

INDIANA

CORN INSECTICIDE EVALUATIONS

2010

PURDUE
UNIVERSITY

Department of Entomology
Purdue University

Department of Entomology
Purdue University
West Lafayette, IN 47907-2089

Principle Investigators

Christian Krupke

Nick Seiter

Larry Bledsoe

Graduate Students

Alexzandra Murphy

Nicole Parker

Madeline Spigler

Vianney Willot

Technical Assistants

Amanda King

Caitlin Race

Jared Oswald

Steven Smith

Christina Short

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Introduction

Weather and Selected Field Crop Pests during 2010

This weather narrative was summarized from personal observations (LWB) and Indiana State Climate Office Monthly Weather Reports (Ken Scheeringa).

The year 2010 began with a continuation of deep cold that began in late December 2009. A thaw that occurred at mid January was interrupted by intrusion of very cold air through the end of the month. Although January had many snowy days, it averaged slightly drier than normal. February was persistently very cold with frequent light snows except for separate severe storms that affected opposite ends of the state and brought periods of deep snow. March turned markedly warmer with average precipitation. Although precipitation was generally average statewide, the southern counties tended to be drier than normal. April began abnormally warm which when combined with relative dry soils resulted in rapidly warming soil temps. This led to a rapid start to the planting season and marked the beginning of elevated temperatures that would persist throughout the summer and fall, and ultimately result in many counties imposing open fire restrictions. Widespread light precipitation in early May briefly interrupted the end of corn and soybean planting. Summer conditions arrived in late May and early June with temperatures much above normal and the appearance of frequent severe storms that produce a wetter than normal June. July was warmer than normal and except for increased precipitation in the northwest and southwest counties, the remainder of the state had about normal rainfall monthly average rainfall. Elevated temperatures coupled with low humidity in August accelerated the trend of abnormal warmth and wild fire danger. Late summer marked the beginning of deepening regional drought conditions. Very warm and dry conditions persisted into September and October resulting in many field and grass fires. Harvest proceeded at an accelerated, record-setting pace. Early winter brought an end to the drought as wide-spread rain began to fall at the end of November. A dramatic shift in temperature began in early December as very cold conditions and frequent snow replaced the persistent warmth and drought of the last half of the year.

Field Crop Pests

Anecdotal and empirical observations again pointed to lower than expected numbers of western corn rootworm, *Diabrotica virgifera*. Similar to the situation in 2009, the regional use of rootworm

resistant corn coupled with the general prevalence of saturated soils in late May and early may be associated with the reduced levels of infestation noted state-wide. Late stage first instars were first detected in Tippecanoe County on 1 June. This is one day later than the 28-year average. Adult rootworm beetles were first captured in sweet corn on 22 June. Adults continued to emerge until about the first week of August, or about 3 weeks earlier than normal. This was a departure from the pattern of very late adult emergence in 2009. The rapid completion of larval development and pupation may be related to the elevated temperatures observed during most of the growing season.

As in preceding years, the near uniform use of highly resistant, transgenic corn hybrids resulted in a dramatic reduction of European corn borer, *Ostrinia nubilalis*, in commercial field corn. However, this insect continues to be an important pest of home gardens and commercial vegetable production.

Economic infestations of soybean aphid, *Aphis glycines*, (SBA) were uncommon. The favorable planting conditions in late April and early April resulted in the generally early planting of soybeans and the subsequent appearance of plant growth stages (R4-R6) that were later than the critical period of SBA infestation (R1-R3) when dispersal flights began in mid July.

As was the situation last year, Japanese beetle, *Popillia japonica*, adult and larval injury to field crops was very localized and the overall impact was minimal. Incidence of economically important populations in horticultural settings was highly variable and localized. The statewide number of complaints of Japanese beetle infestations in row crops has been declining during the past few years.

Large numbers of migrating corn earworm, *Helicoverpa zea*, (CEW) adults were observed abnormally early in the season following strong storms in the spring. This led to early season, economically-important infestations of sweet corn. However, only light infestations were reported in mid and late season field corn and vegetable production.

Western bean cutworm *Striacosta albicosta*, (WBCW) activity was elevated as it continued to expand its range to most include most of the counties in the northern one-third of the state and is becoming a pest of concern.

Alfalfa weevil, *Hypera postica*, injury to alfalfa was light. Excessive moisture in late winter/early spring likely enhanced pathogenic fungi that infect these insects.

Asiatic garden beetle larvae, *Maladera castanea*, were found to be damaging corn roots in very localized areas within fields primarily with sandy soils in across northern counties.

Bean leaf beetle, *Cerotoma trifurcata*, and corn flea beetle, *Chaetochema pulicaria*, numbers were generally low statewide. This was probably due to high mortality of the over-wintering adults caused by persistent very low temperatures in early to mid winter.

The brown marmorated stink bug, *Halyomorpha halys*, a exotic pest of field (and fruit and vegetable) crops, was first detected in Indiana in the fall of 2010 in 3 counties. This insect has the potential of becoming economically important in Indiana.

Slugs (probably the grey garden slug, *Deroceras reticulatum*) tended to be abundant during the early wet season in high residue fields throughout Indiana. Once the weather became warmer and drier at mid season this pest was insignificant.

EVALUATION OF INSECTICIDES USED TO CONTROL CORN ROOTWORM LARVAE

Introduction and Objective:

The western corn rootworm (WCR), *Diabrotica virgifera virgifera* is a very destructive corn pest in Indiana. The northern corn rootworm, *D. barberi*, and the southern corn rootworm, *D. undecimpunctata howardi* also occur in Indiana, but are not considered important pests there. Although rootworm adults can be damaging to above-ground portions of corn, larval damage to roots is most economically important. Test results included in this report compare efficacy of experimental and registered products and application technologies used to manage larvae. The overall goal of this report is to provide public information that would facilitate the most economically efficient, environmental safe, and practical options to manage WCR larval damage to corn.

Methods:

The trial locations were Throckmorton-Purdue Agricultural Center, Lafayette, IN and the Pinney-Purdue Agricultural Center, Wanatah, IN. The trial areas were late-planted to corn (relative to surrounding corn) in 2009 to increase the probability of root damage by subsequent larvae in 2010. The experiments were a randomized complete block design with four replications. The experimental unit or plot was a single row 100 feet in length. Planting was with a John Deere® MaxEmerge model 7000 planter at a speed of 3 mph. Corn was planted in 30-inch wide rows at 27,700 kernels/acre.

Granular insecticides were applied through specially modified, bench-calibrated Noble® metering units as T-band or as in-furrow treatments. Fortress 5G Counter 20G and Smartchoice 5G were applied using an AMVAC SmartBox® applicator that had been modified to hold 1 pound of formulated product. Granular T-band applications were placed in front of the furrow-closure wheels using 4-inch skirted all terrain, plastic diffusers. The band coverage pattern was approximately five inches wide over an open furrow. In-furrow treatments were directed into the open furrow using 3/4-inch ID Tygon® tubing.

Liquid formulations were applied with CO2 propellant at 5 gpa using a TeeJet 80015 nozzle at 11 psi. Liquid T-band treatments had a coverage pattern of approximately five inches wide over an open furrow. Liquid formulations were agitated immediately prior to each application. Seed treatments and transgenic hybrids were planted using a modified seeder constructed from a standard John Deere finger pickup seed meter attached to a planter unit adapter frame and attached to a JD MaxEmerge 7000. The seeder was modified to contain and dispense about 4 ounces of seed.

All treatments were incorporated by a gang of five straight 5/16-inch diameter steel drag chains about eight inches long attached behind each furrow closure wheel.

Evaluation Procedures

Phytotoxicity:

Plant stand establishment was assessed to determine whether any of the insecticide treatments caused significant plant population reductions and to determine the occurrence and impact of additional insect pests. The number of healthy plants per 40 feet was recorded from each plot (4 replicates). In addition to stand counts, extended leaf heights of 10 randomly selected corn plants were measured and averaged for each replicate. This was an estimate of seedling vigor.

Larval Damage:

Five root systems were sampled and damage scores averaged from each plot (4 replicates). Each root system was washed and assigned a root damage rating.

Roots were rated using the node injury scale (Oleson et al. 2005. J. Econ. Entomol. 98:1) which had been slightly modified. The modification was that roots were declared pruned at 1.5 inches from the stalk instead of 2 inches.

Damage Rating

Description

- | | |
|------|---|
| 0.00 | No feeding damage (lowest rating that can be given). |
| 1.00 | One node of roots, or the equivalent of an entire node, eaten back to within approximately 1.5 inches of the stalk (soil line on the 7th node). |
| 2.00 | Two nodes eaten. |
| 3.00 | Three or more nodes eaten. (highest rating) |

Damage between complete nodes is the estimated percentage of the node missing, i.e. 1.50 = 1 1/2 nodes eaten, 0.25 = 1/4 of one node eaten, etc.

Plant Lodging:

Number of plants leaning greater than 45 degrees from vertical beginning below the ear (stalk lodging) per 25 consecutive plants were counted for each plot.

Consistency of Performance:

The proportion of roots (n=5) that were rated less than or equal to 0.25 on the node injury scale was calculated per replicate. The replicates (n=4) were averaged for each test entry to provide a measure of the frequency of root ratings at or below the conventional values of the economic injury level. The arcsine square root transformation was used to adjust the variances prior to mean separation. The means of the angles were back-transformed to the original units.

Analyses:

Ryan, Einot, Gabriel, Welsh Q multiple stage test ($\alpha=0.05$) was used to separate treatment means only where significant ANOVA F test occurred ($P \leq 0.05$). The ANOVA and mean separations for the consistency data (proportion of roots at or below 0.25 rating) were performed on transformed (weighted) data using the arcsine square root function. The original and back transformed test means and original replicate means are shown.

Weather Data:

Weather data are from the Throckmorton and Pinney Purdue Agricultural Automated Weather Stations located at the test site (Appendix I). These data include precipitation, daily maximum and minimum air and soil temperatures from April-October.

Discussion and Results:

These trials were planted at near normal timing. Seed germination was rapid. General weather conditions for the growing season were warm and dry early, follow by a short period of cool, damp conditions before changing to hot and very dry in mid to late summer. Western corn rootworm beetle egg hatch commenced about 1 June in at the Throckmorton site. Larval and adult abundance was generally below average for the entire season at the Throckmorton site and relatively high at the Pinney site.

At the Throckmorton site only the Poncho seed treatment resulted in fewer plants ($P=0.05$) than the control. At Pinney the DEKALB DKC61-19 hybrid had fewer plants than the control and was not different from Smartchoice, Mycogen 2T784, and Pioneer 33W84 ($P=0.05$).

There were no differences ($P=0.05$) among treatments for plant vigor measurements (stand/extended leaf height) at Throckmorton and Pinney.

Root node injury was light at Throckmorton and there were no differences among treatments. At Pinney, root damage in all treatments was significantly less than for the control. Damage in Mycogen 2T784, and DEKALB DKC61-19 was significantly lower ($P=0.05$)

than for Mycogen 2T777 treated with Lorsban 15G applied in a T-band at 4.0 oz product per 1000ft.

The consistency of performance (proportion of plants with 0.25 or less of root whorl pruned) was highly variable at Throckmorton and no treatment differences ($P=0.05$) were detected. At Pinney, all treatments were consistently less damaged than the control. DEKALB DKC61-19, Mycogen 2T784 and Aztec 4.67G applied in-furrow at 3 oz product per 1000ft, Aztec 2.1G applied in both T-Band and in-furrow placements at 6.7 oz product per 1000ft tended to be consistently less damaged than the remaining treatments.

Stalk lodging was so infrequent at both locations that treatment mean separation ($P=0.05$) did not occur.

Protocol name: Purdue University Corn Rootworm Standard Efficacy
Trial Site 1

Researchers: Dr. Christian Krupke, Nick Seiter, Larry Bledsoe
Department of Entomology, Purdue University, West
Lafayette, IN

Location: Throckmorton-Purdue Agricultural Center, Lafayette, IN

Planting date: 29 April 2010

Planting population: 27,700 kernels/acre

Maize hybrids: Mycogen 2T777 (control):
Smartstax Mycogen 2T784
Herculex XTRA Pioneer 33W84
Yieldguard VT3 DEKALB DKC61-19

Soil type/properties:

Mellott silt loam

Organic matter: 2.5%

pH: 5.9

CEC: 13.5

Texture: silt loam (21.6% sand, 62.8% silt, 15.6% clay)

Tillage: Chisel tillage tool

Conditions at planting: Avg. air temp. 50°F
Avg. soil temp. 56°F
Avg. wind speed 3 mph (gust 11 mph)

Previous crop: late-planted maize (trap crop for *Diabrotica*)

Herbicides: 21 April 2010, Degree XTRA 3.5 qts/a

Fertilizers: 21 April 2010: 50 gpa 28-0-0 (urea), 29 April 2010,
113 lbs/a 12-12-12 starter

Row width: 30"

Methods:

The design was randomized complete blocks with 4 reps and single row, 100 ft plots, Field test was installed using John Deere Max-emerge 7000 planter. Banded granules were applied in a T-Band using a modified Noble meter with plastic all terrain, 4 inch diffuser over an open furrow. In-furrow granule applications were applied

with a modified Noble meter or the AMVAC SmartBox® system (where noted) using 0.75 inch diameter plastic tubing (Tygon®) directed to the center of the open furrow ahead of the furrow-closing presswheels. Liquid treatments were applied at 5 gpa using a TeeJet 80015E nozzle at 11 psi over an open furrow ahead of the furrow-closing presswheels. All planting and chemical applications were made at 3 mph. Stand counts were estimated as the number of plants per 40ft. Extended leaf heights were the average length of 10 consecutive plants per plot measured from the ground to the tip of the longest extended leaf to the nearest 0.5 centimeter. Root injury was the average of 6 roots per plot dug, washed, and rated using the node injury 0-3 scale. Data were subjected to analysis of variance procedures and, where appropriate, mean separation was Ryan, Einot, Gabriel, Welsch MRT (P=0.05) SAS.

Table 1. **Stand counts** for experimental and registered soil insecticides for control of corn rootworm larvae at Throckmorton-Purdue Agricultural Center, Lafayette, IN, 2010¹.

Treatment, Place ²	Oz Product /1000 ft	Plants per 40 ft	
		Mean ³	SEM
01 Aztec 2.1G, TB	6.70	65.00 a	0.408
02 Aztec 2.1G, IF	6.70	62.75 a	1.181
03 Force 3G, TB	4.00	62.25 a	1.797
04 Force 3G, IF	4.00	65.50 a	1.658
05 Lorsban 15G, TB	8.00	63.75 a	1.750
06 Lorsban 15G, IF	8.00	65.00 a	0.707
07 Capture LFR, IF	0.49	63.25 a	1.109
08 Poncho 1.25 mg/seed ST	n/a	42.75 b	1.548
09 Aztec 4.67 G, SB IF	3.00	64.00 a	1.225
10 SmartChoice 5G, SB, IF	3.50	63.67 a	2.028
11 Counter 20G, SB, IF	4.50	62.25 a	1.436
12 Mycogen 2T784 Smartstax	n/a	61.50 a	1.323
13 Pioneer 33W84 Herculex XTRA	n/a	63.25 a	0.629
14 DEKALB DKC61-19 YieldGard VT3	n/a	64.00 a	0.913
15 Mycogen 2T777 (control)	n/a	63.00 a	2.273

Replicate Means

Treatment, Place ²	Oz Product 1000 ft	Plants per 40 ft			
		Rep1	Rep2	Rep3	Rep4
01 Aztec 2.1G, TB	6.70	66	65	64	65
02 Aztec 2.1G, IF	6.70	61	63	66	61
03 Force 3G, TB	4.00	64	57	63	65
04 Force 3G, IF	4.00	68	61	68	65
05 Lorsban 15G, TB	8.00	65	68	62	60
06 Lorsban 15G, IF	8.00	67	65	64	64
07 Capture LFR, IF	0.49	65	64	64	60
08 Poncho 1.25 mg/seed ST	n/a	40	43	41	47
09 Aztec 4.67 G, SB IF	3.00	61	66	66	63
10 SmartChoice 5G, SB, IF	3.50	67	64	60	nd
11 Counter 20G, SB, IF	4.50	59	62	62	66
12 Mycogen 2T784 Smartstax	n/a	64	61	58	63
13 Pioneer 33W84 Herculex XTRA	n/a	63	62	63	65
14 DEKALB DKC61-19 YieldGard VT3	n/a	66	63	65	62
15 Mycogen 2T777 (control)	n/a	62	63	69	58

¹Planted, 29 April 2010; Sampled, 25 May 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.0001). Ryan, Einot, Gabriel, Welsch Q MRT ($\alpha = 0.05$)
nd=no data

Table 2. **Plant Height (vigor)** for experimental and registered soil insecticides for control of corn rootworm larvae at Throckmorton-Purdue Agricultural Center, Lafayette, IN, 2010¹.

Treatment, Place ²	Oz Product /1000 ft	Plant Height (cm)	
		Mean ³	SEM
01 Aztec 2.1G, TB	6.70	22.30 a	0.614
02 Aztec 2.1G, IF	6.70	22.35 a	0.506
03 Force 3G, TB	4.00	21.35 a	0.425
04 Force 3G, IF	4.00	21.28 a	0.805
05 Lorsban 15G, TB	8.00	21.99 a	0.375
06 Lorsban 15G, IF	8.00	21.02 a	0.561
07 Capture LFR, IF	0.49	22.15 a	0.625
08 Poncho 1.25 mg/seed, ST	n/a	20.88 a	0.302
09 Aztec 4.67 G, SB, IF	3.00	22.06 a	0.357
10 SmartChoice 5G, SB, IF	3.50	21.80 a	0.333
11 Counter 20G, SB, IF	4.50	22.24 a	0.351
12 Mycogen 2T784 Smartstax	n/a	21.74 a	0.159
13 Pioneer 33W84 Herculex XTRA	n/a	23.41 a	0.698
14 DEKALB DKC61-19 YieldGard VT3	n/a	21.56 a	0.350
15 Mycogen 2T777 (control)	n/a	22.89 a	0.361

Replicate Means

Treatment, Place ²	Oz Product 1000 ft	Plant Height (cm)			
		Rep1	Rep2	Rep3	Rep4
01 Aztec 2.1G, TB	6.70	23.75	21.80	22.75	20.90
02 Aztec 2.1G, IF	6.70	22.40	23.75	21.45	21.80
03 Force 3G, TB	4.00	20.10	21.80	21.95	21.55
04 Force 3G, IF	4.00	23.50	21.20	20.70	19.70
05 Lorsban 15G, TB	8.00	21.25	23.00	21.65	22.05
06 Lorsban 15G, IF	8.00	19.70	20.75	21.25	22.40
07 Capture LFR, IF	0.49	23.90	21.60	21.00	22.10
08 Poncho 1.25 mg/seed, ST	n/a	21.50	21.25	20.55	20.20
09 Aztec 4.67 G, SB, IF	3.00	22.45	22.30	22.50	21.00
10 SmartChoice 5G, SB, IF	3.50	22.40	21.25	21.75	nd
11 Counter 20G, SB, IF	4.50	22.75	22.10	22.80	21.30
12 Mycogen 2T784 Smartstax	n/a	21.85	22.10	21.35	21.65
13 Pioneer 33W84 Herculex XTRA	n/a	25.50	22.85	22.60	22.70
14 DEKALB DKC61-19 YieldGard VT3	n/a	20.65	22.30	21.45	21.85
15 Mycogen 2T777 (control)	n/a	23.50	22.60	23.45	22.00

¹Planted, 29 April 2010; Sampled, 25 May 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.0313)

nd=no data

Table 3. **Root node injury ratings** for experimental and registered soil insecticides for control of corn rootworm larvae at Throckmorton-Purdue Agricultural Center, Lafayette, IN, 2010¹.

Treatment, Place ²	Oz Product	Node ³	SEM
	/1000 ft	Injury	
01 Aztec 2.1G, TB	6.70	0.165 a	0.0884
02 Aztec 2.1G, IF	6.70	0.090 a	0.0158
03 Force 3G, TB	4.00	0.128 a	0.0614
04 Force 3G, IF	4.00	0.092 a	0.0111
05 Lorsban 15G, TB	8.00	0.210 a	0.1155
06 Lorsban 15G, IF	8.00	0.085 a	0.0171
07 Capture LFR, IF	0.49	0.295 a	0.1173
08 Poncho 1.25 mg/seed ST	n/a	0.072 a	0.0149
09 Aztec 4.67 G, SB IF	3.00	0.102 a	0.0111
10 SmartChoice 5G, SB, IF	3.50	0.093 a	0.0067
11 Counter 20G, SB, IF	4.50	0.082 a	0.0103
12 Mycogen 2T784 Smartstax	n/a	0.075 a	0.0087
13 Pioneer 33W84 Herculex XTRA	n/a	0.077 a	0.0125
14 DEKALB DKC61-19 YieldGard VT3	n/a	0.035 a	0.0086
15 Mycogen 2T777 (control)	n/a	0.622 a	0.3644

Replicate Means

Treatment, Place ²	Oz Product /1000 ft	Node Injury			
		R1	R2	R3	R4
01 Aztec 2.1G, TB	6.70	0.43	0.07	0.08	0.08
02 Aztec 2.1G, IF	6.70	0.06	0.13	0.07	0.10
03 Force 3G, TB	4.00	0.06	0.05	0.31	0.09
04 Force 3G, IF	4.00	0.10	0.10	0.06	0.11
05 Lorsban 15G, TB	8.00	0.04	0.15	0.55	0.10
06 Lorsban 15G, IF	8.00	0.07	0.05	0.09	0.13
07 Capture LFR, IF	0.49	0.09	0.41	0.11	0.57
08 Poncho 1.25 mg/seed ST	n/a	0.04	0.11	0.08	0.06
09 Aztec 4.67 G, SB IF	3.00	0.08	0.09	0.13	0.11
10 SmartChoice 5G, SB, IF	3.50	0.08	0.10	0.10	nd
11 Counter 20G, SB, IF	4.50	0.07	0.10	0.10	0.06
12 Mycogen 2T784 Smartstax	n/a	0.08	0.08	0.05	0.09
13 Pioneer 33W84 Herculex XTRA	n/a	0.08	0.07	0.05	0.11
14 DEKALB DKC61-19 YieldGard VT3	n/a	0.01	0.04	0.04	0.05
15 Mycogen 2T777 (control)	n/a	0.07	0.63	0.14	1.65

¹Planted, 29 April 2010; Sampled, 13 July 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.0696.

nd=no data

Table 4. **Root ratings consistency of performance** for experimental and registered insecticides for control of corn rootworm larvae at Throckmorton-Purdue Agricultural Center, Lafayette, IN, 2010¹.

Treatment/Place ²	Oz Product /1000 ft	Percentage Rating \leq 0.25	
		Raw	Means Weighed ³
01 Aztec 2.1G, TB	6.70	90	97.10 a
02 Aztec 2.1G, IF	6.70	100	100.00 a
03 Force 3G, TB	4.00	90	97.10 a
04 Force 3G, IF	4.00	100	100.00 a
05 Lorsban 15G, TB	8.00	85	95.17 a
06 Lorsban 15G, IF	8.00	100	100.00 a
07 Capture LFR, IF	0.49	70	81.62 a
08 Poncho 1.25 mg/seed ST	n/a	100	100.00 a
09 Aztec 4.67 G, SB IF	3.00	100	100.00 a
10 SmartChoice 5G, SB, IF	3.50	100	100.00 a
11 Counter 20G, SB, IF	4.50	100	100.00 a
12 Mycogen 2T784 Smartstax	n/a	100	100.00 a
13 Pioneer 33W84 Herculex XTRA	n/a	100	100.00 a
14 DEKALB DKC61-19 YieldGard VT3	n/a	100	100.00 a
15 Mycogen 2T777 (control)	n/a	60	66.79 a

Replicate Means

Treatment, Place ²	Oz Product /1000 ft	Percentage Rating \leq 0.25			
		Raw Means			
		Rep1	Rep2	Rep3	Rep4
01 Aztec 2.1G, TB	6.70	60	100	100	100
02 Aztec 2.1G, IF	6.70	100	100	100	100
03 Force 3G, TB	4.00	100	100	60	100
04 Force 3G, IF	4.00	100	100	100	100
05 Lorsban 15G, TB	8.00	100	100	40	100
06 Lorsban 15G, IF	8.00	100	100	100	100
07 Capture LFR, IF	0.49	100	40	100	40
08 Poncho 1.25 mg/seed ST	n/a	100	100	100	100
09 Aztec 4.67 G, SB IF	3.00	100	100	100	100
10 SmartChoice 5G, SB, IF	3.50	100	100	100	nd
11 Counter 20G, SB, IF	4.50	100	100	100	100
12 Mycogen 2T784 Smartstax	n/a	100	100	100	100
13 Pioneer 33W84 Herculex XTRA	n/a	100	100	100	100
14 DEKALB DKC61-19 YieldGard VT3	n/a	100	100	100	100
15 Mycogen 2T777 (control)	n/a	100	40	100	0

¹Planted, 29 April 2010; Sampled, 13 July 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³Percentages transformed by Arcsine square root function. Weighted data (mean angles) back transformed to percentage. ANOVA PR>F=0.1270.

nd=no data

Table 5. **Stalk lodging** for experimental and registered insecticides for control of corn rootworm larvae at Throckmorton-Purdue Agricultural Center, Lafayette, IN, 2010¹.

Treatment, Place ²	Oz Product /1000 ft	Plants > 45°(n=25)				
		Rep1	Rep2	Rep3	Rep4	Avg
01 Aztec 2.1G, TB	6.70	0	0	0	0	0.00 a
02 Aztec 2.1G, IF	6.70	0	0	0	0	0.00 a
03 Force 3G, TB	4.00	0	0	0	0	0.00 a
04 Force 3G, IF	4.00	0	0	0	0	0.00 a
05 Lorsban 15G, TB	8.00	0	0	0	0	0.00 a
06 Lorsban 15G, IF	8.00	0	0	0	0	0.00 a
07 Capture LFR, IF	0.49	1	2	0	0	0.75 a
08 Poncho 1.25 mg/seed ST	n/a	0	1	0	0	0.25 a
09 Aztec 4.67 G, SB IF	3.00	0	0	0	0	0.00 a
10 SmartChoice 5G, SB, IF	3.50	0	1	0	nd	0.25 a
11 Counter 20G, SB, IF	4.50	0	0	0	0	0.00 a
12 Mycogen 2T784 Smartstax	n/a	1	0	0	1	0.25 a
13 Pioneer 33W84 Herculex XTRA	n/a	0	0	0	0	0.00 a
14 DEKALB DKC61-19 YieldGard VT3	n/a	0	0	0	0	0.00 a
15 Mycogen 2T777 (control)	n/a	0	0	0	0	0.00 a

¹Planted, 29 April 2010; Sampled, 14 September 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.0561.

nd=no data

Protocol name: Purdue University Corn Rootworm Standard Efficacy
Trial Site 2

Location: Pinney-Purdue Agricultural Center, Wanatah, IN

Researchers: Dr. Christian Krupke, Nick Seiter, Larry Bledsoe
Department of Entomology, Purdue University, West
Lafayette, IN

Planting date: 5 May 2010

Planting population: 27,700 kernels/acre

Maize hybrids:

Base (control) Mycogen 2T777
Smartstax Mycogen 2T784
Herculex XTRA Pioneer 33W84
Yieldguard VT3 DEKALB DKC61-19

Soil type/properties:

Sebewa loam
Organic matter: 2.5%
pH: 6.0
CEC: 14.8
Texture: silt loam (45.6% sand, 34.8% silt, 19.6% clay)

Tillage: Chisel tillage tool

Conditions at planting:

Avg. air temp. TBD°F
Avg. soil temp. TBD°F
Avg. wind speed TBDmph

Previous crop: late-planted maize (trap crop for *Diabrotica*)

Herbicides: TBD April 2010, TBD

Fertilizers: TBD April 2010: 50 gpa 28-0-0 (urea), 5 May 2010, 113
lbs/a 12-12-12 starter

Row width: 30"

Methods:

The design was randomized complete blocks with 4 reps and single row, 100 ft plots, Field test was installed using John Deere Max-emerge 7000 planter. Banded granules were applied in a T-Band using a modified Noble meter with plastic all terrain, 4 inch diffuser

over an open furrow. In-furrow granule applications were applied with a modified Noble meter or the AMVAC SmartBox® system (where noted) using 0.75 inch diameter plastic tubing (Tygon®) directed to the center of the open furrow ahead of the furrow-closing presswheels. Liquid treatments were applied at 5 gpa using a TeeJet 80015E nozzle at 11 psi over an open furrow ahead of the furrow-closing presswheels. All planting and chemical applications were made at 3 mph. Stand counts were estimated as the number of plants per 40ft. Extended leaf heights were the average length of 10 consecutive plants per plot measured from the ground to the tip of the longest extended leaf to the nearest 0.5 centimeter. Root injury was the average of 6 roots per plot dug, washed, and rated using the node injury 0-3 scale. Data were subjected to analysis of variance procedures and, where appropriate, mean separation was Ryan, Einot, Gabriel, Welsch MRT (P=0.05) SAS.

Table 6. **Stand counts** for experimental and registered soil insecticides for control of corn rootworm larvae Pinney-Purdue Agriculture Center, Wanatah, IN. 26 May 2010.

Treatment, Place ²	Oz Product		
	/1000 ft	Plants/40ft	SEM
01 Aztec 2.1G, TB	6.70	65.00 a	1.7321
02 Aztec 2.1G, IF	6.70	63.50 a	1.5546
03 Force 3G, TB	4.00	65.25 a	0.6292
04 Force 3G, IF	4.00	64.50 a	1.5546
05 Lorsban 15G, TB	8.00	64.67 a	0.8819
06 Lorsban 15G, IF	8.00	64.25 a	0.6292
07 Capture LFR, IF	0.49	64.00 a	1.2247
08 Poncho 1.25 mg/seed ST	n/a	60.25 a	1.6008
09 Aztec 4.67 G, SB IF	3.00	64.25 a	0.6292
10 SmartChoice 5G, SB, IF	3.50	62.25 ab	0.4787
11 Counter 20G, SB, IF	4.50	65.25 a	0.6292
12 Mycogen 2T784 Smartstax	n/a	61.75 ab	2.0156
13 Pioneer 33W84 Herculex XTRA	n/a	61.00 ab	0.7071
14 DEKALB DKC61-19 YieldGard VT3	n/a	57.00 b	0.9129
15 Mycogen 2T777 (control)	n/a	65.50 a	0.2887

Replicate Means

Treatment, Place ²	Oz Product /1000 ft	Plants/40ft			
		R1	R2	R3	R4
01 Aztec 2.1G, TB	6.70	62	nd	68	65
02 Aztec 2.1G, IF	6.70	61	63	68	62
03 Force 3G, TB	4.00	64	67	65	65
04 Force 3G, IF	4.00	65	67	66	60
05 Lorsban 15G, TB	8.00	65	nd	63	66
06 Lorsban 15G, IF	8.00	64	63	66	64
07 Capture LFR, IF	0.49	63	66	66	61
08 Poncho 1.25 mg/seed ST	n/a	58	63	57	63
09 Aztec 4.67 G, SB IF	3.00	66	63	64	64
10 SmartChoice 5G, SB, IF	3.50	63	63	62	61
11 Counter 20G, SB, IF	4.50	65	67	65	64
12 Mycogen 2T784 Smartstax	n/a	64	56	65	62
13 Pioneer 33W84 Herculex XTRA	n/a	60	60	63	61
14 DEKALB DKC61-19 YieldGard VT3	n/a	59	58	55	56
15 Mycogen 2T777 (control)	n/a	65	65	66	66

¹Planted, 5 May 2010; Sampled, 26 May 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.0001) Ryan, Einot, Gabriel, Welsch Q MRT ($\alpha = 0.05$)
nd=no data

Table 7. **Plant Height (vigor)** for experimental and registered soil insecticides for control of corn rootworm larvae at Pinney-Purdue Agricultural Center, Wanatah, IN, 2010¹.

Treatment, Place ²	Oz Product /1000 ft	Plant Height (cm)	
		Mean ³	SEM
01 Aztec 2.1G, TB	6.70	11.92 a	0.997
02 Aztec 2.1G, IF	6.70	10.82 a	0.256
03 Force 3G, TB	4.00	11.41 a	1.155
04 Force 3G, IF	4.00	12.24 a	0.676
05 Lorsban 15G, TB	8.00	11.40 a	0.765
06 Lorsban 15G, IF	8.00	10.85 a	0.460
07 Capture LFR, IF	0.49	13.15 a	0.260
08 Poncho 1.25 mg/seed, ST	n/a	11.36 a	0.255
09 Aztec 4.67 G, SB, IF	3.00	10.24 a	0.618
10 SmartChoice 5G, SB, IF	3.50	10.92 a	0.462
11 Counter 20G, SB, IF	4.50	10.90 a	0.183
12 Mycogen 2T784 Smartstax	n/a	13.52 a	0.695
13 Pioneer 33W84 Herculex XTRA	n/a	11.18 a	0.948
14 DEKALB DKC61-19 YieldGard VT3	n/a	12.92 a	0.520
15 Mycogen 2T777 (control)	n/a	12.33 a	0.828

Replicate Means

Treatment, Place ²	Oz Product 1000 ft	Plant Height (cm)			
		Rep1	Rep2	Rep3	Rep4
01 Aztec 2.1G, TB	6.70	13.35	nd	10.00	12.40
02 Aztec 2.1G, IF	6.70	10.60	10.90	11.50	10.30
03 Force 3G, TB	4.00	13.10	12.15	12.40	8.00
04 Force 3G, IF	4.00	11.00	11.20	13.00	13.75
05 Lorsban 15G, TB	8.00	11.45	nd	12.70	10.05
06 Lorsban 15G, IF	8.00	9.55	11.45	11.55	10.85
07 Capture LFR, IF	0.49	12.40	13.30	13.60	13.30
08 Poncho 1.25 mg/seed, ST	n/a	11.40	10.85	12.05	11.15
09 Aztec 4.67 G, SB, IF	3.00	11.15	11.40	8.85	9.55
10 SmartChoice 5G, SB, IF	3.50	10.05	12.05	10.30	11.30
11 Counter 20G, SB, IF	4.50	11.30	10.70	11.10	10.50
12 Mycogen 2T784 Smartstax	n/a	15.10	11.75	13.35	13.90
13 Pioneer 33W84 Herculex XTRA	n/a	8.70	12.85	12.45	10.70
14 DEKALB DKC61-19 YieldGard VT3	n/a	12.65	13.75	11.55	13.70
15 Mycogen 2T777 (control)	n/a	13.35	13.00	13.10	9.85

¹Planted, 5 May 2010; Sampled, 26 May 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.0263) Ryan, Einot, Gabriel, Welsch Q MRT ($\alpha = 0.05$)

nd=no data

Table 8. **Root node injury ratings** for experimental and registered soil insecticides for control of corn rootworm larvae at Pinney-Purdue Ag Center, Wanatah, IN, 2010¹.

Treatment, Place ²	Oz Product	Node		SEM
	/1000 ft	Injury		
01 Aztec 2.1G, TB	6.70	0.367	bc	0.2667
02 Aztec 2.1G, IF	6.70	0.195	bc	0.0343
03 Force 3G, TB	4.00	0.648	bc	0.1520
04 Force 3G, IF	4.00	0.558	bc	0.1938
05 Lorsban 15G, TB	8.00	0.923	b	0.3180
06 Lorsban 15G, IF	8.00	0.638	bc	0.2938
07 Capture LFR, IF	0.49	0.632	bc	0.0858
08 Poncho 1.25 mg/seed ST	n/a	0.458	bc	0.1160
09 Aztec 4.67 G, SB IF	3.00	0.290	bc	0.0804
10 SmartChoice 5G, SB, IF	3.50	0.545	bc	0.1784
11 Counter 20G, SB, IF	4.50	0.382	bc	0.1114
12 Mycogen 2T784 Smartstax	n/a	0.162	c	0.0496
13 Pioneer 33W84 Herculex XTRA	n/a	0.492	bc	0.2134
14 DEKALB DKC61-19 YieldGard VT3	n/a	0.135	c	0.0348
15 Mycogen 2T777 (control)	n/a	2.412	a	0.1375

Replicate Means

Treatment, Place ²	Oz Product /1000 ft	Node Injury			
		R1	R2	R3	R4
01 Aztec 2.1G, TB	6.70	0.11	nd	0.09	0.90
02 Aztec 2.1G, IF	6.70	0.24	0.19	0.10	0.25
03 Force 3G, TB	4.00	0.50	0.90	0.90	0.29
04 Force 3G, IF	4.00	0.39	0.20	0.54	1.10
05 Lorsban 15G, TB	8.00	0.48	nd	1.54	0.75
06 Lorsban 15G, IF	8.00	0.19	0.16	1.40	0.80
07 Capture LFR, IF	0.49	0.39	0.78	0.72	0.64
08 Poncho 1.25 mg/seed ST	n/a	0.17	0.54	0.72	0.40
09 Aztec 4.67 G, SB IF	3.00	0.51	0.31	0.17	0.17
10 SmartChoice 5G, SB, IF	3.50	0.16	0.40	0.62	1.00
11 Counter 20G, SB, IF	4.50	0.19	0.28	0.36	0.70
12 Mycogen 2T784 Smartstax	n/a	0.11	0.13	0.31	0.10
13 Pioneer 33W84 Herculex XTRA	n/a	0.12	0.30	0.45	1.10
14 DEKALB DKC61-19 YieldGard VT3	n/a	0.05	0.13	0.14	0.22
15 Mycogen 2T777 (control)	n/a	2.35	2.15	2.35	2.80

¹Planted, 5 May 2010; Sampled, 27 July 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.0001. Ryan, Einot, Gabriel, Welsch Q MRT ($\alpha = 0.05$)
nd=no data

Table 9. **Root ratings consistency of performance** for experimental and registered insecticides for control of corn rootworm larvae at Pinney-Purdue Agricultural Center, Wanatah, IN, 2010¹.

Treatment, Place ²	Oz Product /1000 ft ²	Percentage Rating ≤ 0.25 Means	
		Raw	Weighed ³
01 Aztec 2.1G, TB	6.70	73.33	86.99 a
02 Aztec 2.1G, IF	6.70	90.00	94.72 a
03 Force 3G, TB	4.00	25.00	14.64 ab
04 Force 3G, IF	4.00	45.00	38.51 ab
05 Lorsban 15G, TB	8.00	33.33	32.30 ab
06 Lorsban 15G, IF	8.00	60.00	72.36 ab
07 Capture LFR, IF	0.49	30.00	29.50 ab
08 Poncho 1.25 mg/seed ST	n/a	55.00	61.49 ab
09 Aztec 4.67 G, SB IF	3.00	80.00	89.04 a
10 SmartChoice 5G, SB, IF	3.50	45.00	44.97 ab
11 Counter 20G, SB, IF	4.50	55.00	55.02 ab
12 Mycogen 2T784 Smartstax	n/a	90.00	97.10 a
13 Pioneer 33W84 Herculex XTRA	n/a	60.00	60.48 ab
14 DEKALB DKC61-19 YieldGard VT3	n/a	90.00	94.72 a
15 Mycogen 2T777 (control)	n/a	0.00	0.00 b

Replicate Means

Treatment, Place ²	Oz Product /1000 ft	Percentage Rating ≤ 0.25 Raw Means			
		Rep1	Rep2	Rep3	Rep4
01 Aztec 2.1G, TB	6.70	100	nd	100	20
02 Aztec 2.1G, IF	6.70	80	100	100	80
03 Force 3G, TB	4.00	40	0	0	60
04 Force 3G, IF	4.00	40	80	60	0
05 Lorsban 15G, TB	8.00	60	nd	20	20
06 Lorsban 15G, IF	8.00	100	100	20	20
07 Capture LFR, IF	0.49	40	40	20	20
08 Poncho 1.25 mg/seed ST	n/a	100	40	20	60
09 Aztec 4.67 G, SB IF	3.00	40	80	100	100
10 SmartChoice 5G, SB, IF	3.50	100	40	40	0
11 Counter 20G, SB, IF	4.50	80	60	60	20
12 Mycogen 2T784 Smartstax	n/a	100	100	60	100
13 Pioneer 33W84 Herculex XTRA	n/a	100	80	60	0
14 DEKALB DKC61-19 YieldGard VT3	n/a	100	100	80	80
15 Mycogen 2T777 (control)	n/a	0	0	0	0

¹Planted, 29 April 2010; Sampled, 13 July 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³Percentages transformed by arcsine square root function. Weighted data (mean angles) back transformed to percentage. ANOVA

PR>F=0.0005. Ryan, Einot, Gabriel, Welsch Q MRT ($\alpha = 0.05$)

nd=no data

Table 10. **Stalk lodging** for experimental and registered insecticides for control of corn rootworm larvae at Pinney-Purdue Agricultural Center, Wanatah, IN, 2010¹.

Treatment, Place ²	Oz Product /1000 ft	Plants > 45°(n=25)				Avg ³
		Rep1	Rep2	Rep3	Rep4	
01 Aztec 2.1G, TB	6.70	1	0	0	0	0.25 a
02 Aztec 2.1G, IF	6.70	0	0	1	0	0.25 a
03 Force 3G, TB	4.00	0	0	1	1	0.50 a
04 Force 3G, IF	4.00	1	0	0	1	0.50 a
05 Lorsban 15G, TB	8.00	0	0	0	0	0.00 a
06 Lorsban 15G, IF	8.00	0	1	0	0	0.25 a
07 Capture LFR, IF	0.49	0	0	0	0	0.00 a
08 Poncho 1.25 mg/seed ST	n/a	1	2	1	2	1.50 a
09 Aztec 4.67 G, SB IF	3.00	1	1	0	0	0.50 a
10 SmartChoice 5G, SB, IF	3.50	0	0	3	0	0.75 a
11 Counter 20G, SB, IF	4.50	0	1	1	0	0.50 a
12 Mycogen 2T784 Smartstax	n/a	0	0	0	0	0.00 a
13 Pioneer 33W84 Herculex XTRA	n/a	0	1	0	0	0.25 a
14 DEKALB DKC61-19 YieldGard VT3	n/a	0	0	0	0	0.00 a
15 Mycogen 2T777 (control)	n/a	0	0	0	1	0.25 a

¹Planted, 5 May 2010; Sampled, 17 September 2010.

²TB=T-band, IF=in-furrow, ST=seed treatment, SB=SmartBox®

³ANOVA PR>F=0.1003.

nd=no data

Appendix I. Weather Observations 2010

Table A1. Throckmorton-Purdue Agricultural Center, Lafayette, IN.

April 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
04/01	0.05	60	77	46	51	50
04/02	0.02	68	81	54	58	54
04/03	0.01	69	79	58	60	56
04/04	0.31	53	64	46	54	53
04/05	0.05	60	74	44	53	52
04/06	0.02	67	76	59	61	58
04/07	0.05	71	83	62	64	60
04/08	0.53	65	72	53	62	59
04/09	0.01	44	54	36	52	54
04/10	0.01	45	57	31	49	51
04/11	0.03	56	72	39	53	52
04/12	0.02	61	77	47	60	55
04/13	0.00	62	75	49	61	56
04/14	0.01	62	79	47	63	57
04/15	0.01	67	85	49	66	58
04/16	0.00	71	83	58	68	60
04/17	0.00	61	69	48	63	58
04/18	0.00	48	59	34	58	54
04/19	0.00	47	59	34	57	53
04/20	0.00	50	64	33	58	53
04/21	0.00	55	68	43	62	54
04/22	0.01	57	73	38	60	54
04/23	0.00	59	74	40	63	56
04/24	0.14	57	64	50	60	56
04/25	0.57	62	71	56	60	57
04/26	0.48	57	61	52	58	57
04/27	0.59	54	65	42	59	57
04/28	0.00	51	59	36	59	56
04/29	0.00	50	65	31	56	54
04/30	0.00	62	77	46	58	55

Table A2. Throckmorton-Purdue Agricultural Center, Lafayette, IN.

May 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
05/01	0.00	71	79	62	63	58
05/02	0.46	66	74	64	64	61
05/03	0.08	64	71	57	64	62
05/04	0.14	61	75	52	63	61
05/05	0.00	64	76	50	63	61
05/06	0.00	67	80	58	64	62
05/07	0.00	60	73	46	63	62
05/08	0.07	64	83	51	63	62
05/09	0.00	47	52	41	55	56
05/10	0.00	48	61	35	56	55
05/11	0.10	52	62	39	57	55
05/12	0.40	59	73	48	59	56
05/13	0.17	57	67	51	60	58
05/14	0.00	70	81	53	65	61
05/15	0.00	61	70	54	65	63
05/16	0.00	59	68	47	62	60
05/17	0.00	60	65	55	61	60
05/18	0.21	53	56	51	58	58
05/19	0.00	55	57	53	57	57
05/20	0.00	58	67	50	60	58
05/21	0.50	60	70	48	60	58
05/22	0.30	64	70	59	62	60
05/23	0.00	67	78	61	66	63
05/24	0.00	76	89	61	70	66
05/25	0.00	80	90	70	73	69
05/26	0.00	77	88	65	73	70
05/27	0.00	78	91	66	73	70
05/28	0.00	75	86	65	73	70
05/29	0.00	72	85	57	72	69
05/30	0.00	76	89	62	74	70
05/31	0.00	80	92	64	75	71

Table A3. Throckmorton-Purdue Agricultural Center, Lafayette, IN.

June 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
06/01	0.43	73	86	66	73	71
06/02	0.00	73	84	65	73	71
06/03	0.12	72	79	65	73	71
06/04	0.00	72	82	65	74	71
06/05	0.00	74	86	60	76	72
06/06	0.02	77	85	72	76	72
06/07	0.00	69	78	59	76	71
06/08	0.00	67	77	55	77	70
06/09	0.08	69	74	64	72	69
06/10	0.31	74	81	65	74	70
06/11	0.00	73	85	59	78	71
06/12	0.00	78	91	69	81	73
06/13	0.26	77	90	70	80	74
06/14	0.69	73	85	67	78	74
06/15	0.58	74	86	69	78	74
06/16	0.16	74	83	68	77	75
06/17	0.00	73	80	67	78	75
06/18	0.00	74	85	62	81	75
06/19	0.14	76	91	67	82	75
06/20	0.48	75	86	66	79	75
06/21	0.00	78	88	67	84	77
06/22	0.31	76	86	67	81	77
06/23	0.33	76	85	67	78	76
06/24	0.10	80	89	69	81	77
06/25	0.01	73	82	66	78	76
06/26	0.00	73	84	61	81	76
06/27	0.00	78	90	67	84	77
06/28	0.01	80	88	74	83	78
06/29	0.14	77	84	67	82	78
06/30	0.00	69	77	61	79	75

Table A4. Throckmorton-Purdue Agricultural Center, Lafayette, IN.

July 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
07/01	0.00	66	77	53	78	73
07/02	0.00	66	78	54	79	72
07/03	0.00	68	81	54	80	71
07/04	0.00	73	86	56	81	72
07/05	0.01	79	90	68	82	74
07/06	0.00	79	88	71	84	76
07/07	0.00	80	90	68	85	76
07/08	0.00	82	93	69	86	77
07/09	0.37	78	90	72	83	77
07/10	0.00	76	85	65	80	77
07/11	0.00	75	89	61	80	76
07/12	0.00	74	85	62	82	76
07/13	0.03	75	85	67	83	78
07/14	0.27	74	84	68	80	77
07/15	0.00	79	89	67	82	79
07/16	0.08	76	88	72	79	78
07/17	0.00	77	87	68	83	79
07/18	0.19	76	89	65	83	79
07/19	0.00	75	84	68	78	78
07/20	0.02	76	85	67	80	78
07/21	0.01	73	81	67	77	77
07/22	0.00	77	89	68	83	78
07/23	0.56	79	87	70	81	79
07/24	0.21	82	90	74	84	81
07/25	0.11	81	90	73	83	82
07/26	0.19	76	85	68	81	81
07/27	0.00	74	85	65	82	80
07/28	0.00	78	90	66	86	81
07/29	0.49	79	89	73	84	82
07/30	0.00	76	84	68	82	82
07/31	0.00	72	79	66	77	79

Table A5. Throckmorton-Purdue Agricultural Center, Lafayette, IN.

August 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
08/01	0.07	69	74	65	73	76
08/02	0.00	73	85	65	79	77
08/03	0.00	75	87	63	81	79
08/04	0.36	80	92	71	82	80
08/05	0.76	81	92	71	84	82
08/06	0.00	77	87	67	82	81
08/07	0.00	71	81	60	79	79
08/08	0.00	72	83	60	80	78
08/09	0.00	75	85	63	80	78
08/10	0.03	80	93	69	84	80
08/11	0.00	82	94	74	86	82
08/12	0.02	82	91	75	87	83
08/13	0.00	81	92	71	87	83
08/14	0.00	81	92	70	87	82
08/15	0.02	79	92	72	86	82
08/16	0.00	79	89	68	87	82
08/17	0.00	71	82	57	82	79
08/18	0.00	71	81	59	79	76
08/19	0.00	75	87	67	85	78
08/20	0.00	77	91	64	85	78
08/21	0.00	79	91	69	86	79
08/22	0.33	76	85	70	79	78
08/23	0.00	76	86	66	79	78
08/24	0.00	71	84	61	79	77
08/25	0.00	71	81	61	77	76
08/26	0.00	71	81	62	81	76
08/27	0.00	66	79	54	79	74
08/28	0.00	68	85	51	79	73
08/29	0.00	73	90	56	81	74
08/30	0.00	80	93	69	84	76
08/31	0.14	77	87	67	83	76

Table A6. Throckmorton-Purdue Agricultural Center, Lafayette, IN.

September

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
09/01	0.00	78	90	68	84	76
09/02	0.20	74	84	70	77	75
09/03	0.24	74	83	71	75	75
09/04	0.06	67	75	58	70	73
09/05	0.00	60	71	49	67	69
09/06	0.00	62	78	45	69	69
09/07	0.00	73	87	61	74	69
09/08	0.00	73	83	61	74	69
09/09	0.00	63	77	48	71	68
09/10	0.00	62	76	45	71	68
09/11	0.00	67	82	52	73	69
09/12	0.18	67	76	60	70	69
09/13	0.00	66	83	49	69	69
09/14	0.00	71	88	58	72	69
09/15	0.00	68	85	57	71	68
09/16	0.00	71	88	56	72	68
09/17	0.00	68	76	53	71	69
09/18	0.00	62	79	46	69	67
09/19	0.00	68	83	53	70	67
09/20	0.00	69	83	60	73	69
09/21	0.00	74	89	64	76	71
09/22	0.00	80	94	67	77	72
09/23	0.22	70	81	64	73	71
09/24	0.00	78	93	64	72	71
09/25	0.00	72	80	57	71	71
09/26	0.05	58	70	49	65	67
09/27	0.00	54	61	49	60	64
09/28	0.00	56	70	44	61	62
09/29	0.00	57	74	44	62	62
09/30	0.00	60	80	42	63	62

Table A7. Throckmorton-Purdue Agricultural Center, Lafayette, IN.

October

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
10/01	0.00	62	78	48	65	63
10/02	0.00	57	74	41	63	62
10/03	0.12	54	60	47	58	60
10/04	0.00	49	60	40	54	57
10/05	0.00	48	62	34	54	56
10/06	0.00	50	69	31	55	56
10/07	.00	57	76	38	58	57
10/08	0.00	62	78	46	62	59
10/09	0.00	60	82	39	61	59
10/10	0.00	67	87	47	64	61
10/11	0.00	69	86	52	66	63
10/12	0.00	67	84	53	66	63
10/13	0.00	65	83	49	65	63
10/14	0.01	58	73	45	61	62
10/15	0.00	52	66	34	56	58
10/16	0.00	54	65	41	58	58
10/17	0.00	53	71	33	57	56
10/18	0.00	57	73	43	59	57
10/19	0.00	50	57	41	55	55
10/20	0.00	47	64	30	54	54
10/21	0.00	54	71	34	55	54
10/22	0.00	50	60	34	54	54
10/23	0.00	50	68	28	53	53
10/24	0.00	66	77	54	59	56
10/25	0.00	69	78	61	64	59
10/26	0.00	67	74	62	65	62
10/27	0.36	63	74	48	61	61
10/28	0.00	57	67	49	52	56
10/29	0.00	43	50	38	48	52
10/30	0.00	41	52	34	48	51
10/31	0.00	49	65	37	48	49

Table B1. Pinney-Purdue Agricultural Center, Wanatah, IN.

April 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
04/01	0.06	60	76	44	50	47
04/02	0.02	66	81	53	55	52
04/03	0.01	69	80	58	57	54
04/04	0.14	52	63	44	51	52
04/05	0.08	56	73	40	50	50
04/06	0.13	59	73	42	57	54
04/07	0.01	69	79	59	60	57
04/08	0.89	53	69	41	56	56
04/09	0.00	37	41	35	44	50
04/10	0.08	42	55	29	47	48
04/11	0.03	55	74	36	50	50
04/12	0.00	54	65	42	52	53
04/13	0.01	58	69	45	52	53
04/14	0.01	56	67	47	54	54
04/15	0.01	63	82	45	58	56
04/16	0.01	69	83	53	62	58
04/17	0.10	58	66	42	58	58
04/18	0.00	43	54	30	51	54
04/19	0.00	40	50	29	50	52
04/20	0.00	44	60	30	52	53
04/21	0.00	50	64	35	54	54
04/22	0.00	47	68	34	55	54
04/23	0.00	49	66	36	58	56
04/24	0.12	57	63	53	56	56
04/25	0.82	56	61	49	56	55
04/26	0.34	55	62	47	57	57
04/27	0.01	49	60	39	55	56
04/28	0.00	43	52	31	51	55
04/29	0.00	49	64	29	53	55
04/30	0.00	60	76	44	54	56

Table B2. Pinney-Purdue Agricultural Center, Wanatah, IN.

May 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
05/01	0.00	69	79	59	62	59
05/02	0.12	67	75	60	65	63
05/03	0.31	60	69	52	63	63
05/04	0.00	61	73	51	62	63
05/05	0.00	64	78	48	62	63
05/06	0.00	63	72	53	62	63
05/07	0.00	55	63	45	61	62
05/08	0.71	55	67	48	58	60
05/09	0.02	46	52	42	51	55
05/10	0.00	47	56	36	54	56
05/11	0.06	49	60	31	52	55
05/12	1.07	50	62	42	51	53
05/13	0.11	50	53	45	53	54
05/14	0.32	63	79	48	59	57
05/15	0.00	58	67	47	60	60
05/16	0.00	55	66	46	57	58
05/17	0.00	58	68	44	58	59
05/18	0.45	54	57	52	56	58
05/19	0.04	53	57	50	55	56
05/20	0.00	60	73	46	60	59
05/21	0.08	62	75	47	61	61
05/22	0.56	62	68	56	62	62
05/23	0.00	64	73	58	65	64
05/24	0.00	74	88	58	70	68
05/25	0.00	79	90	67	75	72
05/26	0.00	77	87	66	74	73
05/27	0.00	76	89	64	76	74
05/28	0.00	67	76	60	72	72
05/29	0.00	65	75	55	71	71
05/30	0.00	73	87	56	75	72
05/31	0.00	79	91	63	79	75

Table B3. Pinney-Purdue Agricultural Center, Wanatah, IN.

June 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
06/01	0.78	71	86	63	75	74
06/02	0.01	71	82	62	75	74
06/03	0.27	71	78	57	72	74
06/04	0.00	62	72	56	70	72
06/05	0.02	69	83	56	69	71
06/06	0.37	73	81	63	71	71
06/07	0.03	63	73	56	69	71
06/08	0.00	62	71	52	69	71
06/09	0.28	60	65	53	63	67
06/10	0.00	73	82	62	71	70
06/11	0.00	69	80	55	71	72
06/12	0.00	77	88	66	74	74
06/13	0.34	73	86	61	76	76
06/14	0.00	67	77	60	72	73
06/15	0.00	69	77	63	72	74
06/16	0.54	71	81	61	72	73
06/17	0.00	72	81	65	73	74
06/18	0.00	72	83	59	75	76
06/19	0.66	74	89	66	75	76
06/20	0.06	74	86	65	74	76
06/21	0.00	71	81	59	74	75
06/22	0.67	73	83	64	74	75
06/23	0.05	75	85	68	77	77
06/24	1.73	75	86	66	76	76
06/25	0.00	70	77	61	75	75
06/26	0.00	71	81	58	75	76
06/27	0.29	75	87	66	78	78
06/28	0.33	76	84	69	77	78
06/29	0.00	75	83	65	77	78
06/30	0.00	66	74	53	75	76

Table B4. Pinney-Purdue Agricultural Center, Wanatah, IN.

July 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
07/01	0.00	61	75	47	73	74
07/02	0.00	63	78	44	74	73
07/03	0.00	67	80	51	76	74
07/04	0.00	71	83	55	78	75
07/05	0.00	77	91	64	82	77
07/06	0.00	79	87	72	84	79
07/07	0.00	79	89	68	84	79
07/08	0.00	80	93	67	87	80
07/09	0.28	75	83	69	81	80
07/10	0.00	74	82	62	80	79
07/11	1.03	71	87	58	76	75
07/12	0.22	73	83	61	76	75
07/13	0.16	73	84	64	78	78
07/14	0.80	72	83	63	78	78
07/15	0.00	76	87	62	79	79
07/16	0.00	79	90	70	80	80
07/17	0.00	75	86	62	82	80
07/18	0.00	76	89	62	82	80
07/19	0.26	76	85	67	80	79
07/20	0.00	75	84	65	79	79
07/21	0.00	72	81	65	77	78
07/22	0.00	77	89	67	81	79
07/23	0.00	76	85	63	79	79
07/24	0.02	82	90	71	85	80
07/25	0.89	76	88	70	80	79
07/26	0.41	72	78	61	79	79
07/27	0.00	71	82	57	76	78
07/28	0.00	74	86	61	80	79
07/29	0.14	78	90	72	81	80
07/30	0.00	71	81	59	80	80
07/31	0.00	69	77	59	74	77

Table B5. Pinney-Purdue Agricultural Center, Wanatah, IN.

August 2010

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
08/01	0.66	68	75	60	74	76
08/02	0.00	70	83	57	76	76
08/03	0.05	72	83	60	77	77
08/04	0.65	76	85	68	78	78
08/05	0.16	74	81	67	78	78
08/06	0.00	73	84	62	77	78
08/07	0.00	69	80	59	76	77
08/08	0.00	71	82	58	77	77
08/09	0.00	73	83	64	76	76
08/10	0.00	77	87	70	79	78
08/11	0.00	79	93	70	82	80
08/12	0.00	80	89	72	85	81
08/13	0.00	78	89	67	85	81
08/14	0.00	78	90	67	85	81
08/15	0.01	76	86	70	83	81
08/16	0.00	75	83	63	83	80
08/17	0.00	69	80	58	79	78
08/18	0.02	68	81	56	76	76
08/19	0.02	71	87	64	80	77
08/20	0.00	74	87	59	82	78
08/21	0.02	77	89	65	83	78
08/22	0.3	73	81	69	79	78
08/23	0.00	71	78	63	78	78
08/24	0.00	69	79	58	76	76
08/25	0.00	68	80	57	76	75
08/26	0.00	68	76	58	78	75
08/27	0.00	64	77	51	77	74
08/28	0.00	66	83	47	76	74
08/29	0.00	70	86	50	78	74
08/30	0.00	77	92	62	81	76
08/31	0.00	77	89	67	82	76

Table B6. Pinney-Purdue Agricultural Center, Wanatah, IN.

September

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
09/01	0.00	79	90	68	83	77
09/02	0.00	74	81	70	79	77
09/03	0.91	73	82	68	75	76
09/04	0.01	65	73	56	70	73
09/05	0.00	57	68	48	65	69
09/06	0.01	61	77	42	67	68
09/07	0.00	72	82	62	70	69
09/08	0.00	71	81	52	72	70
09/09	0.00	58	69	46	69	68
09/10	0.00	56	72	40	68	68
09/11	0.00	63	77	49	70	68
09/12	0.64	60	69	54	65	67
09/13	0.00	66	81	48	66	67
09/14	0.00	67	80	53	69	68
09/15	0.00	63	80	48	69	68
09/16	0.06	65	79	50	67	67
09/17	0.15	64	72	59	66	67
09/18	0.00	63	75	48	67	67
09/19	0.15	61	72	53	64	66
09/20	0.00	62	74	54	66	67
09/21	0.00	68	80	59	67	67
09/22	0.29	75	93	64	72	69
09/23	0.23	67	78	63	70	70
09/24	0.00	77	91	63	70	70
09/25	0.02	69	79	51	69	70
09/26	0.00	54	59	48	60	65
09/27	0.00	53	60	46	60	63
09/28	0.00	50	64	37	60	62
09/29	0.00	53	69	38	61	62
09/30	0.00	57	76	39	63	62

Table B7. Pinney-Purdue Agricultural Center, Wanatah, IN.

October

Date	Precip (inch)	Air (degF)	Max Air (degF)	Min Air (degF)	Soil Bare°F	Soil GrassF°
10/01	0.00	59	72	43	65	63
10/02	0.00	56	72	37	62	62
10/03	0.33	52	59	44	59	61
10/04	0.00	46	55	37	53	57
10/05	0.00	44	57	30	52	55
10/06	0.00	47	64	27	53	55
10/07	0.00	57	75	33	58	56
10/08	0.00	57	72	41	61	58
10/09	0.00	60	80	36	60	58
10/10	0.00	67	87	49	65	60
10/11	0.00	67	85	51	66	62
10/12	0.00	65	82	53	66	63
10/13	0.00	62	79	52	66	63
10/14	0.01	54	63	44	59	61
10/15	0.00	54	64	40	56	58
10/16	0.00	52	61	36	58	58
10/17	0.00	52	70	32	56	57
10/18	0.00	53	66	38	58	57
10/19	0.00	48	61	36	54	56
10/20	0.00	47	61	32	54	55
10/21	0.00	54	70	37	54	55
10/22	0.00	44	54	30	53	55
10/23	0.01	47	65	28	51	53
10/24	0.10	58	64	49	54	54
10/25	0.04	65	76	56	59	57
10/26	0.28	65	72	57	62	60
10/27	0.39	62	69	51	59	60
10/28	0.00	56	66	43	52	55
10/29	0.00	42	45	38	46	52
10/30	0.00	41	50	35	47	50
10/31	0.00	47	62	34	47	49