015; machine harvested October 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 6 observations (4-row treatment x 19 row-feet/treatment x 6 replications)

<sup>6</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

**Table 18. Average root injury and product consistency for Monsanto Traits and Insecticides: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node- Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
DeKalb Smartstax RIB + Precept	3G	0.13	T-band	0.03a	100
Agrisure 5122 + Precept	3G	0.13	T-band	0.03a	100
Agrisure 3122 + Precept	3G	0.13	T-band	0.04a	100
Agrisure 3122	-----	-----	-----	0.05ab <sup>10</sup>	100
Mycogen HXX + Precept	3G	0.13	T-band	0.05ab	100
DeKalb non-RW Bt + Precept	3G	0.13	T-band	0.07abc	100
DeKalb Smartstax RIB	-----	-----	-----	0.08abc	95
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	0.08abcd	90
DeKalb VT3	-----	-----	-----	0.09abc	95
Agrisure 5122	-----	-----	-----	0.11abcd	95
Mycogen HXX	-----	-----	-----	0.20 bcde	75
Pioneer non-RW Bt + Precept	3G	0.13	In-furrow	0.23 cde	65
DeKalb VT2Pro	-----	-----	-----	0.25 de	70
DeKalb non-RW Bt	-----	-----	-----	0.37 e	65
Pioneer non-RW Bt	-----	-----	-----	0.37 e	65

<sup>1</sup> Planted May 21, 2015; evaluated August 20, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb Smartstax RIB = DeKalb Smartstax RIB (DKC 62-08); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb non-RW Bt = DeKalb brand RR Isoline (DKC 62-98); DeKalb VT2Pro = DeKalb brand VT2Pro (DKC 58-89); Mycogen HXX = Mycogen Herculex XTRA (Mycogen 2K592); Agrisure 3122 = Syngenta Agrisure (Agrisure N53W-3122); Agrisure 5122 = Syngenta Agrisure Duracade (Agrisure N75A-5122A); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> T-band & In-furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>6</sup> Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>9</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

<sup>10</sup> These chemical and check means based on 19 observations

**Table 19. Average stand counts for Monsanto Traits and Insecticides: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
DeKalb Smartstax RIB	-----	-----	-----	32.75
Mycogen HXX	-----	-----	-----	32.50
DeKalb VT2Pro	-----	-----	-----	32.50
Agrisure 3122	-----	-----	-----	32.25
Mycogen HXX + Precept	3G	0.13	T-band	32.25
DeKalb VT3	-----	-----	-----	32.00
Agrisure 5122	-----	-----	-----	32.00
Agrisure 3122 + Precept	3G	0.13	T-band	31.75
DeKalb non-RW Bt + Precept	3G	0.13	T-band	31.75
DeKalb non-RW Bt	-----	-----	-----	31.75
Pioneer non-RW Bt	-----	-----	-----	31.50
Agrisure 5122 + Precept	3G	0.13	T-band	31.50
Smartstax RIB + Precept	3G	0.13	T-band	31.00
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	30.50
Pioneer non-RW Bt + Precept	3G	0.13	In-furrow	30.50

<sup>1</sup> Planted May 21, 2015; evaluated June 8 and October 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb Smartstax RIB= DeKalb Smartstax RIB (DKC 62-08); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb non-RW Bt = DeKalb brand RR Isoline (DKC 62-98); DeKalb VT2Pro = DeKalb brand VT2Pro (DKC 58-89); Mycogen HXX = Mycogen Herculex XTRA (Mycogen 2K592); Agrisure 3122 = Syngenta Agrisure (Agrisure N53W-3122); Agrisure 5122 = Syngenta Agrisure Duracade (Agrisure N75A-5122A); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> T-band & In-furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 16 observations (2 rows/ treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)

<sup>6</sup> No significant differences between means (ANOVA, P < 0.05)

**Table 20. Average yield for Monsanto Traits and Insecticides: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
DeKalb Smartstax RIB + Precept	3G	0.13	T-band	269
DeKalb Smartstax RIB	-----	-----	-----	262
DeKalb non-RW Bt + Precept	3G	0.13	T-band	243
Agrisure 5122	-----	-----	-----	237
Pioneer non-RW Bt + Precept	3G	0.13	In-furrow	232
Agrisure 3122	-----	-----	-----	230
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	229
Mycogen HXX	-----	-----	-----	229
DeKalb non-RW Bt	-----	-----	-----	227
Agrisure 5122 + Precept	3G	0.13	T-band	220
DeKalb VT2Pro	-----	-----	-----	217
Mycogen HXX + Precept	3G	0.13	T-band	214
DeKalb Smartstax	-----	-----	-----	211
Pioneer non-RW Bt	-----	-----	-----	204
Agrisure 3122 + Precept	3G	0.13	T-band	203

<sup>1</sup> Planted May 21, 2015; machine harvested October 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb Smartstax RIB= DeKalb Smartstax RIB (DKC 62-08); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb non-RW Bt = DeKalb brand RR Isoline (DKC 62-98); DeKalb VT2Pro = DeKalb brand VT2Pro (DKC 58-89); Mycogen HXX = Mycogen Herculex XTRA (Mycogen 2K592); Agrisure 3122 = Syngenta Agrisure (Agrisure N53W-3122); Agrisure 5122 = Syngenta Agrisure Duracade (Agrisure N75A-5122A); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> T-band & In-furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 4 observations (2-row treatment x 19 row-feet/treatment x 4 replications)

<sup>6</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

**Table 21. Node injury and product consistency for FMC Experimental Capture 3RIVE 3D on non-RW Bt: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>8</sup>
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	0.15a	85
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	0.16a	85
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	0.21ab	80
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	0.22ab	70
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	0.23abc	75
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	0.43 bc	45
Pioneer non-RW Bt				0.47 c	40

<sup>1</sup> Planted May 22, 2015; evaluated August 20, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>6</sup> Iowa State Node-Injury scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>9</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

**Table 22. Stand counts for FMC Experimental Capture 3RIVE 3D on non-RW Bt: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	35.75
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	34.75
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	34.50
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	34.25
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	34.25
Pioneer non-RW Bt				34.25
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	34.25

<sup>1</sup> Planted May 22, 2015; evaluated June 8 and September 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 16 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)

<sup>6</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

**Table 23. Yield for FMC Experimental Capture 3RIVE 3D on non-RW Bt: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	211a
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	198ab
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	182ab
Pioneer non-RW Bt				180ab
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	176ab
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	172ab
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	165 b

<sup>1</sup> Planted May 22, 2015; Machine harvested October 22, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 4 observations (4-row treatment x 33 row-feet/treatment x 4 replications)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture



**Table 24. Node injury and product consistency for FMC Experimental Capture 3RIVE3D on Traited Corn: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
Pioneer AMX + Capture LFR	1.5SC	0.10	Furrow	0.03a	100
Pioneer AMX + Ethos LFR	2.0SC	0.49	Furrow	0.03a	100
Pioneer AMX + Force	250CS	0.12	Furrow	0.04ab	100
Pioneer AMX				0.05ab	100
Pioneer AMX + Capture 3RIVE 3D	1.6SC	0.10	Furrow	0.06 b	100

<sup>1</sup> Planted May 22, 2015; evaluated August 20, 2015<sup>2</sup> Pioneer AMX = Pioneer AcreMax Xtra (Pioneer P0157AMX)<sup>3</sup> Insecticides listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)<sup>6</sup> Iowa State Node-Injury scale (0-3). Number of full or partial nodes completely eaten<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less<sup>9</sup> No significant differences between means (ANOVA,  $P < 0.05$ )**Table 25. Stand counts for FMC Experimental Capture 3RIVE3D on Traited Corn: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
Pioneer AMX + Force	250CS	0.12	Furrow	36.50a
Pioneer AMX				36.25a
Pioneer AMX + Capture 3RIVE 3D	1.6SC	0.10	Furrow	35.00ab
Pioneer AMX + Capture LFR	1.5SC	0.10	Furrow	34.75ab
Pioneer AMX + Ethos LFR	2.0SC	0.49	Furrow	33.75 b

<sup>1</sup> Planted May 22, 2015; evaluated June 8 and September 22, 2015<sup>2</sup> Pioneer AMX = Pioneer AcreMax Xtra (Pioneer P0157AMX)<sup>3</sup> Insecticides listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 16 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )**Table 26. Yield for FMC Experimental Capture 3RIVE3D on Traited Corn: Bruner Farm, Boone.<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/Acre <sup>5,6,7</sup>
Pioneer AMX + Capture LFR	1.5SC	0.10	Furrow	209
Pioneer AMX + Force	250CS	0.12	Furrow	208
Pioneer AMX + Ethos LFR	2.0SC	0.49	Furrow	207
Pioneer AMX + Capture 3RIVE 3D	1.6SC	0.10	Furrow	203
Pioneer AMX				201

<sup>1</sup> Planted May 22, 2015; Machine harvested October 22, 2015<sup>2</sup> Pioneer AMX = Pioneer AcreMax Xtra (Pioneer P0157AMX)<sup>3</sup> Insecticides listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 4 observations (4-row treatment x 33 row-feet/treatment x 4 replications)<sup>6</sup> No significant differences between means (ANOVA,  $P < 0.05$ )<sup>7</sup> Yields converted to 15.5% Moisture



**Table 27. Average root injury and product consistency for Monsanto Traits and Insecticides: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	0.04a	100
Agrisure 3122	-----	-----	-----	0.05a	100
DeKalb non-RW Bt + Precept	3G	0.13	T-band	0.05ab	100
Mycogen HXX	-----	-----	-----	0.06abcd	100
Pioneer non-RW Bt + Precept	3G	0.13	In-furrow	0.06abc	100
Mycogen HXX + Precept	3G	0.13	T-band	0.06abcd	100
Agrisure 3122 + Precept	3G	0.13	T-band	0.06abcd	100
Agrisure 5122 + Precept	3G	0.13	T-band	0.06abcd	100
DeKalb Smartstax RIB	-----	-----	-----	0.07abc	100
DeKalb Smartstax RIB + Precept	3G	0.13	T-band	0.08abcd	100
DeKalb non-RW Bt	-----	-----	-----	0.08abcd	100
DeKalb VT3	-----	-----	-----	0.08abcd	100
Pioneer non-RW Bt	-----	-----	-----	0.13 bcd	80
Agrisure 5122	-----	-----	-----	0.14 cd	90
DeKalb VT2Pro	-----	-----	-----	0.20 d	80

<sup>1</sup> Planted May 13, 2015; evaluated July 27 & 28, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb Smartstax RIB= DeKalb Smartstax RIB (DKC 62-08); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb non-RW Bt = DeKalb brand RR Isoline (DKC 62-98); DeKalb VT2Pro = DeKalb brand VT2Pro (DKC 58-89); Mycogen HXX = Mycogen Herculex XTRA (Mycogen 2K592); Agrisure 3122 = Syngenta Agrisure (Agrisure N53W-3122); Agrisure 5122 = Syngenta Agrisure Duracade (Agrisure N75A-5122A); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> T-band & In-furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>6</sup> Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>9</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

**Table 28. Average stand counts for Monsanto Traits and Insecticides: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
DeKalb Smartstax RIB	-----	-----	-----	32.75a
Agrisure 3122	-----	-----	-----	32.00ab
DeKalb VT2Pro	-----	-----	-----	32.00ab
Mycogen HXX + Precept	3G	0.13	T-band	32.00ab
Agrisure 5122	-----	-----	-----	32.00ab
Mycogen HXX	-----	-----	-----	31.75ab
DeKalb non-RW Bt	-----	-----	-----	31.75ab
Agrisure 3122 + Precept	3G	0.13	T-band	31.50ab
Pioneer non-RW Bt	-----	-----	-----	31.25ab
DeKalb non-RW Bt + Precept	3G	0.13	T-band	31.25ab
DeKalb VT3	-----	-----	-----	31.00ab
DeKalb Smartstax RIB + Precept	3G	0.13	T-band	30.75ab
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	30.50ab
Agrisure 5122 + Precept	3G	0.13	T-band	30.50ab
Pioneer non-RW Bt + Precept	3G	0.13	In-furrow	29.75 b

<sup>1</sup> Planted May 13, 2015; evaluated May 28 and October 8, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb Smartstax RIB= DeKalb Smartstax RIB (DKC 62-08); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb non-RW Bt = DeKalb brand RR Isoline (DKC 62-98); DeKalb VT2Pro = DeKalb brand VT2Pro (DKC 58-89); Mycogen HXX = Mycogen Herculex XTRA (Mycogen 2K592); Agrisure 3122 = Syngenta Agrisure (Agrisure N53W-3122); Agrisure 5122 = Syngenta Agrisure Duracade (Agrisure N75A-5122A); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> T-band & In-furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 16 observations (2 rows/ treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)

<sup>6</sup> No significant differences between means (ANOVA, P < 0.05)

**Table 29. Average yield for Monsanto Traits and Insecticides: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
Agrisure 5122	-----	-----	-----	267a
Agrisure 5122 + Precept	3G	0.13	T-band	253a
DeKalb Smartstax RIB + Precept	3G	0.13	T-band	242ab
DeKalb Smartstax RIB	-----	-----	-----	228ab
Mycogen HXX	-----	-----	-----	196ab
Pioneer non-RW Bt	-----	-----	-----	187ab
Agrisure 3122 + Precept	3G	0.13	T-band	187ab
Pioneer non-RW Bt + Precept	3G	0.13	In-furrow	175ab
DeKalb VT3	-----	-----	-----	171ab
Mycogen HXX + Precept	3G	0.13	T-band	166ab
DeKalb non-RW Bt	-----	-----	-----	163ab
DeKalb non-RW Bt + Precept	3G	0.13	T-band	163ab
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	159ab
DeKalb VT2Pro	-----	-----	-----	144ab
Agrisure 3122	-----	-----	-----	142 b

<sup>1</sup> Planted May 13, 2015; machine harvested October 8, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb Smartstax RIB= DeKalb Smartstax RIB (DKC 62-08); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb non-RW Bt = DeKalb brand RR Isoline (DKC 62-98); DeKalb VT2Pro = DeKalb brand VT2Pro (DKC 58-89); Mycogen HXX = Mycogen Herculex XTRA (Mycogen 2K592); Agrisure 3122 = Syngenta Agrisure (Agrisure N53W-3122); Agrisure 5122 = Syngenta Agrisure Duracade (Agrisure N75A-5122A); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> T-band & In-furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 4 observations (2-row treatment x 19 row-feet/treatment x 4 replications)

<sup>6</sup> No significant differences between means (ANOVA, P < 0.05)

<sup>7</sup> Yields converted to 15.5% Moisture

**Table 30. Node injury and product consistency for FMC Experimental Capture 3RIVE 3D on non-RW Bt: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node- Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	0.04	100
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	0.04	100
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	0.05	100
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	0.06	100
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	0.06	100
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	0.06	100
Pioneer non-RW Bt				0.07	100

<sup>1</sup> Planted May 19, 2015; evaluated July 24, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>6</sup> Iowa State Node-Injury scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> No significant differences between means (ANOVA, P < 0.05)

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>9</sup> No significant differences between means (ANOVA, P < 0.05)

**Table 31. Stand counts for FMC Experimental Capture 3RIVE 3D on non-RW Bt: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	36.25
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	35.50
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	35.50
Pioneer non-RW Bt				35.25
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	34.25
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	33.50
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	32.50

<sup>1</sup> Planted May 19, 2015; evaluated June 4 and October 8, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 16 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)

<sup>6</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

**Table 32. Yield for FMC Experimental Capture 3RIVE 3D on non-RW Bt: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
Pioneer non-RW Bt + Force	250CS	0.12	Furrow	228a
Pioneer non-RW Bt				223ab
Pioneer non-RW Bt + Ethos XB	1.5SC	0.10	Furrow	221ab
Pioneer non-RW Bt + Ethos LFR	2.0SC	0.149	Furrow	214ab
Pioneer non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	210ab
Pioneer non-RW Bt + Capture LFR+VGR	1.5SC	0.10+5.0	Furrow	204ab
Pioneer non-RW Bt + Capture 3RIVE 3D	1.6SC	0.10	Furrow	200 b

<sup>1</sup> Planted May 19, 2015; Machine harvested October 8, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; Pioneer non-RW Bt = Pioneer brand RR (Pioneer 1151 RR2)

<sup>3</sup> All Insecticides listed as ounces a.i. per 1,000 row-feet except product VGR listed as grams per acre

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 4 observations (4-row treatment x 34 row-feet/treatment x 4 replications)

<sup>6</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

**Table 33. Node injury and product consistency for FMC Experimental Capture 3RIVE3D on Traited Corn: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
Pioneer AMX + Capture LFR	1.5SC	0.10	Furrow	0.01	100
Pioneer AMX + Capture 3RIVE 3D	1.6SC	0.10	Furrow	0.01	100
Pioneer AMX + Ethos LFR	2.0SC	0.49	Furrow	0.01	100
Pioneer AMX				0.01	100
Pioneer AMX + Force	250CS	0.12	Furrow	0.02	100

<sup>1</sup> Planted May 19, 2015; evaluated July 24, 2015<sup>2</sup> Pioneer AMX = Pioneer AcreMax Xtra (Pioneer P0157AMX)<sup>3</sup> Insecticides listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)<sup>6</sup> Iowa State Node-Injury scale (0-3). Number of full or partial nodes completely eaten<sup>7</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less<sup>9</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )**Table 34. Stand counts for FMC Experimental Capture 3RIVE3D on Traited Corn: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
Pioneer AMX				36.50
Pioneer AMX + Capture LFR	1.5SC	0.10	Furrow	35.50
Pioneer AMX + Force	250CS	0.12	Furrow	34.75
Pioneer AMX + Ethos LFR	2.0SC	0.49	Furrow	34.00
Pioneer AMX + Capture 3RIVE 3D	1.6SC	0.10	Furrow	33.75

<sup>1</sup> Planted May 19, 2015; evaluated June 4 and October 8, 2015<sup>2</sup> Pioneer AMX = Pioneer AcreMax Xtra (Pioneer P0157AMX)<sup>3</sup> Insecticides listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 16 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)<sup>6</sup> No significant differences between means (ANOVA,  $P < 0.05$ )

**Table 35. Yield for FMC Experimental Capture 3RIVE3D on Traited Corn: Southeast Iowa Research and Demonstration Farm, Crawfordsville<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
Pioneer AMX				192
Pioneer AMX + Ethos LFR	2.0SC	0.49	Furrow	184
Pioneer AMX + Capture 3RIVE 3D	1.6SC	0.10	Furrow	182
Pioneer AMX + Capture LFR	1.5SC	0.10	Furrow	180
Pioneer AMX + Force	250CS	0.12	Furrow	172

<sup>1</sup> Planted May 19, 2015; Machine harvested October 8, 2015<sup>2</sup> Pioneer AMX = Pioneer AcreMax Xtra (Pioneer P0157AMX)<sup>3</sup> Insecticides listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 4 observations (4-row treatment x 34 row-feet/treatment x 4 replications)<sup>6</sup> No significant differences between means (ANOVA, P < 0.05)<sup>7</sup> Yields converted to 15.5% Moisture**Table 36. Average root-injury and product consistency for Bt Rootworm Traits and Insecticides: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node- Injury <sup>5,6,7</sup>	Product Consistency <sup>7,8</sup>
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	0.06a	100a
DeKalb Smartstax	-----	-----	-----	0.11a	93a
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	0.12a	93a
Mycogen-HXX	-----	-----	-----	0.26 b	73ab
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	0.37 b	50 bc
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	0.87 c	17 cd
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	0.87 c	13 d
DeKalb VT3	-----	-----	-----	1.28 d	3 d
DeKalb non-RW Bt	-----	-----	-----	2.06 e	0 d
Mycogen non-RW Bt	-----	-----	-----	2.30 e	0 d

<sup>1</sup> Planted April 29, 2015; evaluated July 30 & 31, 2015<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-8x3); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 30 observations (5 roots/2 rows x 6 replications)<sup>6</sup> Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test (P ≤ 0.05)<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

**Table 37. Average stand count for Bt Rootworm Traits and Insecticides: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	31.50
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	31.25
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	31.00
DeKalb Smartstax	-----	-----	-----	31.00
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	31.00
Mycogen-HXX	-----	-----	-----	30.75
DeKalb non-RW Bt	-----	-----	-----	30.75
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	30.00
DeKalb VT3	-----	-----	-----	30.00
Mycogen non-RW Bt	-----	-----	-----	29.50

<sup>1</sup> Planted April 29, 2015 evaluated June 4 and September 24, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = Insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 24 observations (2 rows/ treatment x 17.5 row-ft/treatment x 6 replications x 2 evaluation dates)

<sup>6</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

**Table 38. Average lodging for Bt Rootworm Traits and Insecticides: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Lodging <sup>5,6</sup>
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	0a
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	0a
Smartstax	-----	-----	-----	0a
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	0a
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	1a
Mycogen-HXX	-----	-----	-----	1a
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	1a
DeKalb VT3	-----	-----	-----	5a
DeKalb non-RW Bt	-----	-----	-----	42 b
Mycogen non-RW Bt	-----	-----	-----	66 b

<sup>1</sup> Planted April 29, 2015; evaluated September 24, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = Insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 12 observations (2 rows/ treatment x 17.5 row-ft/treatment x 6 replications)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

**Table 39. Average yield for Bt Rootworm Traits and Insecticides: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	247a
DeKalb VT3	-----	-----	-----	243a
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	238ab
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	237ab
DeKalb Smartstax	-----	-----	-----	234ab
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	224ab
Mycogen-HXX	-----	-----	-----	223ab
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	221ab
DeKalb non-RW Bt	-----	-----	-----	206 b
Mycogen non-RW Bt	-----	-----	-----	169 c

<sup>1</sup> Planted April 29, 2015; machine harvested October 16, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 6 observations (4-row treatment x 19 row-feet/treatment x 6 replications)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture



**Table 40. Root injury and product consistency for Comparison among Multiple Products: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>8,9</sup>
Agrisure 3122 RIB	-----	-----	-----	0.06a	100a
Agrisure 3122 RIB + Force	250CS	0.14	T-Band	0.06a	100a
Agrisure 3000GT + Force	250CS	0.14	T-Band	0.12ab	95a
Pioneer OAM1	-----	-----	-----	0.14ab	90a
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	0.22ab	85a
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	0.23ab	75ab
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	0.28abc	75ab
Agrisure 3000GT + Capture LFR	1.5SC	0.10	Furrow	0.35 bc	55abc
Agrisure non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	0.37abc	75ab
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	0.38abc	70ab
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	0.62 cd	45abc
DeKalb VT3 RIB	-----	-----	-----	1.04 de	30 cde
Agrisure 3111	-----	-----	-----	1.12 e	10 de
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	1.16 de	30 bcd
Agrisure 3000GT	-----	-----	-----	1.43 ef	5 de
Pioneer non-RW Bt	-----	-----	-----	1.89 f <sup>10</sup>	0 e
Agrisure non-RW Bt <sup>12</sup>	-----	-----	-----	1.99 f	0 e
Agrisure non-RW Bt <sup>11</sup>	-----	-----	-----	2.06 f	0 e

<sup>1</sup> Planted April 29, 2015; evaluated August 4, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; \*DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure 3111 = Syngenta Agrisure Viptera 3111 (N68B-3111), Agrisure 3122 RIB = Syngenta Agrisure RIB (Agrisure N53W-3122 RIB); Agrisure 3000GT = Syngenta Agrisure (Agrisure N53W-3000GT)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 20 observations (5 roots/2 rows x 4 replications)

<sup>6</sup> Iowa State Node-Injury scale (0-3). Number of full or partial nodes completely eaten

<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less

<sup>9</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>10</sup> This check mean based on 39 observations

<sup>11</sup> Syngenta Agrisure GT hybrid (Agrisure N53-W3, Glyphosate Tolerant), near isoline of Agrisure N53-3122 RIB and N53-3000GT

<sup>12</sup> Syngenta Agrisure GT hybrid (Agrisure N68B-GT, Glyphosate Tolerant), near isoline of Agrisure N68-3111

**Table 41. Stand counts for Comparison among Multiple Products: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
Agrisure non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	37.25a
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	36.75ab
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	36.50ab
Pioneer OAM1	-----	-----	-----	36.50ab
DeKalb VT3 RIB	-----	-----	-----	36.25ab
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	36.25ab
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	36.00ab
Agrisure 3000GT + Capture LFR	1.5SC	0.10	Furrow	36.00ab
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	35.75ab
Agrisure non-RW Bt <sup>8</sup>	-----	-----	-----	35.75ab
Agrisure 3000GT + Force	250CS	0.14	T-Band	35.50ab
Agrisure 3111	-----	-----	-----	35.25ab
Agrisure 3122 RIB + Force	250CS	0.14	T-Band	35.25ab
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	35.25ab
Pioneer non-RW Bt	-----	-----	-----	34.75ab <sup>7</sup>
Agrisure 3122 RIB	-----	-----	-----	34.50ab
Agrisure 3000GT	-----	-----	-----	34.25ab
Agrisure non-RW Bt <sup>9</sup>	-----	-----	-----	33.50 b

<sup>1</sup> Planted April 29, 2015; evaluated June 4 and September 24, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; \*DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure 3111 = Syngenta Agrisure Viptera 3111 (N68B-3111); Agrisure 3122 RIB = Syngenta Agrisure RIB (Agrisure N53W-3122 RIB); Agrisure 3000GT = Syngenta Agrisure (Agrisure N53W-3000GT)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 16 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications x 2 evaluation dates)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> This check mean based on 32 observations

<sup>8</sup> Syngenta Agrisure GT hybrid (Agrisure N53-W3, Glyphosate Tolerant), near isoline of Agrisure N53-3122 RIB and N53-3000GT

<sup>9</sup> Syngenta Agrisure GT hybrid (Agrisure N68B-GT, Glyphosate Tolerant), near isoline of Agrisure N68-3111

**Table 42. Lodging for Comparison among multiple products: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Lodging <sup>5,6</sup>
Agrisure 3122 RIB	-----	-----	-----	0a
Agrisure 3122 RIB + Force	250CS	0.14	T-Band	0a
Agrisure 3000GT + Force	250CS	0.14	T-Band	0a
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	0a
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	0a
Agrisure non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	0a
Pioneer OAM1	-----	-----	-----	1a
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	1a
Agrisure 3000GT + Capture LFR	1.5SC	0.10	Furrow	1a
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	1a
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	3a
DeKalb VT3 RIB	-----	-----	-----	11ab
Agrisure 3111	-----	-----	-----	12ab
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	12ab
Agrisure non-RW Bt <sup>8</sup>	-----	-----	-----	18 bc
Agrisure 3000GT	-----	-----	-----	22 bc
Pioneer non-RW Bt	-----	-----	-----	30 bc <sup>7</sup>
Agrisure non-RW Bt <sup>9</sup>	-----	-----	-----	38 c

<sup>1</sup> Planted April 29, 2015; evaluated September 24, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; \*DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure 3111 = Syngenta Agrisure Viptera 3111 (N68B-3111); Agrisure 3122 RIB = Syngenta Agrisure RIB (Agrisure N53W-3122 RIB); Agrisure 3000GT = Syngenta Agrisure (Agrisure N53W-3000GT)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 8 observations (2-row treatment x 17.5 row-feet/treatment x 4 replications)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> This check mean based on 16 observations

<sup>8</sup> Syngenta Agrisure GT hybrid (Agrisure N53-W3, Glyphosate Tolerant), near isoline of Agrisure N53-3122 RIB and N53-3000GT

<sup>9</sup> Syngenta Agrisure GT hybrid (Agrisure N68B-GT, Glyphosate Tolerant), near isoline of Agrisure N68-3111

**Table 43. Yield for Comparison among Multiple Products: Northeast Iowa Research and Demonstration Farm, Nashua<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
Agrisure 3111 + Aztec-SB	4.67G	0.14	SB/Furrow	217a
Pioneer OAM1	-----	-----	-----	201ab
Agrisure 3000GT + Force	250CS	0.14	T-Band	200ab
DeKalb VT3 RIB	-----	-----	-----	197ab
Agrisure 3111	-----	-----	-----	196ab
DeKalb VT3 RIB + Aztec-SB	4.67G	0.14	SB/Furrow	194ab
Agrisure non-RW Bt + Capture LFR	1.5SC	0.10	Furrow	193ab
Pioneer OAM1 + Aztec-SB	4.67G	0.14	SB/Furrow	192ab
Pioneer non-RW Bt + Precept	3G	0.13	Furrow	192ab
Agrisure 3122 RIB + Force	250CS	0.14	T-Band	189ab
Pioneer non-RW Bt + Aztec-SB	4.67G	0.14	SB/Furrow	188ab
Agrisure 3000GT + Capture LFR	1.5SC	0.10	Furrow	185ab
Agrisure non-RW Bt <sup>10</sup>	-----	-----	-----	182ab
Agrisure 3000GT	-----	-----	-----	181ab
Pioneer non-RW Bt + Precept	3G	0.13	T-Band	176ab
Agrisure 3122 RIB	-----	-----	-----	173ab
Agrisure non-RW Bt <sup>9</sup>	-----	-----	-----	168ab
Pioneer non-RW Bt	-----	-----	-----	165 b <sup>8</sup>

<sup>1</sup> Planted April 29, 2015; machine harvested October 16, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; \*DeKalb VT3 RIB = YieldGard VT Triple RIB (DKC 58-83 RIB); Pioneer OAM1 = Pioneer Optimum AcreMax1 (P0533AM1); Pioneer non-RW Bt = Pioneer Herculex 1 (P0533HR); Agrisure 3111 = Syngenta Agrisure Viptera 3111 (N68B-3111); Agrisure 3122 RIB = Syngenta Agrisure RIB (Agrisure N53W-3122 RIB); Agrisure 3000GT = Syngenta Agrisure (Agrisure N53W-3000GT)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow & T-Band = insecticide applied at planting time; SB = SmartBox application at planting time

<sup>5</sup> Chemical and check means based on 4 observations (2-row treatment x 68 row-feet/treatment x 4 replications)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

<sup>8</sup> This check mean based on 8 observations

<sup>9</sup> Syngenta Agrisure GT hybrid (Agrisure N53-W3, Glyphosate Tolerant), near isolate of Agrisure N53-3122 RIB and N53-3000GT

<sup>10</sup> Syngenta Agrisure GT hybrid (Agrisure N68B-GT, Glyphosate Tolerant), near isolate of Agrisure N68-3111

**Table 44. Average root-injury and product consistency for Bt Rootworm Traits and Insecticides: Northeastern Iowa<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Node-Injury <sup>5,6,7</sup>	Product Consistency <sup>7,8</sup>
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	0.04a	100a
DeKalb Smartstax	-----	-----	-----	0.06ab	100a
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	0.09abc	97a
Mycogen-HXX	-----	-----	-----	0.20 bc	90a
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	0.29 c	73ab
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	0.38 d	50ab
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	0.40 d	63ab
DeKalb VT3	-----	-----	-----	0.89 e	37 b
DeKalb non-RW Bt	-----	-----	-----	1.59 f	0 c
Mycogen non-RW Bt	-----	-----	-----	2.09 g	7 c

<sup>1</sup> Planted May 19, 2015; evaluated August 8, 2015<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = insecticide applied at planting time<sup>5</sup> Chemical and check means based on 30 observations (5 roots/2 rows x 6 replications)<sup>6</sup> Iowa State Node-Injury Scale (0-3). Number of full or partial nodes completely eaten<sup>7</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )<sup>8</sup> Product consistency = Percentage of times nodal injury was 0.25 (¼ node eaten) or less**Table 45. Average stand count for Bt Rootworm Traits and Insecticides: Northeastern Iowa<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Stand Counts <sup>5,6</sup>
DeKalb VT3	-----	-----	-----	31.25a
Mycogen-HXX	-----	-----	-----	31.25a
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	30.00ab
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	30.00ab
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	30.00ab
DeKalb non-RW Bt	-----	-----	-----	29.75ab
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	29.50ab
DeKalb Smartstax	-----	-----	-----	29.25ab
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	29.25ab
Mycogen non-RW Bt	-----	-----	-----	28.25 b

<sup>1</sup> Planted May 19, 2015; evaluated June 10 and September 25, 2015<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet<sup>4</sup> Furrow = Insecticide applied at planting time<sup>5</sup> Chemical and check means based on 24 observations (2 rows/ treatment x 17.5 row-ft/treatment x 6 replications x 2 evaluation dates)<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

**Table 46. Average lodging for Bt Rootworm Traits and Insecticides: Northeastern Iowa<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Lodging <sup>5,6</sup>
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	0
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	0
Mycogen-HXX	-----	-----	-----	0
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	1
Smartstax	-----	-----	-----	1
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	1
DeKalb VT3	-----	-----	-----	1
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	1
DeKalb non-RW Bt	-----	-----	-----	2
Mycogen non-RW Bt	-----	-----	-----	2

<sup>1</sup> Planted May 19, 2015; evaluated September 25, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = Insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 18 observations (2 rows/ treatment x 17.5 row-ft/treatment x 6 replications)

<sup>6</sup> No significant differences between means (ANOVA,  $P \leq 0.05$ )

**Table 47. Average yield for Bt Rootworm Traits and Insecticides: Northeastern Iowa<sup>1</sup>**

Treatment <sup>2</sup>	Form.	Rate <sup>3</sup>	Placement <sup>4</sup>	Bushels/ Acre <sup>5,6,7</sup>
DeKalb Smartstax	-----	-----	-----	240a
DeKalb Smartstax + Aztec	2.1G	0.14	Furrow	236ab
DeKalb non-RW Bt + Aztec	2.1G	0.14	Furrow	236ab
DeKalb VT3 + Aztec	2.1G	0.14	Furrow	235ab
DeKalb VT3	-----	-----	-----	231ab
DeKalb non-RW Bt	-----	-----	-----	229ab
Mycogen non-RW Bt + Aztec	2.1G	0.14	Furrow	219ab
Mycogen-HXX	-----	-----	-----	212 b
Mycogen-HXX + Aztec	2.1G	0.14	Furrow	209 b
Mycogen non-RW Bt	-----	-----	-----	185 c

<sup>1</sup> Planted May 19, 2015; machine harvested October 20, 2015

<sup>2</sup> non-RW Bt = an absence of any Bt trait targeting corn rootworm; DeKalb non-RW Bt = DeKalb brand RR (DKC 58-89); DeKalb VT3 = DeKalb brand YieldGard VT Triple (DKC 58-83); DeKalb Smartstax = DeKalb brand Smartstax (DKC 58-87); Mycogen non-RW Bt = Mycogen brand RR (Mycogen 2K591); Mycogen-HXX = Mycogen brand Herculex XTRA (Mycogen 2K592)

<sup>3</sup> Insecticide listed as ounces a.i. per 1,000 row-feet

<sup>4</sup> Furrow = insecticide applied at planting time

<sup>5</sup> Chemical and check means based on 6 observations (4-row treatment x 19 row-feet/treatment x 6 replications)

<sup>6</sup> Means sharing a common letter do not differ significantly according to Ryan's Q Test ( $P \leq 0.05$ )

<sup>7</sup> Yields converted to 15.5% Moisture

# APPENDIX I

## **Agronomic Information**

2015  
Field History Data

	Ames, IA-ISU Johnson Farm Corn Rootworm studies (following trap crop)	Boone, IA-ISU Bruner Farm Corn Rootworm studies (following continuous corn)
Insecticide History		
2014	Insecticide Test Plot	Corn (Trap crop)
2013	Insecticide Test Plot	Corn (Insecticide Test Plot)
2012	No Insecticide (trap crop)	Corn
2011	Insecticide Test Plot	Corn
Tillage	Fall 2014-disk ripper Spring 2015-field cultivation (2X)	Fall 2014-chopped stalks & disk ripper Spring 2015-field cultivation (2X)
Variety	Agrisure N68B-3111, Agrisure N68-GT, DeKalb DKC 58-83 RIB VT3, DeKalb DKC 58-89 VT2PRO, DeKalb DKC 62-97 VT3, DeKalb DKC 62-98 RR2, Pioneer P0533AM1, Pioneer P0533HR, Pioneer P1151 RR2	Agrisure N53W-3122, DeKalb DKC 58-83 VT3, DeKalb DKC 58-87 Smartstax, DeKalb DKC 58-89 VT2PRO, DeKalb DKC 62- 08 RIB Smartstax, DeKalb DKC 62-98 RR2, Mycogen 2K592 HXX, Pioneer P0533HR, Pioneer P0157AMX, Pioneer P1151 RR2,
Planting Date	May 1, 4, 18 & 19	May 21 & 22
Planting Rate	35,600 seeds/A	35,600 seeds/A
Herbicides <sup>1</sup>	26 oz. Harness + 3 oz Balance Flexx-April 17; 6 oz. Capreno + 1 pt. Atrazine 4L-June 5 0.6 oz. Cadet + 6 oz. Status-July 2	5.6 oz. Corvus-May 13 3 oz. Laudis + 26 oz. Roundup PowerMax-June 19
Fertilizer <sup>2</sup>	<u>N</u> <u>P</u> <u>K</u>	<u>N</u> <u>P</u> <u>K</u>
Preplant	200    ---    120	202    ---    ---
Dates		
Stand Count	May 28, 29, June 8. Sept. 22	June 8 & September 22
Root Digging	August 10 & 12	August 19
Lodging	September 22	September 22
Harvest	October 14	October 22
Soil Type	Clay loam & loam	Silty clay loam
Soil Organic Matter %	3.7	3.5
Soil pH	5.6	6.1

<sup>1</sup> Expressed as formulation per acre.

<sup>2</sup> Expressed as pounds per acre. Spring-preplant 200 lbs., 32% UAN applied on April 15 at ISU Johnson Farm (Ames); Spring-120 lbs. of K was applied in potash form. Spring-preplant 202 lbs., UAN applied on May 13 at ISU Bruner Farm (Boone);



2015  
Field History Data

	Crawfordsville, IA Corn Rootworm studies (following trap crop)	Nashua, IA Corn Rootworm studies (following trap crop)
Insecticide History		
2014	No Insecticide (trap crop)	No Insecticide (trap crop)
2013	Insecticide Test Plot	Insecticide Test Plot
2012	No Insecticide (trap crop)	No Insecticide (trap crop)
2011	Insecticide Test Plot	Insecticide Test Plot
Tillage	Fall 2014-chisel plow; Spring 2015-field cultivation	Fall 2014-chisel plow; Spring 2015-field cultivation
Variety	Agrisure N53W-3122, DeKalb DKC 58-83 VT3, DeKalb DKC 62-08 RIB VT2PRO, DeKalb DKC 62-98 RR2, Smartstax, DeKalb DKC 62-98 RR2, Mycogen 2K592 HXX, Pioneer P1151 RR2, Pioneer P0157AMX	Agrisure N53W-3122 RIB, Agrisure N53W-3000GT, Agrisure N53-W3 GT, DeKalb DKC 58-83 VT3, DeKalb DKC 58-87 Smartstax, DeKalb DKC 58-89 VT2PRO, Mycogen 2K591 RR2, Mycogen 2K592 HXX, Pioneer P0533AM1, Pioneer P0533HR
Planting Date(s)	May 13 & 19	April 29
Planting Rate	35,600 seeds/A	35,600 seeds/A
Herbicides <sup>1</sup>	1.5 lbs. Atrazine + 2 pts. TripleFlex + 32 oz. Roundup-May 22 3.6 pts. Halex GT-June 30	2.3 qts. Harness Extra-May 3 40 oz. Roundup Weathermax-June 9
Fertilizer <sup>2</sup>		
Preplant	<u>N</u> <u>P</u> <u>K</u> 36   92   120	<u>N</u> <u>P</u> <u>K</u> ----   ---   ---
Preplant	150   ---   ---	200   ---   ---
Dates		
Stand Count	May 28, June 4 & October 8	June 4 & September 24
Root Digging	July 21 & 22	August 3
Lodging	October 8	September 24
Harvest	October 8	October 16
Soil Type	Silty Clay Loam	Loam
Soil Organic Matter %	5.1	3.9
Soil pH	4.9	7.6

<sup>1</sup> Expressed as formulation per acre.

<sup>2</sup> Expressed as pounds per acre. Spring-Preplant 36-92-120 (36 lbs. N, 92 lbs. P, 120 lbs K) dry fertilizer was applied and 150 lbs. per acre actual nitrogen applied as anhydrous ammonia (82.5-0- 0) on April 17, 2015 at Crawfordsville. Spring-Preplant 200 lbs. per acre actual nitrogen applied as anhydrous ammonia (82.5-0- 0) on April 5 at Nashua.

2015  
Field History Data

Northeastern Iowa  
Corn Rootworm studies  
(following continuous corn)

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Field History	
2014	Corn-Agrisure 3000GT
2013	Corn-Agrisure 3111
2012	Corn-Agrisure 3000GT
2011	Corn
Tillage	Spring 2015-disking, Chisel plow, disking and finisher
Variety	DKC 58-83 VT3, DeKalb DKC 58-87 Smartstax, DeKalb DKC 58-89 VT2PRO, DeKalb Mycogen 2K591 RR2, Mycogen 2K592 HXX,
Planting Date(s)	May 19
Planting Rate	35,600 seeds/A
Herbicides <sup>1</sup>	13 oz. Verdict + 1 qt. Atrazine (May) 1 qt. Roundup WeatherMax + 2.5 oz. Status (July)
Fertilizer <sup>2</sup>	<u>N</u> <u>P</u> <u>K</u>
Preplant	200   35   120
Dates	
Stand Count	June 10 & September 25
Root Digging	August 5
Lodging	September 25
Harvest	October 20
Soil Type	Silt Loam
Soil Organic Matter %	2.5
Soil pH	7.1

<sup>1</sup> Expressed as formulation per acre.

<sup>2</sup> Spring-Preplant-120 lbs. dry nitrogen fertilizer was applied as Urea (broadcast) + 40 lbs.32% UAN applied with planter + 40 lbs. 28% UAN applied with sprayer. Spring-120 lbs. of K was applied in potash form. Spring-35 lbs. of Phosphorus applied.

## APPENDIX II

### **Weather Data**

Ames & Boone<sup>1</sup>  
2015 Rainfall and Temperature

Day	April			May			June		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	42	82	0.06	42	70	0.02	48	72	
2	48	65	0.62	48	71	0.11	53	71	
3	28	48		55	83		59	79	0.09
4	30	65		57	68	0.10	60	81	
5	44	72		57	74	0.44	64	85	
6	45	56	0.07	61	76		62	75	
7	41	51	0.09	62	76	0.16	65	83	0.53
8	41	51	0.16	53	67		60	86	
9	33	49	0.31	46	72		62	96	
10	35	55		56	68	0.25	68	88	
11	33	72		44	56		62	74	1.92
12	46	72	0.28	40	66		60	66	0.20
13	44	64		43	70		63	76	0.05
14	40	70		51	60	0.87	67	81	0.11
15	43	68		55	73		61	74	0.41
16	51	74		62	80	0.20	57	79	0.02
17	51	79		54	74	0.28	65	85	0.10
18	55	69	0.90	41	54		60	77	
19	46	64	0.42	37	56		59	80	
20	34	53		40	49	0.09	61	83	
21	33	54		39	76		63	85	
22	31	55		47	75		66	89	0.03
23	31	61		56	72		59	82	
24	44	56	0.32	58	69	0.79	61	71	2.92
25	42	51	0.17	61	78	0.17	66	80	0.05
26	37	61		59	70	0.82	63	74	0.02
27	39	66		55	82		60	84	
28	43	73		59	78		64	83	0.21
29	45	71		58	76		63	81	
30	46	71		53	61	0.01	64	80	
31				48	67				
Mean/Total	52.0	3.41		58.3	4.82		68.6	6.68	
Normal	50.8	3.72		61.6	4.81		70.7	4.96	
D.F.N.	1.2	-0.31		-3.3	0.01		-2.1	1.72	

<sup>1</sup>Weather station located 5 miles WSW of Ames at ISU AEA/Agronomy Farm.

Ames & Boone<sup>1</sup>  
2015 Rainfall and Temperature

Day	July			August			September		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	57	75		63	89		65	88	
2	54	70		68	89	0.02	68	87	1.29
3	55	80		60	81		68	90	
4	55	82		60	80		67	89	
5	60	85		64	78		70	91	
6	63	76	1.10	62	80		69	92	1.71
7	53	70		67	86		71	88	
8	52	72		68	84	0.02	63	80	
9	55	79		67	82	3.16	56	83	
10	59	80		63	81	0.03	58	82	
11	67	83	0.51	62	83		50	67	
12	71	91		62	84		45	71	
13	70	92		60	84		46	74	
14	69	88		67	87		54	82	
15	67	80	0.22	64	85		65	85	
16	69	85	1.03	64	86		62	87	
17	69	92		66	76	0.65	66	84	0.82
18	70	88		57	69	1.86	51	68	0.27
19	65	86		55	67		49	72	
20	62	84	0.11	50	79		47	74	
21	58	80		58	80		51	77	
22	61	78		61	80	0.41	64	82	0.04
23	61	83		52	71		65	71	0.09
24	66	86		49	72		63	77	
25	72	89		50	74		60	78	
26	68	88	0.24	52	76		55	80	
27	68	79	1.08	54	72	0.02	54	81	
28	70	78	1.65	61	68	1.89	55	87	0.17
29	63	82		61	72	0.01	47	71	0.69
30	60	85		58	75		41	65	
31	64	85		62	85				
Mean/Total	70.6	5.93		67.3	8.08		69.1	5.08	
Normal	74.0	4.83		72.0	4.82		64.8	3.25	
D.F.N.	-3.4	1.10		-4.7	3.26		4.3	1.83	

<sup>1</sup>Weather station located 5 miles WSW of Ames at ISU AEA/Agronomy Farm.

Ames & Boone<sup>1</sup>  
2015 Rainfall and Temperature

Day	October								
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	41	63							
2	38	64							
3	40	62							
4	38	55							
5	43	70							
6	54	72							
7	53	79							
8	54	79							
9	46	64							
10	39	73							
11	54	85							
12	52	71							
13	41	70							
14	39	70							
15	41	68							
16	37	53							
17	33	57							
18	32	64							
19	51	80							
20	53	71							
21	50	67	0.21						
22	46	60							
23	54	62	0.34						
24	41	59							
25	33	62							
26	37	61							
27	44	51	0.44						
28	35	49	0.03						
29	34	46							
30	29	54	0.10						
31									

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Mean/Total	53.7	1.12
Normal	52.5	2.56
D.F.N.	1.2	-1.44

<sup>1</sup> Weather station located 5 miles WSW of Ames at ISU AEA/Agronomy Farm.

Crawfordsville<sup>1</sup>  
2015 Rainfall and Temperature

Day	May			June			July		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	36	72		48	72		63	76	
2	48	77		52	75		57	74	
3	56	84		56	80		59	81	
4	60	79		60	86		55	82	
5	61	82		65	87		61	85	
6	59	85	0.40	58	80		66	87	0.90
7	63	83	0.15	67	86	0.50	59	74	
8	61	68	0.10	60	86		58	65	
9	52	75		60	93		57	81	
10	57	68		73	94		58	81	
11	50	67	0.70	69	81		67	85	1.60
12	47	67		68	78	1.40	68	90	
13	40	72		66	82		74	93	
14	53	62		69	85		69	88	
15	59	79	0.35	66	83	1.90	66	80	
16	62	82		62	81	0.55	67	83	1.10
17	63	80		59	81	0.34	71	93	0.70
18	46	68	0.30	65	80		75	90	
19	40	62		61	80		68	84	
20	40	52	0.15	57	87	0.65	65	84	0.10
21	37	74		65	85		60	82	
22	47	80		73	86		57	83	
23	51	81		62	81		60	83	
24	60	78	1.50	63	72		62	85	
25	64	80	0.20	66	82	3.20	72	90	0.25
26	63	75	0.60	62	73		72	86	
27	59	81		59	80		71	87	0.10
28	58	84		60	76		70	87	0.55
29	65	81	0.10	63	82	0.10	64	82	0.25
30	54	69		63	83	0.05	63	86	
31	47	70					62	86	
Mean/Total	62.4		4.55	72.2		10.00	71.8		5.55
Normal	63.0		5.14	71.6		7.44	74.7		3.11
D.F.N.	-0.6		-0.59	0.6		2.56	-2.9		2.44

<sup>1</sup> Weather station located at test site.

Crawfordsville<sup>1</sup>  
2015 Rainfall and Temperature

Day	August			September			October		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	59	87		69	90		40	66	
2	66	90		68	85		41	69	
3	59	81		68	93		40	66	
4	56	80		69	93		49	59	
5	62	82		70	93		53	64	
6	60	82		71	95		53	77	
7	66	88		70	89	0.60	55	82	
8	64	82		66	82	0.10	52	84	
9	68	81	2.35	60	85		40	64	
10	65	84		62	85		36	69	
11	61	82		47	72	0.20	50	85	
12	59	84		45	69		53	76	
13	60	85		43	75		44	67	
14	67	87	0.60	55	88		39	68	
15	65	88		63	88		40	73	
16	67	87		61	90		33	56	
17	68	88	0.30	69	93		25	58	
18	65	81	0.90	60	75	0.30	31	64	
19	56	68		47	73	1.80	49	79	
20	55	77		44	77		58	73	
21	58	82		45	80		54	78	0.15
22	61	79		55	86		51	70	
23	53	74	0.30	57	87		54	66	
24	52	73		59	88		39	66	0.35
25	51	74		54	82		33	64	
26	48	79		54	83		36	63	
27	52	74		54	81		39	53	
28	57	72		59	85		36	52	1.45
29	63	77		47	68	0.10	33	51	
30	62	83		42	67		28	54	
31	61	88							
Mean/Total	68.3	4.45		70.5	3.10		55.0	1.95	
Normal	73.0	4.66		64.9	3.47		52.7	2.94	
D.F.N.	-4.7	-0.21		5.6	-0.37		2.3	-0.99	

<sup>1</sup> Weather station located at test site.



Nashua<sup>1</sup>  
2015 Rainfall and Temperature

Day	April			May			June		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	38	80		37	66		42	72	
2	45	65	0.39	47	78		50	75	
3	23	45		56	84		57	82	0.02
4	22	61		56	69	0.57	57	82	
5	32	68		52	58	0.25	60	82	
6	34	60		54	77	0.07	58	79	
7	38	47	0.60	61	79	T	62	83	0.23
8	39	49	0.65	54	64		60	83	
9	32	47	1.01	49	70		56	97	
10	33	50		56	64	0.06	66	86	
11	32	68		42	61		60	69	0.66
12	47	69	0.01	41	61		58	67	0.01
13	35	63		41	69		61	76	0.03
14	30	70		49	57	0.29	60	84	
15	41	69		57	73		56	73	0.65
16	49	73	T	59	81	0.06	51	78	
17	44	80		54	77	0.01	63	78	
18	51	80	0.40	38	54	0.01	57	78	
19	44	66	0.85	38	55		57	80	
20	34	47	T	39	49	0.01	60	80	0.34
21	33	46		37	76		60	85	
22	28	50		40	75		64	84	1.30
23	24	56		52	78	T	55	77	
24	37	47	0.42	58	65	0.38	55	76	T
25	36	53		61	79	0.08	64	82	0.05
26	28	61		58	68	1.39	59	74	1.94
27	31	67		56	82		54	81	
28	35	74		59	82		60	78	0.55
29	41	70		62	78	0.21	58	81	
30	35	68		49	62	0.03	56	78	
31				45	66				
Mean/Total	48.7	4.33		58.3	3.50		68.6	5.78	
Normal	47.7	3.81		59.5	4.41		68.9	5.33	
D.F.N.	1.0	0.52		-1.2	-0.91		-0.3	0.45	

<sup>1</sup>Weather station located at test site.

Nashua<sup>1</sup>  
2015 Rainfall and Temperature

Day	July			August			September		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	51	67	T	55	87		66	87	
2	48	73		63	89		68	87	0.04
3	50	78		53	80		64	91	
4	54	80		51	80		66	90	
5	59	84		50	79		70	90	
6	58	78	0.91	55	81		68	92	0.82
7	51	68		63	85		69	84	
8	47	72		60	80	0.01	57	79	0.32
9	49	78		64	81	0.04	48	81	
10	56	83		59	82		51	77	0.54
11	63	80		56	82		45	66	
12	66	86		54	84		41	70	
13	69	91		61	87		40	74	
14	64	84		67	91		53	84	
15	61	76		61	89		61	86	
16	64	80	0.27	65	86		65	87	
17	67	93	0.55	66	78	0.08	63	78	0.43
18	67	88	0.01	59	68	0.40	52	70	0.11
19	58	83		54	71	0.97	43	71	
20	59	82	0.24	49	76	0.03	40	74	
21	54	81		54	81		47	78	
22	53	83		60	79		54	86	
23	54	84		50	73	0.50	60	83	
24	63	85	0.71	47	69		60	81	
25	65	89		46	73		59	76	
26	66	84	0.45	43	78		52	82	
27	68	83		47	76		53	83	
28	70	84	0.86	58	63	2.60	58	86	0.35
29	61	82		56	76		41	69	
30	56	86		52	74		39	65	
31	59	82		57	86				
Mean/Total	68.3		4.00	65.4		4.63	67.7		2.61
Normal	72.0		4.65	69.6		4.35	61.9		2.79
D.F.N.	-3.7		-0.65	-4.2		0.28	5.8		-0.18

<sup>1</sup>Weather station located at test site.

Nashua<sup>1</sup>  
2015 Rainfall and Temperature

Day	October								
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	37	63							
2	38	64							
3	39	63							
4	39	52							
5	38	71							
6	43	75							
7	46	74							
8	53	77							
9	37	64							
10	33	72							
11	48	85							
12	48	69							
13	38	66							
14	30	71							
15	39	64							
16	26	49							
17	20	57							
18	34	62							
19	49	79							
20	51	73							
21	37	67							
22	31	63							
23	51	61	0.22						
24	35	60							
25	29	62							
26	38	63							
27	45	53	0.98						
28	34	49							
29	35	48							
30	41	54							
31	42	50	0.04						

Mean/Total	51.5	1.61
Normal	49.3	2.50
D.F.N.	2.2	-0.89

<sup>1</sup> Weather station located at test site.

Northeastern Iowa<sup>1</sup> location  
2015 Rainfall and Temperature

Day	May			June			July		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	31	63		36	65		50	76	
2	36	66		40	68		44	68	0.001
3	45	77		45	73		47	72	
4	55	80	0.55	53	77	0.001	49	75	
5	51	71	0.13	59	81		53	80	
6	51	55	0.12	49	79		57	81	
7	53	78	0.05	54	77	0.31	56	79	
8	58	79	0.07	54	82	0.001	45	69	0.11
9	53	63		52	79		48	70	
10	54	67		56	92		50	77	
11	53	63	0.14	60	85	0.10	54	81	
12	41	54	0.001	58	64	1.71	61	76	
13	33	57		57	64		64	82	0.43
14	39	65		59	73		64	90	0.40
15	48	61	0.28	61	83		58	82	
16	58	73	0.01	50	75		61	74	0.001
17	60	79	0.18	56	77	0.001	62	74	0.09
18	47	77	0.07	59	76	0.001	70	91	0.001
19	38	52		54	78		61	88	0.001
20	40	55		53	77		58	79	
21	37	47	0.23	55	67	0.18	53	83	0.05
22	35	73		59	83	0.05	51	79	
23	41	74		51	81	0.95	53	81	
24	48	78	0.02	52	77		55	82	
25	56	66	0.82	56	75	0.09	64	82	0.26
26	56	79	0.15	56	79		63	86	
27	55	69	0.69	54	73	0.02	63	79	1.12
28	52	78		54	80	0.10	66	83	
29	56	81	0.02	56	72	0.19	64	82	0.82
30	59	79	0.20	56	80	0.32	56	81	
31	40	60	0.02				59	84	
Mean/Total	56.5	3.75		65.1	4.02		66.1	3.28	
Normal	58.2	4.40		67.8	5.58		72.0	4.24	
D.F.N.	-1.7	-0.65		-2.7	-1.56		-5.9	-0.96	

<sup>1</sup> Weather station located approximately 15 miles northwest of field location

Northeastern Iowa<sup>1</sup> location  
2015 Rainfall and Temperature

Day	August			September			October		
	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches	Temp (°F)		Rainfall Inches
	Low	High		Low	High		Low	High	
1	54	80		53	84		34	62	
2	57	84		63	87		33	61	
3	54	88		66	83		34	62	
4	49	77		67	90		35	60	
5	48	78		69	89	0.03	46	54	
6	50	79		69	87		42	65	
7	55	81		68	90	0.19	43	74	
8	58	83	0.05	69	80	0.02	43	72	
9	60	75	0.001	50	77		50	76	
10	62	77	0.16	50	79	0.35	33	62	
11	54	82		49	75	0.88	36	67	
12	50	80		43	65		52	82	
13	52	81		38	66		44	62	
14	59	83	0.04	39	71		30	60	
15	63	87		54	81		30	66	
16	60	87		62	83	0.001	32	65	
17	62	87		63	85		20	49	
18	64	78	0.06	60	73	0.44	20	55	
19	56	69	0.62	49	72	0.50	27	61	
20	52	66	0.06	38	68		50	77	
21	49	73		39	72		49	73	
22	51	81		41	75		33	66	
23	54	78	0.16	53	80		32	62	
24	48	70		54	82		52	62	0.53
25	47	68		56	79		29	54	T
26	42	72		47	75		29	61	
27	42	75		47	77		31	62	
28	46	75		50	79		36	54	1.77
29	60	63	2.97	52	82	1.50	35	50	0.02
30	53	69	0.01	36	67	0.04	37	48	0.01
31	52	74					41	48	0.28
Mean/Total	63.4	4.13		65.8	3.95		48.0	2.61	
Normal	70.1	4.38		61.2	3.18		49.5	2.59	
D.F.N.	-6.7	-0.25		4.6	0.77		-1.5	0.02	

<sup>1</sup> Weather station located approximately 15 miles northwest of field location

## APPENDIX III

### **Materials Tested**

Table 1. Conventional Insecticides used in studies in 2015

<b>Product name</b>	<b>Rate (ounces a.i. per 1000 row-feet)</b>	<b>Active ingredient</b>	<b>Company</b>
Ampex 1.73SC	0.20	clothianidin	Valent Corporation
Aztec 2.1G	0.14	tebupirimphos & cyfluthrin	AMVAC Chem. Corp.
Aztec-SB 4.67G	0.14	tebupirimphos & cyfluthrin	AMVAC Chem. Corp.
Capture 3RIVE 3D 1.6SC	0.10	bifenthrin	FMC Corporation
Capture LFR 1.5SC	0.10	bifenthrin	FMC Corporation
Ethos LFR 2.0SC	0.149	bifenthrin	FMC Corporation
Ethos XB 1.5SC	0.10	bifenthrin	FMC Corporation
Force 3G	0.12	tefluthrin	Syngenta
Force 250CS	0.12 & 0.14	tefluthrin	Syngenta
Precept 3G	0.13	tefluthrin	Monsanto

Table 2. Rootworm active Bt Traits

<b>Product name</b>	<b>Event</b>	<b>Toxin</b>	<b>Company</b>
Agrisure 3000GT Agrisure 3111	MIR604	mCry3A	Syngenta
Agrisure 3122	DAS-59122-7 + MIR604	Cry34/35Ab1 + mCry3A	Syngenta
Agrisure 5122	MIR604 + 5307	mCry3A + eCry3.1Ab	Syngenta
Herculex	DAS-59122-7	Cry34/35Ab1	Pioneer & Dow AgroSciences
Pioneer AMX	DAS-59122-7	Cry34/35Ab1	DuPont-Pioneer
Pioneer OAM1	DAS-59122-7	Cry34/35Ab1	DuPont-Pioneer
Smartstax	DAS-59122-7 + MON 88017	Cry34/35Ab1 + Cry3Bb1	Dow AgroSciences & Monsanto
VT Triple	MON 88017	Cry3Bb1	Monsanto

## APPENDIX IV

### **Research Pictures**





Artificial infestation of WCR eggs in corn plots at the ISU Johnson farm location



Seed packets filled, randomization completed and ready for planting at field locations throughout Iowa



Planting corn plots at the ISU Johnson farm location.



Summer undergraduate technical assistant hoeing out corn plants in the alleys of plots