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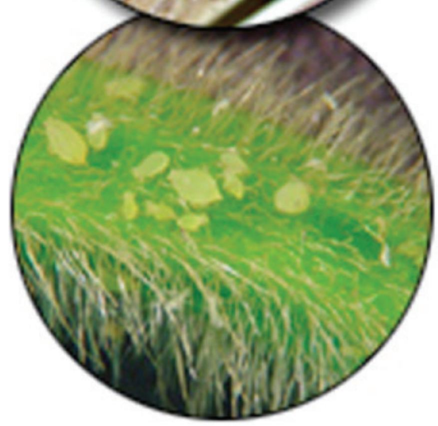
Annual review of University of Illinois insect management trials

2011 Report



Providing accurate and unbiased evaluations of insect control products and management strategies to assist growers in Illinois.

UNIVERSITY OF ILLINOIS EXTENSION

College of Agricultural, Consumer and Environmental Sciences
Department of Crop Sciences

ILLINOIS SOYBEAN ASSOCIATION

Since its inception in 1984, the University of Illinois Insect Management and Insecticide Evaluation Program has provided the producers of Illinois complete and informative evaluations of registered insecticides and new chemical and transgenic tools for the management of insect pests in Illinois. It is our intention to provide scientifically sound efficacy data to aid the producers of Illinois in their insect pest management decision making.

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APPENDICES

SECTION 1

Evaluation of products to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2011

Nicholas A. Tinsley, Ronald E. Estes, and Michael E. Gray

Location

We established four trials at University of Illinois research and education centers near DeKalb (DeKalb County), Monmouth (Warren County), Perry (Pike County), and Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 10 ft (four rows) x 40 ft at DeKalb, Perry, and Urbana, and 10 ft (four rows) x 30 ft at Monmouth. Five randomly selected root systems were extracted from the first row of each plot on 12 July at Monmouth and Perry, and on 11 and 18 July at Urbana and DeKalb, respectively. Root systems were washed and rated for corn rootworm larval injury using the 0 to 3 node-injury scale developed by Oleson et al. (2005) (Appendix I). The percentage of roots with a node-injury rating less than 0.25 was determined for each product at each location.

Planting, Insecticide Application, and Yield

Trials were planted on 2, 3, 10, and 11 May at Monmouth, Perry, DeKalb, and Urbana, respectively. All trials were planted using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches. Granular insecticides were applied through modified Noble metering units or through modified SmartBox metering units mounted to each row. Plastic tubes directed the insecticide granules into the seed furrow. Force 2.1CS was applied at a spray volume of 5 gallons per acre (gal/A) using a CO_2 system. All insecticides were applied in front of the firming wheels on the planter. Twisted drag chains were attached behind each of the row units to improve insecticide incorporation. Active ingredients for all insecticides are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each plot on 15 and 24 September at Perry and Monmouth, respectively, and on 7 and 22 October at Urbana and Dekalb, respectively. Weights were converted to bushels per acre (bu/A) at 15.5% moisture. To ensure uniform plant densities across all plots, plant populations in the harvested rows had been thinned at the V6–V8 growth stage to 35,000 plants per acre at all locations.

Agronomic Information

Agronomic information for all four locations is listed in Table 1.1.

Climatic Conditions

Temperature and precipitation data for all four locations are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

DeKalb—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 18 July are reported in Table 1.2. Mean node-injury ratings for the untreated checks (UTCs) ranged from 0.98–1.65, indicating that corn rootworm larval feeding was moderate. DKC61-22 had a statistically smaller mean node-injury rating than the other UTCs. One factor that may have contributed to this observation is that DKC61-22 was treated with clothianidin at the rate of 0.50 mg a.i. per seed while the other UTCs were treated with thiamethoxam at the rate of 0.25 mg a.i. per seed. Mean node-injury ratings for the seed and soil-applied insecticides ranged from 0.07–0.13; these ratings were significantly smaller than their UTC (DKC61-22). Mean node-injury ratings for the rootworm Bt hybrids ranged from 0.01–0.63 and, in all instances, were significantly smaller than their respective UTCs. The addition of soil-applied insecticides to rootworm Bt hybrids only resulted in significantly smaller mean node-injury ratings for Agrisure RW (Garst 84U58 3111). The percentages of roots with a node-injury rating < 0.25 were variable and ranged from 40–100% for the control products that were evaluated.

Mean yields for the UTCs were very low and ranged from 102–145 bu/A. Mean yields for the soil-applied insecticide Aztec 2.1G and the rootworm Bt hybrids were significantly greater than their respective UTCs—this trend was not observed for Poncho 1250 when compared with its UTC (DKC61-22). The addition of soil-applied insecticides to rootworm Bt hybrids resulted in a significantly greater mean yield for Agrisure RW (Garst 84U58 3111) (only when SmartChoice 5G was used). However, adding soil-applied insecticide to the other rootworm Bt hybrids did not result in significantly greater mean yields. These results indicate that at these moderate levels of injury, the addition of a soil insecticide did not result in significantly greater yields for most rootworm Bt hybrids.

Monmouth—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 12 July are reported in Table 1.3. Mean node-injury ratings for the UTCs ranged from 0.11–0.42, indicating that corn rootworm larval feeding was minimal to moderate. Mean node-injury ratings for the seed- and soil-applied insecticides ranged from 0.02–0.11; however, mean node-injury ratings for these treatments were not significantly different from their UTC (DKC61-22). Mean node-injury ratings for the rootworm Bt hybrids ranged from 0.01–0.05. For most rootworm Bt hybrids, mean node-injury ratings were smaller than their respective UTCs; this trend excluded SmartStax (DKC61-21) and YieldGard VT3 (DKC62-97). The addition of soil-applied insecticides to rootworm Bt hybrids never resulted in significantly smaller mean node-injury ratings when compared with the rootworm Bt hybrids alone. The percentages of roots with a node-injury rating < 0.25 ranged from 84–100% for the control products that were evaluated. Percentage consistency for the rootworm Bt hybrids was not improved by adding a soil-applied insecticide.

Mean yields for the UTCs ranged from 179–218 bu/A. Mean yields for the seed- and soil-applied insecticides were not

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TABLE 1.1 • Agronomic information for efficacy trials with products to control corn rootworm larvae, University of Illinois, 2011

	DeKalb	Monmouth	Perry	Urbana
Planting date	10 May	2 May	3 May	11 May
Root evaluation date	18 July	12 July	12 July	11 July
Harvest date	22 October	24 September	15 September	7 October
Hybrids	DKC61-21 SmartStax DKC61-22 RR2 DKC62-97 YieldGard VT3 Garst 84U58 3111 Agrisure RW Garst 84U58 GT GH H-8577 3000GT Agrisure RW GH H-8577 GT/CB/LL Mycogen 2T777 RR2 Mycogen 2T784 SmartStax Mycogen 2T789 Herculex XTRA	DKC61-21 SmartStax DKC61-22 RR2 DKC62-97 YieldGard VT3 Garst 84U58 3111 Agrisure RW Garst 84U58 GT GH H-8577 3000GT Agrisure RW GH H-8577 GT/CB/LL Mycogen 2T777 RR2 Mycogen 2T784 SmartStax Mycogen 2T789 Herculex XTRA	DKC61-21 SmartStax DKC61-22 RR2 DKC62-97 YieldGard VT3 Garst 84U58 3111 Agrisure RW Garst 84U58 GT GH H-8577 3000GT Agrisure RW GH H-8577 GT/CB/LL Mycogen 2T777 RR2 Mycogen 2T784 SmartStax Mycogen 2T789 Herculex XTRA	DKC61-21 SmartStax DKC61-22 RR2 DKC62-97 YieldGard VT3 Garst 84U58 3111 Agrisure RW Garst 84U58 GT GH H-8577 3000GT Agrisure RW GH H-8577 GT/CB/LL Mycogen 2T777 RR2 Mycogen 2T784 SmartStax Mycogen 2T789 Herculex XTRA
Row spacing	30 inches	30 inches	30 inches	30 inches
Seeding rate	36,000/acre	36,000/acre	36,000/acre	36,000/acre
Previous crop	Trap crop[1]	Trap crop[1]	Trap crop[1]	Trap crop[1]
Tillage	Fall—moldboard plow Spring—mulch finisher	Fall—chisel plow Spring—field cultivator	Fall—chisel plow Spring—field cultivator	Fall—chisel plow Spring—field cultivator

[1] Late-planted corn and pumpkins.

TABLE 1.2 • **Evaluation of products to control corn rootworm larvae, DeKalb, University of Illinois, 2011**

Product	Rate[1,2]	Placement[1,2]	Mean node-injury rating[3,4,5,6] 18 July	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 22 Oct
Seed- and soil-applied insecticides					
Aztec 2.1G + DKC61-22[10]	6.7	NU furrow[12]	0.07 e	85	176 b–e
Poncho 1250 + DKC61-22[10]	1.25	Seed	0.13 de	79	160 efg
Rootworm Bt hybrids					
Agrisure RW (Garst 84U58 3111[11])	—	—	0.63 bc	40	175 b–f
Agrisure RW (GH H-8577 3000GT[11])	—	—	0.50 cd	60	169 def
Herculex XTRA (Mycogen 2T789[11])	—	—	0.17 de	85	159 efg
SmartStax (DKC61-21[10])	—	—	0.03 e	100	184 a–d
SmartStax (Mycogen 2T784[11])	—	—	0.01 e	100	157 fg
YieldGard VT3 (DKC62-97[10])	—	—	0.08 e	90	191 abc
Soil-applied insecticides + rootworm Bt hybrids					
Counter 20G + Agrisure RW (Garst 84U58 3111[11])	4.5	SB furrow[13]	0.01 e	100	184 a–d
Counter 20G + YieldGard VT3 (DKC62-97[10])	4.5	SB furrow[13]	0.02 e	100	194 ab
Force 2.1CS + Agrisure RW (Garst 84U58 3111[11])	0.46	Band	0.04 e	100	191 abc
Force 2.1CS + Herculex XTRA (Mycogen 2T789[11])	0.46	Band	0.01 e	100	172 c–f
Force 2.1CS + SmartStax (DKC61-21[10])	0.46	Band	0.00 e	100	188 a–d
Force 2.1CS + YieldGard VT3 (DKC62-97[10])	0.46	Band	0.02 e	100	187 a–d
SmartChoice 5G + Agrisure RW (Garst 84U58 3111[11])	3.5	SB furrow[13]	0.03 e	100	199 a
SmartChoice 5G + Herculex XTRA (Mycogen 2T789[11])	3.5	SB furrow[13]	0.02 e	100	178 b–e
Untreated checks (UTCs)					
DKC61-22[10]	—	—	0.98 b	20	145 g
Garst 84U58 GT[11]	—	—	1.45 a	0	122 h
GH H-8577 GT/CB/LL[11]	—	—	1.65 a	10	102 i
Mycogen 2T777[11]	—	—	1.55 a	16	107 hi

[1] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[2] Rates of application for seed-applied insecticides are milligrams (mg) active ingredient (a.i.) per seed.
[3] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[4] Mean node-injury ratings were derived from five root systems per treatment in each of four replications.
[5] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[6] Data were analyzed using a square-root transformation; actual means are shown.
[7] Percentage of roots with a node-injury rating < 0.25.
[8] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture.
[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[10] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified Noble metering units.
[13] Applied with modified SmartBox metering units.

TABLE 1.3 • **Evaluation of products to control corn rootworm larvae, Monmouth, University of Illinois, 2011**

Product	Rate[1,2]	Placement[1,2]	Mean node-injury rating[3,4,5,6] 12 July	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 24 Sep
Seed- and soil-applied insecticides					
Aztec 2.1G + DKC61-22[10]	6.7	NU furrow[12]	0.02 d	100	225 ab
Poncho 1250 + DKC61-22[10]	1.25	Seed	0.11 cd	84	222 abc
Rootworm Bt hybrids					
Agrisure RW (Garst 84U58 3111[11])	—	—	0.03 d	100	186 de
Agrisure RW (GH H-8577 3000GT[11])	—	—	0.05 d	100	212 a–d
Herculex XTRA (Mycogen 2T789[11])	—	—	0.02 d	100	194 b–e
SmartStax (DKC61-21[10])	—	—	0.01 d	100	199 b–e
SmartStax (Mycogen 2T784[11])	—	—	0.01 d	100	179 e
YieldGard VT3 (DKC62-97[10])	—	—	0.02 d	100	240 a
Soil-applied insecticides + rootworm Bt hybrids					
Counter 20G + Agrisure RW (Garst 84U58 3111[11])	4.5	SB furrow[13]	0.01 d	100	208 b–e
Force 2.1CS + Agrisure RW (Garst 84U58 3111[11])	0.46	Band	0.01 d	100	214 a–d
Force 2.1CS + Herculex XTRA (Mycogen 2T789[11])	0.46	Band	0.00 d	100	188 de
Force 2.1CS + SmartStax (DKC61-21[10])	0.46	Band	0.01 d	100	216 a–d
Force 2.1CS + YieldGard VT3 (DKC62-97[10])	0.46	Band	0.01 d	100	220 abc
SmartChoice 5G + Herculex XTRA (Mycogen 2T789[11])	3.5	SB furrow[13]	0.01 d	100	205 b–e
Untreated checks (UTCs)					
DKC61-22[10]	—	—	0.11 cd	85	218 a–d
Garst 84U58 GT[11]	—	—	0.27 b	60	216 a–d
GH H-8577 GT/CB/LL[11]	—	—	0.23 bc	60	193 cde
Mycogen 2T777[11]	—	—	0.42 a	50	179 e

[1] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[2] Rates of application for seed-applied insecticides are milligrams (mg) active ingredient (a.i.) per seed.
[3] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[4] Mean node-injury ratings were derived from five root systems per treatment in each of four replications.
[5] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[6] Data were analyzed using a square-root transformation; actual means are shown.
[7] Percentage of roots with a node-injury rating < 0.25.
[8] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture.
[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[10] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified Noble metering units.
[13] Applied with modified SmartBox metering units.

statistically different from their respective UTCs. Likewise, mean yields for all rootworm Bt hybrids were statistically similar to their UTCs. Adding soil-applied insecticides to the rootworm Bt hybrids never resulted in significantly greater mean yields.

Perry—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 12 July are reported in Table 1.4. Mean node-injury ratings for the UTCs ranged from 0.21–0.55, indicating that corn rootworm larval feeding was minimal to moderate. Mean node-injury ratings for the seed- and soil-applied insecticides ranged from 0.08–0.09. As was observed in Monmouth, mean node-injury ratings for these treatments were not significantly different from their UTC (DKC61-22). Mean node-injury ratings for the rootworm Bt hybrids ranged from 0.00–0.05. For all rootworm Bt hybrids, mean node-injury ratings were smaller than their respective UTCs. The addition of soil-applied insecticides to rootworm Bt hybrids never resulted in significantly smaller mean node-injury ratings. The percentages of roots with a node-injury rating < 0.25 ranged from 84–100% for the control products that were evaluated.

Overall, mean yields for this location were lower than for the other locations—no treatment yielded more than 152 bu/A. Mean yields for the seed- and soil-applied insecticides were not statistically different from their respective UTCs. Similarly, the mean yield for most of the rootworm Bt hybrids were statistically similar to their respective UTCs. However, the mean yields for Agrisure RW (GH H-8577 3000GT) and SmartStax (DKC61-21) were significantly higher and lower than their corresponding UTCs (GH H-8577 GT/CB/LL and DKC61-22), respectively. The addition of soil insecticides to rootworm Bt hybrids resulted in significantly greater yield for only one rootworm Bt hybrid (SmartStax, DKC61-21). It is likely that some other factor (e.g., moisture stress, see Appendix III) played a more important role in determining yield than the levels of root injury we observed.

Urbana—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 11 July are reported in Table 1.5. Mean node-injury ratings for the UTCs ranged from 0.87–1.70, indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for the seed and soil-applied insecticides ranged from 0.31–0.68. The mean node injury rating for Aztec 2.1G was significantly smaller than its UTC (DKC61-22); however, Poncho 1250 and its UTC (DKC61-22) had statistically similar mean node-injury ratings. Mean node-injury ratings for the rootworm Bt hybrids ranged from 0.02–0.41 and, in all instances, were significantly smaller than their respective UTCs. The addition of soil-applied insecticides to rootworm Bt hybrids only resulted in significantly smaller mean node-injury ratings for Agrisure RW (Garst 84U58 3111). The percentages of roots with a node-injury rating < 0.25 were variable and ranged from 20–100% for the control products that were evaluated.

Mean yields for the UTCs were very low and ranged from 68–149 bu/A. Mean yields for the soil-applied insecticide Aztec 2.1G and the rootworm Bt hybrids were significantly greater than their respective UTCs—this trend was not observed for Poncho 1250 when compared with its UTC (DKC61-22). The addition of soil-applied insecticides to rootworm Bt hybrids never resulted in significantly greater mean yields when compared with rootworm Bt hybrids alone.

TABLE 1.4 • Evaluation of products to control corn rootworm larvae, Perry, University of Illinois, 2011

Product	Rate[1,2]	Placement[1,2]	Mean node-injury rating[3,4,5,6] 12 July	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 15 Sep
Seed- and soil-applied insecticides					
Aztec 2.1G + DKC61-22[10]	6.7	NU furrow[12]	0.08 cd	84	131 b
Poncho 1250 + DKC61-22[10]	1.25	Seed	0.09 cd	85	137 b
Rootworm Bt hybrids					
Agrisure RW (Garst 84U58 3111[11])	—	—	0.05 d	100	144 ab
Agrisure RW (GH H-8577 3000GT[11])	—	—	0.02 d	100	152 a
Herculex XTRA (Mycogen 2T789[11])	—	—	0.05 d	90	131 b
SmartStax (DKC61-21[10])	—	—	0.03 d	100	117 c
SmartStax (Mycogen 2T784[11])	—	—	0.00 d	100	138 ab
YieldGard VT3 (DKC62-97[10])	—	—	0.01 d	100	144 ab
Soil-applied insecticides + rootworm Bt hybrids					
Counter 20G + Agrisure RW (Garst 84U58 3111[11])	4.5	SB furrow[13]	0.03 d	100	142 ab
Force 2.1CS + Agrisure RW (Garst 84U58 3111[11])	0.46	Band	0.01 d	100	144 ab
Force 2.1CS + Herculex XTRA (Mycogen 2T789[11])	0.46	Band	0.00 d	100	137 b
Force 2.1CS + SmartStax (DKC61-21[10])	0.46	Band	0.00 d	100	139 ab
Force 2.1CS + YieldGard VT3 (DKC62-97[10])	0.46	Band	0.00 d	100	152 a
SmartChoice 5G + Herculex XTRA (Mycogen 2T789[11])	3.5	SB furrow[13]	0.01 d	100	139 ab
Untreated checks (UTCs)					
DKC61-22[10]	—	—	0.21 bc	70	135 b
Garst 84U58 GT[11]	—	—	0.29 b	55	141 ab
GH H-8577 GT/CB/LL[11]	—	—	0.55 a	20	137 b
Mycogen 2T777[11]	—	—	0.44 a	35	133 b

[1] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[2] Rates of application for seed-applied insecticides are milligrams (mg) active ingredient (a.i.) per seed.
[3] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[4] Mean node-injury ratings were derived from five root systems per treatment in each of four replications.
[5] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[6] Data were analyzed using a square-root transformation; actual means are shown.
[7] Percentage of roots with a node-injury rating < 0.25.
[8] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture.
[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[10] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified Noble metering units.
[13] Applied with modified SmartBox metering units.

TABLE 1.5 • Evaluation of products to control corn rootworm larvae, Urbana, University of Illinois, 2011

Product	Rate[1,2]	Placement[1,2]	Mean node-injury rating[3,4,5,6] 11 July	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 7 Oct
Seed- and soil-applied insecticides					
Aztec 2.1G + DKC61-22[10]	6.7	NU furrow[12]	0.31 ef	70	192 bcd
Poncho 1250 + DKC61-22[10]	1.25	Seed	0.68 cd	20	155 ef
Rootworm Bt hybrids					
Agrisure RW (Garst 84U58 3111[11])	—	—	0.41 de	30	237 a
Agrisure RW (GH H-8577 3000GT[11])	—	—	0.40 de	55	185 de
Herculex XTRA (Mycogen 2T789[11])	—	—	0.05 f	100	211 a–d
SmartStax (DKC61-21[10])	—	—	0.02 f	100	213 a–d
SmartStax (Mycogen 2T784[11])	—	—	0.05 f	100	240 a
YieldGard VT3 (DKC62-97[10])	—	—	0.15 ef	85	216 a–d
Soil-applied insecticides + rootworm Bt hybrids					
Counter 20G + Agrisure RW (Garst 84U58 3111[11])	4.5	SB furrow[13]	0.06 f	100	226 abc
Counter 20G + YieldGard VT3 (DKC62-97[10])	4.5	SB furrow[13]	0.02 f	100	190 cd
Force 2.1CS + Agrisure RW (Garst 84U58 3111[11])	0.46	Band	0.05 f	100	248 a
Force 2.1CS + Herculex XTRA (Mycogen 2T789[11])	0.46	Band	0.02 f	100	235 a
Force 2.1CS + SmartStax (DKC61-21[10])	0.46	Band	0.01 f	100	222 a–d
Force 2.1CS + YieldGard VT3 (DKC62-97[10])	0.46	Band	0.02 f	100	229 ab
SmartChoice 5G + Agrisure RW (Garst 84U58 3111[11])	3.5	SB furrow[13]	0.06 f	100	220 a–d
SmartChoice 5G + Herculex XTRA (Mycogen 2T789[11])	3.5	SB furrow[13]	0.01 f	100	223 abc
Untreated checks (UTCs)					
DKC61-22[10]	—	—	0.87 bc	15	149 f
Garst 84U58 GT[11]	—	—	1.04 bc	15	95 g
GH H-8577 GT/CB/LL[11]	—	—	1.15 b	15	68 g
Mycogen 2T777[11]	—	—	1.70 a	0	82 g

[1] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[2] Rates of application for seed-applied insecticides are milligrams (mg) active ingredient (a.i.) per seed.
[3] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[4] Mean node-injury ratings were derived from five root systems per treatment in each of four replications.
[5] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[6] Data were analyzed using a square-root transformation; actual means are shown.
[7] Percentage of roots with a node-injury rating < 0.25.
[8] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture.
[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[10] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified Noble metering units.
[13] Applied with modified SmartBox metering units.

SECTION 2

Evaluation of Force 3G and a seed-blend to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2011

Nicholas A. Tinsley, Ronald E. Estes, and Michael E. Gray

Location

We established one trial at the University of Illinois Agricultural Engineering Farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 20 ft (eight rows) x 20 ft. For the seed-blend, three root clusters were extracted from the center four rows of each plot on 13 July—each cluster contained a non-rootworm Bt refuge root system and two adjacent rootworm Bt root systems (Figure 2.1). For non-seed-blend treatments, six randomly selected root systems were extracted from the center four rows of each plot. Root systems were washed and rated for corn rootworm larval injury using the 0 to 3 node-injury scale developed by Oleson et al. (2005) (Appendix I). The percentage of roots with a node-injury rating less than 0.25 was determined for each product. For the seed-blend treatment, a weighted formula was used to calculate the mean node-injury rating and percentage consistency.

Planting and Insecticide Application

The trial was planted on 12 May using a four-row, ALMACO constructed planter with John Deere 7300 row units. Precision cone units were used to plant the seeds. Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches. Force 3G was applied through modified Noble metering units mounted to each row. Plastic tubes directed the insecticide granules into the seed furrow. The insecticide was applied in front of the firming wheels on the planter. Twisted drag chains were attached behind each of the row units to improve insecticide incorporation. Active ingredients for all insecticides are listed in Appendix II.

Agronomic Information

Agronomic information is listed in Table 2.1.

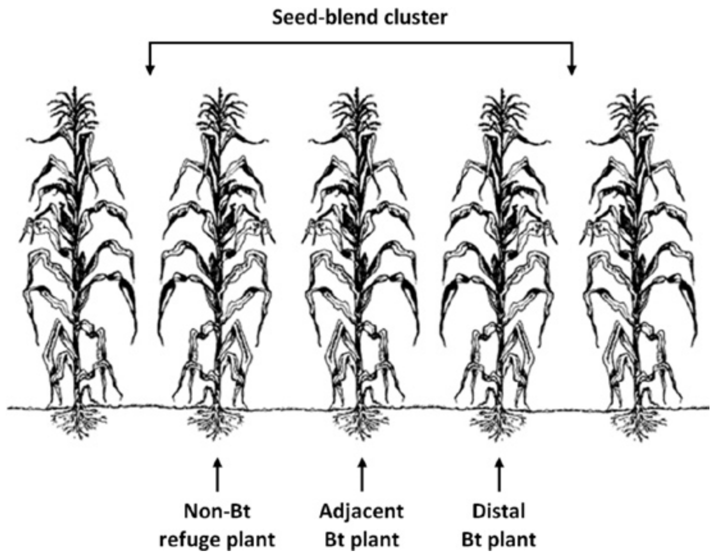

FIGURE 2.1 • Diagram of root cluster selection for the seed-blend treatment, Urbana, University of Illinois, 2011

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using SAS 9.2 (Copyright© 2002–2008 SAS Institute, Inc., Cary, NC).

TABLE 2.1 • Agronomic information for efficacy trial of Force 3G and a seed-blend to control corn rootworm larvae, Urbana, University of Illinois, 2011

Planting date	12 May
Root evaluation date	13 July
Hybrids	Mycogen 2T777 RR2 Mycogen 2T784 SmartStax
Row spacing	30 inches
Seeding rate	36,000/acre
Previous crop	Trap crop[1]
Tillage	Fall—chisel plow Spring—field cultivator

[1] Late-planted corn and pumpkins.

Results and Discussion

Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 13 July are reported in Table 2.2.

The mean node-injury rating for the untreated check (UTC) was 1.12, indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for SmartStax and the seed-blend (95% Mycogen 2T784 + 5% Mycogen 2T777) were very low and ranged from 0.04–0.05. Although the mean node-injury rating for Force 3G was numerically greater (0.31), it was not statistically different from SmartStax or the seed-blend. The percentage of roots with a node-injury rating < 0.25 was very high for SmartStax and the seed-blend (95–100%), moderately high for Force 3G (58%), and very low for the UTC (17%).

Mean node-injury ratings for the root systems included in the root clusters for the seed-blend treatment are reported in Table 2.3. The mean node-injury rating for refuge root systems was 0.68; mean node-injury ratings for the two rootworm-Bt root systems were each 0.03. These values were statistically similar to each other and were significantly smaller than the mean node-injury rating for the refuge root systems.

TABLE 2.3 • Spatial analysis of root-injury for seed-blend root clusters, Urbana, University of Illinois, 2011

Location[1]	Mean node-injury rating[2,3,4,5] 13 July
Refuge (Mycogen 2T777[6])	0.68 a
Adjacent (Mycogen 2T784[6])	0.03 b
Distal (Mycogen 2T784[6])	0.03 b

[1] Indicates location of root system within the root cluster (see Figure 2.1).
[2] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[3] Mean node-injury ratings were derived from three root systems per plot in each of four replications.
[4] Means followed by the same letter do not differ significantly (*P* = 0.05, PROC MIXED).
[5] Data were analyzed using a square-root transformation; actual means are shown.
[6] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.

TABLE 2.2 • Evaluation of Force 3G and a seed-blend to control corn rootworm larvae, Urbana, University of Illinois, 2011

Product	Rate[1]	Placement	Mean node-injury rating[2,3,4,5,6] 13 July	% consistency < 0.25[7,8]
Force 3G + Mycogen 2T777[9]	4	NU furrow[11]	0.31 a	58
SmartStax (Mycogen 2T784[9])	—	—	0.04 a	100
95% SmartStax (Mycogen 2T784[9]) + 5% Mycogen 2T777[9]	—	—	0.05 a	95
UTC[10] (Mycogen 2T777[9])	—	—	1.12 b	17

[1] Rates of application for Force 3G are ounces (oz) of product per 1,000 ft of row.
[2] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[3] For non-seed-blend treatments, mean node-injury ratings were derived from six root systems in each of four replications.
[4] For the seed-blend treatment, a weighted formula was used to calculate the mean node-injury rating.
[5] Means followed by the same letter do not differ significantly (*P* = 0.05, PROC MIXED).
[6] Data were analyzed using a square-root transformation; actual means are shown.
[7] Percentage of roots with a node-injury rating < 0.25.
[8] For the seed blend treatment, a weighted formula was used to calculate percentage consistency.
[9] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[10] UTC = untreated check.
[11] Applied with modified Noble metering units.

SECTION 3

Evaluation of Force 2.1CS, SmartStax, and a seed-blend to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2011

Ronald E. Estes, Nicholas A. Tinsley, and Michael E. Gray

Location

We established one trial at the University of Illinois Agricultural Engineering Farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 10 ft (four rows) x 40 ft. For the seed-blend, one root cluster was extracted from rows one and four of each plot on 13 July—each cluster contained a non-rootworm Bt refuge root system and four adjacent rootworm Bt root systems (Figure 3.1). For non-seed-blend treatments, five randomly selected root systems were extracted from rows one and four of each plot. Root systems were washed and rated for corn rootworm larval injury using the 0 to 3 node-injury scale developed by Oleson et al. (2005) (Appendix I). The percentage of roots with a node-injury rating less than 0.25 was determined for each product. For the seed-blend treatment, a weighted formula was used to calculate the mean node-injury rating and percentage consistency.

Planting, Insecticide Application, and Yield

The trial was planted on 13 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches. Force 2.1CS was applied at a spray volume of 5 gallons per acre (gal/A) using a CO_2 system. The insecticide was applied in front of the firming wheels on the planter. Twisted drag chains were attached behind each of the row units to improve insecticide incorporation. Active ingredients for all insecticides are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each plot on 8 October. Weights were converted to bushels per acre (bu/A) at 15.5% moisture. To ensure uniform plant densities across all plots, plant populations in the harvested rows had been thinned at the V7 growth stage to 32,000 plants per acre.

Agronomic Information

Agronomic information is listed in Table 3.1.

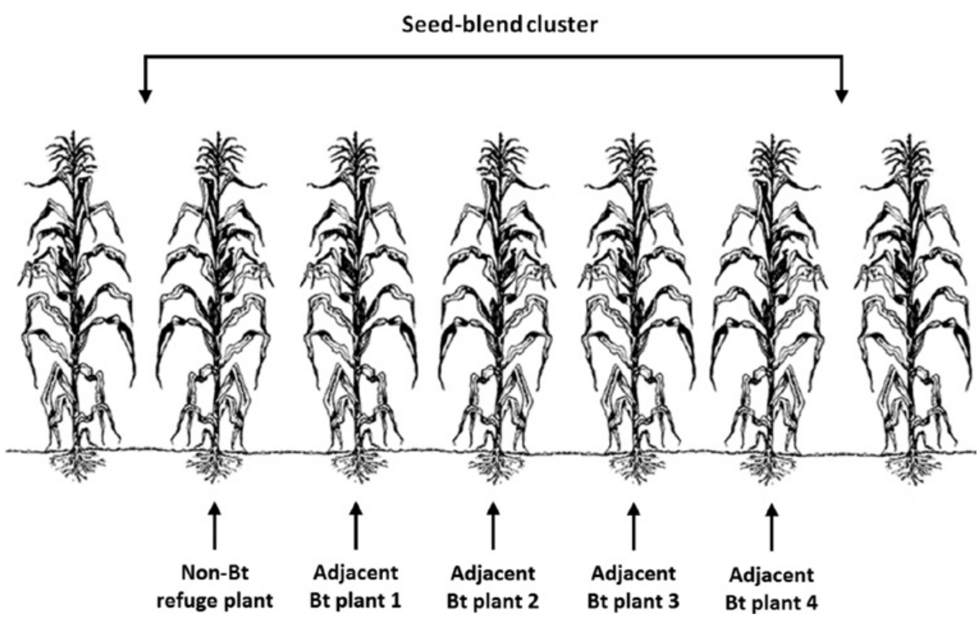

FIGURE 3.1 • **Diagram of root cluster selection for the seed-blend treatment, Urbana, University of Illinois, 2011**

TABLE 3.1 • **Agronomic information for efficacy trial of Force 2.1CS, SmartStax, and a seed-blend to control corn rootworm larvae, Urbana, University of Illinois, 2011**

Planting date	13 May
Root evaluation date	13 July
Harvest date	8 October
Hybrids	DKC61-21 DKC61-21JRM SmartStax RIB[1] (95/5) DKC61-22 RR2
Row spacing	30 inches
Seeding rate	36,000/acre
Previous crop	Trap crop[2]
Tillage	Fall—chisel plow Spring—field cultivator

[1] Refuge-in-the-bag (95% rootworm-Bt seed, 5% non-rootworm-Bt seed).
[2] Late-planted corn and pumpkins.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using SAS 9.2 (Copyright© 2002–2008 SAS Institute, Inc., Cary, NC).

Results and Discussion

Mean node-injury ratings, consistency percentages, and yield are reported in Table 3.2. The mean node-injury rating for the untreated check (UTC) was 0.75, indicating that corn rootworm larval feeding was low to moderate. Mean node-injury ratings for SmartStax and the seed-blend (95% DKC61-21 + 5% non-rootworm Bt hybrid), with and without the addition of Force 2.1CS, were very low and ranged from

TABLE 3.2 • **Evaluation of Force 2.1CS, SmartStax, and a seed-blend to control corn rootworm larvae, Urbana, University of Illinois, 2011**

Product	Rate[1]	Placement	Mean node-injury rating[2,3,4,5,6] 13 July	% consistency < 0.25[7,8]	Mean yield (bu/A)[9,10] 8 Oct
Force 2.1CS + DKC61-22[11]	0.46	Band	0.23 b	78	163 b
Force 2.1CS + SmartStax (DKC61-21[11])	0.46	Band	0.00 c	100	219 a
Force 2.1 CS + SmartStax RIB[12] (DKC61-21JRM[13])	0.46	Band	0.00 c	100	214 a
SmartStax (DKC61-21[11])	—	—	0.01 c	98	219 a
SmartStax RIB[12] (DKC61-21JRM[13])	—	—	0.02 c	98	208 a
UTC[14] (DKC61-22[11])	—	—	0.75 a	25	162 b

[1] Rates of application for Force 2.1CS are ounces (oz) of product per 1,000 ft of row.
[2] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[3] For non-seed-blend treatments, mean node-injury ratings were derived from ten root systems in each of four replications.
[4] For the seed-blend treatment, a weighted formula was used to calculate the mean node-injury rating.
[5] Means followed by the same letter do not differ significantly ($P = 0.05$, PROC MIXED).
[6] Data were analyzed using a square-root transformation; actual means are shown.
[7] Percentage of roots with a node-injury rating < 0.25.
[8] For the seed blend treatment, a weighted formula was used to calculate percentage consistency.
[9] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture.
[10] Means followed by the same letter do not differ significantly ($P = 0.10$, PROC MIXED).
[11] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[12] RIB = refuge-in-the-bag (95% rootworm-Bt seed, 5% non-rootworm-Bt seed).
[13] Seed treated with Poncho (clothianidin), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[14] UTC = untreated check.

0.00–0.02. All treatments had significantly lower node-injury ratings than the UTC, but Force 2.1CS by itself had significantly more root injury than SmartStax (and the seed-blend), with or without additional insecticide. The percentage of roots with a node-injury rating < 0.25 was very high for SmartStax and the seed-blend (98–100%), moderately high for Force 2.1CS by itself (78%), and very low for the UTC (25%). Yields in the SmartStax treatments ranged from 208 to 219 bu/A and were significantly greater than the UTC (162 bu/A). The yield of the Force treatment (163 bu/A) was not significantly different from the UTC.

Mean node-injury ratings for the root systems included in the root clusters for the seed-blend treatment are reported in Table 3.3. The mean node-injury rating for refuge root systems (0.26) was significantly greater than the adjacent Bt root systems (0.00–0.01) The mean node-injury ratings for the adjacent Bt root systems were statistically similar.

TABLE 3.3 • Spatial analysis of root-injury for seed-blend root clusters, Urbana, University of Illinois, 2011

Location[1]	Mean node-injury rating[2,3,4,5] 13 July
Refuge[6]	0.26 a
Adjacent 1 (DKC61-21[7])	0.01 b
Adjacent 2 (DKC61-21[7])	0.00 b
Adjacent 3 (DKC61-21[7])	0.00 b
Adjacent 4 (DKC61-21[7])	0.00 b

[1] Indicates location of root system within the root cluster (see Figure 3.1).
[2] Mean node-injury ratings are based on the 0 to 3 node-injury scale (Oleson et al. 2005, Appendix I).
[3] Mean node-injury ratings were derived from two root systems per plot in each of four replications.
[4] Means followed by the same letter do not differ significantly ($P = 0.05$, PROC MIXED).
[5] Data were analyzed using a square-root transformation; actual means are shown.
[6] The identity for the refuge hybrid used in DKC61-21JRM was not provided.
[7] Seed treated with Poncho (clothianidin), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.

SECTION 4

Evaluation of experimental and commercially available foliar-applied insecticides to control silk-feeding beetles in Illinois, 2011

Nicholas A. Tinsley, Ronald E. Estes, and Michael E. Gray

Location

We established one trial at the University of Illinois Agricultural Engineering Farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. Plot size for each treatment was 10 ft (four rows) x 30 ft. Densities of silk-feeding beetles were estimated by counting the total number of beetles on 10 ears in each plot. After the application of insecticides, beetle densities were assessed on 22 and 27 July, and on 3 August (2, 7, and 14 days after treatment [DAT], respectively).

Planting, Insecticide Application, and Yield

The trial was planted on 20 May using a four-row, ALMACO constructed planter with John Deere 7300 row units. Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches. Insecticides were applied on 20 July with a CO_2 backpack sprayer and a four-row boom. For treatments receiving a spray volume of 15 gallons per acre (gal/A), TeeJet TTJ60-1102VP spray tips were calibrated. For treatments receiving a spray volume of 1 gal/A, TeeJet TJ80-0017 spray tips were calibrated and a TeeJet 126 strainer was used. Active ingredients for all insecticides, including those not registered for commercial use, are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each plot on 9 October. Weights were converted to bushels per acre (bu/A) at 15.5% moisture. To ensure uniform plant densities across all plots, plant populations in the harvested rows were thinned at the V7 growth stage to 34,000 plants per acre.

Agronomic Information

Agronomic information is listed in Table 4.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean densities of silk-feeding beetles and yield are presented in Table 4.2. Although some beetles were observed on 20 July, the focus of this discussion will be on the densities of beetles on dates following the application of foliar insecticides.

Mean densities of Japanese beetles and northern corn rootworm beetles were very low across all sampling dates and never exceeded 0.8 beetles per 10 ears. No significant differences were observed between foliar insecticides or the untreated check (UTC) for densities of these beetles on any sampling date.

While no significant differences were observed in the mean number of western corn rootworm beetles between foliar insecticides or the UTC on 22 July (2 DAT), some differences were observed on subsequent sampling dates. On 27 July (7 DAT), low-volume Endigo ZCX and Warrior II had statistically similar mean numbers of western corn rootworm beetles as the UTC. No differences were observed among the remaining foliar insecticides, however, all had lower densities than the UTC. Although some significant differences were

TABLE 4.1 • Agronomic information for efficacy trial of experimental and commercially available foliar-applied insecticides to control silk-feeding beetles, Urbana, University of Illinois, 2011

Planting date	20 May
Harvest date	9 October
Hybrid	Pioneer P0916X
Row spacing	30 inches
Seeding rate	36,000/acre
Previous crop	Corn
Tillage	Fall—chisel plow Spring—field cultivator

observed on 3 August (14 DAT), none of the insecticide treatments had a statistically different mean number of western corn rootworm beetles than the UTC. No significant differences in yield were observed among the treatments.

TABLE 4.2 • Evaluation of experimental and commercially available foliar-applied insecticides to control silk-feeding beetles, Urbana, University of Illinois, 2011

Product[1]	Rate[2]	Spray volume[3]	Mean no. Japanese beetles per 10 ears[4,5]				Mean no. northern corn rootworm beetles per 10 ears[4,5]			
			20 July (0 DAT[6])	22 July (2 DAT[6])	27 July (7 DAT[6])	3 Aug (14 DAT[6])	20 July (0 DAT[6])	22 July (2 DAT[6])	27 July (7 DAT[6])	3 Aug (14 DAT[6])
Endigo ZC	4.5	15	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Endigo ZC	4.5	1	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Endigo ZCX[9]	4.5	15	0.0 a	0.3 a	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a
Endigo ZCX[9]	4.5	1	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
Voliam Xpress	9	15	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a
Warrior II	1.92	15	0.3 a	0.0 a	0.0 a	0.5 a	0.0 a	0.0 a	0.0 a	0.0 a
Warrior II	1.92	1	0.0 a	0.0 a	0.0 a	0.8 a	0.3 a	0.0 a	0.0 a	0.0 a
UTC[10]	—	—	0.3 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a

[1] Crop oil concentrate (COC) was added to foliar insecticide applications at a rate of 1% volume per volume of spray solution.
[2] Rates of application for foliar insecticides are ounces of product per acre (oz/A).
[3] Spray volumes for foliar insecticides are gallons per acre (gal/A).
[4] Means were derived from the numbers of beetles on 10 ears per treatment in each of four replications.
[5] Means for the same insect, on the same date, and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[6] DAT = days after treatment (with insecticide).
[7] Corn was harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 15.5% moisture.
[8] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[9] Endigo ZCX is not registered for commercial use.
[10] UTC = untreated check.

TABLE 4.2 (CONTINUED) • Evaluation of experimental and commercially available foliar-applied insecticides to control silk-feeding beetles, Urbana, University of Illinois, 2011

Product[1]	Rate[2]	Spray volume[3]	Mean no. western corn rootworm beetles per 10 ears[4,5]				Mean yield (bu/acre)[7,8] 9 Oct
			20 July (0 DAT[6])	22 July (2 DAT[6])	27 July (7 DAT[6])	3 Aug (14 DAT[6])	
Endigo ZC	4.5	15	1.8 a	0.0 a	0.3 b	2.0 ab	242 a
Endigo ZC	4.5	1	2.0 a	2.3 a	0.8 b	6.5 a	232 a
Endigo ZCX[9]	4.5	15	3.3 a	0.0 a	0.3 b	0.0 b	218 a
Endigo ZCX[9]	4.5	1	3.8 a	1.3 a	6.3 a	4.5 ab	236 a
Voliam Xpress	9	15	2.5 a	0.0 a	0.5 b	1.3 b	221 a
Warrior II	1.92	15	2.3 a	0.0 a	0.3 b	0.5 b	236 a
Warrior II	1.92	1	1.3 a	0.8 a	2.3 ab	6.0 a	238 a
UTC[10]	—	—	3.3 a	0.8 a	5.3 a	2.0 ab	223 a

[1] Crop oil concentrate (COC) was added to foliar insecticide applications at a rate of 1% volume per volume of spray solution.
[2] Rates of application for foliar insecticides are ounces of product per acre (oz/A).
[3] Spray volumes for foliar insecticides are gallons per acre (gal/A).
[4] Means were derived from the numbers of beetles on 10 ears per treatment in each of four replications.
[5] Means for the same insect, on the same date, and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[6] DAT = days after treatment (with insecticide).
[7] Corn was harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 15.5% moisture.
[8] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[9] Endigo ZCX is not registered for commercial use.
[10] UTC = untreated check.

SECTION 5

Evaluation of Bt hybrids and a seed-blend to control black cutworm larvae (*Agrotis ipsilon*) in Illinois, 2011

Nicholas A. Tinsley, Ronald E. Estes, and Michael E. Gray

Location

We established one trial at the University of Illinois Agricultural Engineering Farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. Plot size for each treatment was 2.5 ft (1 row) x 10 ft. Steel barriers (6 in x 4.5 ft, 5 in tall) were placed around approximately 10 consecutive plants in each plot. Each plant within the barrier was infested with two third-instar black cutworm larvae on 3 June. The number of plants that were fed upon or cut by the larvae was recorded on 6, 10, 17, and 24 June (3, 7, 14, and 21 days after infestation [DAI], respectively).

Planting

The trial was planted on 12 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches.

Agronomic Information

Agronomic information is listed in Table 5.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

The mean percentages of plants cut and plants with feeding injury for dates following infestation with black cutworm larvae are presented in Table 5.2.

Across all sampling dates, the percentage of plants cut was very small and ranged from 0–7%. No significant differences in the percentage of plants cut were observed between any of the treatments on any sampling date.

There was a significant amount of feeding injury for the untreated checks (UTCs) across all sampling dates—the percentage of plants with feeding injury ranged from 62–95%. On all sampling dates, Mycogen 2T777 had a significantly greater amount of feeding injury than DKC63-45. The percentage of plants with feeding injury was significantly smaller for the Bt hybrids and the seed-blend when compared with the UTCs and ranged from 18–37%. No significant differences in the percentage of plants with feeding injury were observed between the Bt hybrids or the seed-blend on any sampling date.

TABLE 5.1 • Agronomic information for efficacy trial of Bt hybrids and a seed-blend to control black cutworm larvae, Urbana, University of Illinois, 2011

Planting date	12 May
Hybrids	DKC63-25 YieldGard VT2 DKC63-25BJW YieldGard VT2 RIB[1] DKC63-45 RR2 Mycogen 2T777 RR2 Mycogen 2T784 SmartStax
Row spacing	30 inches
Seeding rate	36,000/acre
Previous crop	Corn
Tillage	Fall—chisel plow Spring—field cultivator

[1] Refuge-in-the-bag (90% Bt seed, 10% non-Bt seed).

TABLE 5.2 • **Evaluation of Bt hybrids and a seed-blend to control black cutworm larvae, Urbana, University of Illinois, 2011**

Product	6 June (3 DAI[1])		10 June (7 DAI[1])		17 June (14 DAI[1])		24 June (21 DAI[1])	
	Mean % of plants cut[2]	Mean % of plants with feeding injury[2]	Mean % of plants cut[2]	Mean % of plants with feeding injury[2]	Mean % of plants cut[2]	Mean % of plants with feeding injury[2]	Mean % of plants cut[2]	Mean % of plants with feeding injury[2]
SmartStax (Mycogen 2T784[3])	0 a	26 c	2 a	26 c	2 a	37 c	2 a	37 c
YieldGard VT2 (DKC63-25[4])	0 a	23 c	2 a	30 c	2 a	32 c	2 a	32 c
YieldGard VT2 RIB[5] (DKC63-25BJW[6])	0 a	18 c	0 a	25 c	0 a	32 c	0 a	32 c
UTC[7] (DKC63-45[4])	0 a	62 b	7 a	69 b	7 a	69 b	7 a	69 b
UTC[7] (Mycogen 2T777[3])	0 a	88 a	4 a	93 a	6 a	95 a	6 a	95 a

[1] DAI = days after infestation (with black cutworm larvae).
[2] Means followed by the same letter do not differ significantly (*P* = 0.05, Duncan's New Multiple Range Test).
[3] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[4] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[5] Refuge-in-the-bag (90% Bt seed, 10% non-Bt seed).
[6] Seed treated with Poncho (clothianidin), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[7] UTC = untreated check.

SECTION 6

Evaluation of Bt hybrids and a seed-blend to control corn earworm larvae (*Helicoverpa zea*) in Illinois, 2011

Ronald E. Estes, Nicholas A. Tinsley, and Michael E. Gray

Location

We established one trial at the University of Illinois Agricultural Engineering Farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. Plot size for each treatment was 10 ft (four rows) x 30 ft. Densities of ear-feeding lepidopteran pests (fall armyworms, corn earworms, and European corn borers) were assessed on 25 August (at the R3 growth stage); only corn earworm larvae were present. Densities were estimated by counting the total number of larvae on 10 ears in each plot. The number of kernels consumed was recorded for each ear that was evaluated.

Planting Information

The trial was planted on 13 June using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). The planting date was later than normal to attract late-season flights of corn earworm. Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches.

Agronomic Information

Agronomic information is listed in Table 6.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

The mean number of corn earworm larvae and kernels consumed per ear are reported in Table 6.2.

Densities of corn earworm larvae were small at the time of sampling. Both untreated checks (UTCs) had significantly more corn earworm larvae and kernels consumed per ear than SmartStax or YieldGard VT2 plants. The DeKalb UTC (DKC63-45) had significantly more kernels consumed per ear than any other hybrid in the trial.

TABLE 6.1 • Agronomic information for efficacy trial of Bt hybrids and a seed-blend to control corn earworm larvae, Urbana, University of Illinois, 2011

Planting date	13 June
Hybrids	DKC63-25 YieldGard VT2 DKC63-25BJW YieldGard VT2 RIB[1] DKC63-45 RR2 Mycogen 2T777 RR2 Mycogen 2T784 SmartStax
Row spacing	30 inches
Seeding rate	36,000/acre
Previous crop	Corn
Tillage	Fall—chisel plow Spring—field cultivator

[1] Refuge-in-the-bag (90% Bt seed, 10% non-Bt seed).

TABLE 6.2 • Evaluation of Bt hybrids and a seed-blend to control corn earworm larvae, Urbana, University of Illinois, 2011

Product	Mean no. of CEW[1] larvae per ear[2,3,4]	Mean no. of kernels consumed per ear[3,4,5]
SmartStax (Mycogen 2T784[6])	0.00 b	0.00 c
YieldGard VT2 (DKC63-25[7])	0.18 b	1.68 c
YieldGard VT2 RIB[8] (DKC63-25BJW[9])	0.05 b	1.00 c
UTC[10] (DKC63-45[7])	1.38 a	30.43 a
UTC[10] (Mycogen 2T777[6])	0.90 a	7.90 b

[1] CEW = corn earworm.
[2] Means were derived from the numbers of larvae on 10 ears per treatment in each of four replications.
[3] Means followed by the same letter do not differ significantly (*P* = 0.05, Duncan's New Multiple Range Test).
[4] Data were analyzed using a square root transformation; actual means are shown.
[5] Means were derived from the numbers of kernels consumed on 10 ears per treatment in each of four replications.
[6] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[7] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[8] RIB = refuge-in-the-bag (90% Bt seed, 10% non-Bt seed).
[9] Seed treated with Poncho (clothianidin), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[9] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[10] UTC = untreated check.

SECTION 7

Evaluation of Bt hybrids and a seed-blend to control European corn borer larvae (*Ostrinia nubilalis*) in Illinois, 2011

Ronald E. Estes, Nicholas A. Tinsley, and Michael E. Gray

Location

We established one trial at the University of Illinois Agricultural Engineering Farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 10 ft (four rows) x 30 ft. A Davis inoculator was used to place approximately 90 neonate European corn borer larvae near the tip and base of the ear on 10 consecutive plants in row two of each plot on 26 July (at the R1 growth stage). Densities of European corn borer larvae were assessed on 26 August (31 days after infestation [DAI]). Densities were estimated by splitting the stalks of 10 plants in each plot and counting the total number of larvae. The number and total length of tunnels that were present were also recorded for each plant evaluated.

Planting Information

The trial was planted on 12 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches.

Agronomic Information

Agronomic information is listed in Table 7.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Means for the number of European corn borer larvae, number of tunnels, and tunnel length per plant are reported in Table 7.2.

No European corn borer larvae or tunnels were observed in any plot with SmartStax plants. Virtually no European corn borer larvae or tunnels were observed in any plot with YieldGard VT2 or YieldGard VT2 RIB plants, which provided statistically similar levels of protection as the SmartStax plants. The untreated checks (UTCs) had significantly more larvae and damage than any of the Bt hybrids. The DeKalb UTC had significantly more larvae and damage than the Mycogen UTC.

TABLE 7.1 • Agronomic information for efficacy trial of Bt hybrids and a seed-blend to control European corn borer larvae, Urbana, University of Illinois, 2011

Planting date	12 May
Hybrids	DKC63-25 YieldGard VT2 DKC63-25BJW YieldGard VT2 RIB[1] DKC63-45 RR2 Mycogen 2T777 RR2 Mycogen 2T784 SmartStax
Row spacing	30 inches
Seeding rate	36,000/acre
Previous crop	Corn
Tillage	Fall—chisel plow Spring—field cultivator

[1] Refuge-in-the-bag (90% Bt seed, 10% non-Bt seed).

TABLE 7.2 • **Evaluation of Bt hybrids and a seed-blend to control European corn borer larvae, Urbana, University of Illinois, 2011**

Product	Mean no. of ECB[1] larvae per ear[2,3]	Mean no. of tunnels per plant[3,4]	Mean tunnel length per plant[3,5]
SmartStax (Mycogen 2T784[6])	0.00 c	0.00 c	0.00 c
YieldGard VT2 (DKC63-25[7])	0.03 c	0.08 c	0.30 c
YieldGard VT2 RIB[8] (DKC63-25BJW[9])	0.05 c	0.08 c	0.10 c
UTC[10] (DKC63-45[7])	2.50 a	4.55 a	15.58 a
UTC[10] (Mycogen 2T777[6])	1.33 b	2.68 b	8.83 b

[1] ECB = European corn borer.
[2] Means were derived from the numbers of larvae in 10 plants per treatment in each of four replications.
[3] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] Means were derived from the numbers of tunnels in 10 plants per treatment in each of four replications.
[5] Means were derived from the total length of tunnels in 10 plants per treatment in each of four replications.
[6] Seed treated with Cruiser (thiamethoxam), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[7] Seed treated with Poncho (clothianidin), 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[8] RIB = refuge-in-the-bag (90% Bt seed, 10% non-Bt seed).
[9] Seed treated with Poncho (clothianidin), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[10] UTC = untreated check.

SECTION 8

Demonstration of YieldGard VT3 sweet corn to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2011

Ronald E. Estes , Nicholas A. Tinsley, and Michael E. Gray

Location

We established two trials at University of Illinois research and education centers near DeKalb (DeKalb County) and Urbana (Champaign County).

Experimental Design and Methods

This was a demonstration trial because the treatments were not replicated. The plot size for each treatment was 30 ft (twelve rows) x 50 ft. Twenty randomly selected root systems were extracted from rows one and twelve of each plot on 13 and 18 July at Urbana and DeKalb, respectively. Root systems were washed and rated for corn rootworm larval injury using the 0 to 3 node-injury scale developed by Oleson et al. (2005) (Appendix I).

Planting and Insecticide Application

Trials were planted on 10 and 11 May at DeKalb and Urbana, respectively. All trials were planted using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1.75 inches. Warrior II was applied at three- to five-day intervals with a CO_2 backpack sprayer and a four-row boom. TeeJet TTJ60-1102VP spray tips were calibrated to deliver a volume of 20 gallons per acre (gal/A). Active ingredients for all insecticides are listed in Appendix II.

Agronomic Information

Agronomic information for both locations is listed in Table 8.1.

Climatic Conditions

Temperature and precipitation data for both locations are presented in Appendix III.

Results and Discussion

Beginning at VT, foliar applications of Warrior II were made at 3- to 5-day intervals in designated plots to control ear feeding lepidopteron pests. Although these foliar applications were made, the focus of this discussion will be on the damage caused by corn rootworm larvae, and the protection provided by the use of YieldGard VT3.

Mean node-injury ratings for DeKalb and Urbana are reported in Table 8.2. Because this was a non-replicated trial, statistical comparisons cannot be made. Node-injury ratings ranged from 0.09–1.48 in DeKalb and 0.03–1.35 in Urbana. Mean node-injury ratings in the non-rootworm Bt hybrids ranged from 1.12–1.48 indicating that corn rootworm larval feeding was moderate to severe at both locations. Obsession VT3 provided excellent protection from injury caused by corn rootworm

TABLE 8.1 • Agronomic information for demonstration trials of YieldGard VT3 sweet corn to control corn rootworm larvae, University of Illinois, 2011

	DeKalb	Urbana
Planting date	11 May	10 May
Root evaluation date	18 July	13 July
Hybrids	Attribute Obsession Obsession YieldGard VT3	Attribute Obsession Obsession YieldGard VT3
Row spacing	30 inches	30 inches
Seeding rate	23,000/acre	23,000/acre
Previous crop	Trap crop[1]	Trap crop[1]
Tillage	Fall—moldboard plow Spring—mulch finisher	Fall—chisel plow Spring—field cultivator

[1] Late-planted corn and pumpkins.

TABLE 8.2 • Demonstration of YieldGard VT3 sweet corn to control corn rootworm larvae, DeKalb and Urbana, University of Illinois, 2011

Hybrid	Rootworm Bt present	Mean node-injury rating	
		DeKalb 18 July	Urbana 13 July
Attribute[1]	No	1.48	1.35
Obsession[2]	No	1.37	1.12
Obsession VT3[2]	Yes	0.09	0.03

[1] Seed treated with Cruiser (thiamethoxam), 0.30 milligrams (mg) of active ingredient (a.i.) per seed.
[2] Seed treated with Poncho (clothianidin), 0.25 milligrams (mg) of active ingredient (a.i.) per seed.

larvae, keeping mean node injury ratings at 0.09 or below. Because treatments were not replicated, caution is urged in the interpretation of these observations.

SECTION 9

Evaluation of experimental and commercially available foliar-applied insecticides to control soybean aphids (*Aphis glycines*) and other insect pests of soybean in Illinois, 2011

Ronald E. Estes, Nicholas A. Tinsley, and Michael E. Gray

Location

We established one trial at the Adam Yoeckel Farm near Morrison (Whiteside County). Funding for this experiment was provided by the Illinois Soybean Association.

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 10 ft (four rows) x 30 ft. Insecticides were applied to designated plots on 19 August. Prior to insecticide application, densities of soybean aphids were estimated by counting the total number of aphids on 20 randomly selected plants in the trial area; densities of other insect pests were determined by taking 20 sweeps in 8 randomly selected plots using a 15-inch diameter sweep net. After the application of insecticides, densities of soybean aphids were estimated by counting the total number of aphids on three plants in each plot. Soybean aphid densities were assessed on 27 August, and on 3 and 10 September (7, 14, and 21 days after treatment [DAT], respectively). Densities of other insect pests were assessed on 27 August (7 DAT) by taking 20 sweeps in each plot with a 15-inch diameter sweep net.

Planting, Insecticide Application, and Yield

The trial was planted on 10 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1 inch. Insecticides were applied on 20 August with a CO_2 backpack sprayer and a four-row boom. TeeJet TTJ60-1102VP spray tips were calibrated to deliver a volume of 20 gallons per acre (gal/A). Active ingredients for all insecticides, except those with experimental designations, are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each plot on 6 October. Weights were converted to bushels per acre (bu/A) at 13% moisture.

Agronomic Information

Agronomic information is listed in Table 9.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean densities of soybean aphids, corn rootworm beetles, grasshoppers, green stink bugs, Japanese beetles and yields are reported in Table 9.2. Densities of all insects were very small across all sampling dates and never exceeded their economic thresholds. Prior to insecticide application, mean insect pest densities were:

- Soybean aphids—1.5 per plant
- Corn rootworm beetles—0.6 per plot
- Grasshoppers—0.1 per plot
- Green stink bugs—0.3 per plot
- Japanese beetles—6.0 per plot

TABLE 9.1 • Agronomic information for efficacy trial of experimental and commercially available foliar-applied insecticides to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Planting date	10 May
Harvest date	6 October
Soybean variety	Pioneer 92Y80
Row spacing	30 inches
Seeding rate	140,000/acre
Previous crop	Corn
Tillage	Spring—vertical tillage

No significant differences in the mean number of soybean aphids were observed through 3 September (14 DAT). On 10 September (21 DAT), all but one of the insecticide treatments, Declare + Nufos, had significantly smaller numbers of soybean aphids per plant than the untreated check (UTC).

There were no significant differences observed in mean densities of all other pests.

Due to the low number of pests found in the study, no significant differences in yield were observed among any of the treatments. This observation further justifies the value of scouting and using economic thresholds and demonstrates that there is no guarantee of a benefit from "insurance applications" of insecticides.

TABLE 9.2 • Evaluation of experimental and commercially available foliar-applied insecticides to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Product	Rate[1]	Mean no. soybean aphids per plant[2,3]			Mean no. corn rootworm beetles per plot[3,4]	Mean no. grass-hoppers per plot[3,4]	Mean no. green stink bugs per plot[3,4]	Mean no. Japanese beetles per plot[3,4]	Mean yield (bu/acre)[6,7] 6 Oct
		27 Aug (7 DAT[5])	3 Sep (14 DAT[5])	10 Sep (21 DAT[5])	27 Aug (7 DAT[5])	27 Aug (7 DAT[5])	27 Aug (7 DAT[5])	27 Aug (7 DAT[5])	
Baythroid XL	2.4	0.5 a	2.6 a	3.2 b	0.0 a	0.0 a	0.0 a	1.3 a	41 a
Baythroid XL + Lorsban 4E	2 4	0.1 a	1.5 a	0.3 b	0.0 a	0.3 a	0.0 a	1.5 a	38 a
Declare	1.02	1.2 a	1.9 a	1.9 b	0.0 a	0.0 a	0.0 a	0.5 a	41 a
Declare	1.28	0.2 a	0.2 a	0.3 b	0.3 a	0.0 a	0.0 a	1.3 a	36 a
Declare + Nufos 4E	1.02 4	0.1 a	0.3 a	5.6 ab	0.0 a	0.0 a	0.3 a	0.0 a	43 a
F-9210	4	0.7 a	3.8 a	1.8 b	0.0 a	0.0 a	0.0 a	0.5 a	38 a
F-9210	4.8	0.4 a	5.2 a	1.0 b	0.0 a	0.0 a	0.0 a	0.5 a	37 a
Hero	10.3	0.3 a	0.8 a	0.2 b	0.0 a	0.0 a	0.0 a	0.3 a	40 a
Leverage 360	2.8	0.2 a	1.5 a	1.3 b	0.0 a	0.8 a	0.0 a	0.0 a	42 a
Warrior II	1.54	0.5 a	2.3 a	1.0 b	0.0 a	0.5 a	0.3 a	1.3 a	37 a
UTC[8]	—	2.0 a	7.0 a	9.7 a	0.0 a	0.0 a	0.3 a	1.8 a	39 a

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of soybean aphids on three plants in each plot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] Means were derived from the numbers of insects per 20 sweeps in each plot in each of four replications.
[5] DAT = days after treatment (with insecticide).
[6] Soybeans were harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 13% moisture.
[7] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[8] UTC = untreated check.

SECTION 10

Evaluation of resistant soybean lines and Cobalt to control soybean aphids (*Aphis glycines*) and other insect pests of soybean in Illinois, 2011

Nicholas A. Tinsley, Ronald E. Estes, Michael E. Gray, and Brian W. Diers

Location

We established one trial at the Adam Yoeckel Farm near Morrison (Whiteside County). Funding for this experiment was provided by the Illinois Soybean Association.

Experimental Design and Methods

The experimental design was a split-plot, randomized complete block with four replications. The plot size for each treatment was 20 ft (eight rows) x 30 ft. One half (four rows) of each plot was treated with a foliar-applied insecticide for yield comparisons. The remaining half was not treated with an insecticide. Six experimental soybean lines were provided from the soybean breeding program at the University of Illinois—four of the lines contained resistance to soybean aphids. The resistant lines LD05-16657a and LD06-16721a contained the *Rag1* resistance gene (their susceptible near-isoline was Dwight). The resistant lines LD09-15081a and LD09-15179a contained the *Rag2* gene (their susceptible near-isoline was LD02-4485). These genes do not provide protection against feeding by any of the other insect pests we assessed during this trial.

Densities of soybean aphids were determined by counting the total number of soybean aphids on each of three plants in each subplot. Densities of other insect pests were determined by taking 20 sweeps per plot with a 15-inch diameter sweep net. After the application of insecticides, densities of soybean aphids were assessed on 27 August, and on 3 and 10 September (7, 14, and 21 days after treatment [DAT], respectively). Densities of other insect pests were assessed on 27 August (7 DAT).

Planting, Insecticide Application, and Yield

The trial was planted on 10 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1 inch. Insecticide was applied on 20 August with a CO_2 backpack sprayer and a four-row boom. TeeJet TTJ60-1102VP spray tips were calibrated to deliver a volume of 20 gallons per acre (gal/A). Active ingredients for all insecticides are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each subplot on 6 October. Weights were converted to bushels per acre (bu/A) at 13% moisture.

Agronomic Information

Agronomic information is listed in Table 10.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean densities of soybean aphids, other insect pests of soybean, and yield are presented in Table 10.2. Although some soybean aphids and other insect pests were observed on 17 or 19 August, the focus of this discussion will be on the densities of insects following the application of Cobalt (20 August).

TABLE 10.1 • Agronomic information for efficacy trial of resistant soybean lines and Cobalt to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Planting date	10 May
Harvest date	6 October
Lines	Dwight LD05-16657a LD06-16721a LD02-4485 LD09-15081a LD09-15179a
Row spacing	30 inches
Seeding rate	140,000/acre
Previous crop	Corn
Tillage	Spring—vertical tillage

Mean densities of soybean aphids were very low across all sampling dates. No significant differences were observed between treatments through 3 September (14 DAT). On 10 September (21 DAT), LD05-16657a with Cobalt had statistically more soybean aphids per plant than all other treatments; however, this density was well below the economic threshold of 250 soybean aphids per plant (Ragsdale et al. 2007). Mean densities of other insect pests were very low. No significant differences were observed among any of the treatments across all sampling dates.

While the addition of Cobalt resulted in significantly greater mean yields for Dwight, LD02-4485, and LD09-15179a, differences in yield are difficult to interpret because densities of pests were very low. For example, the aphid-susceptible line LD02-4485 had the greatest yield among all of the treatments (44.4 bu/A). A small, but significant, increase in yield (39.3 to 42.8 bu/A) was observed when Cobalt was applied to Dwight (not resistant to soybean aphids).

TABLE 10.2 • **Evaluation of resistant soybean lines and Cobalt to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011**

Product	Resistance to Soybean Aphids	Rate[1]	Mean no. soybean aphids per plant[2,3]				Mean no. bean leaf beetles per plot[3,4]		Mean no. brown stink bugs per plot[3,4]		Mean no. corn rootworm beetles per plot[3,4]	
			17 Aug (0 DAT[5])	27 Aug (7 DAT[5])	3 Sep (14 DAT[5])	10 Sep (21 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])
Dwight	No	—	5.6 a	3.2 a	2.4 a	1.5 b	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a
LD05-16657a	Yes[6]	—	0.2 a	1.3 a	12.7 a	3.6 b	0.0 a	0.8 a	0.5 a	0.0 a	0.5 a	0.3 a
LD06-16721a	Yes[6]	—	0.9 a	0.4 a	2.5 a	1.3 b	0.0 a	0.1 a	0.0 a	0.0 a	1.0 a	0.1 a
LD02-4485	No	—	1.3 a	4.6 a	17.9 a	1.4 b	0.0 a	0.1 a	0.5 a	0.0 a	0.3 a	0.1 a
LD09-15081a	Yes[7]	—	0.8 a	0.7 a	2.8 a	1.3 b	0.0 a	0.1 a	0.5 a	0.0 a	0.8 a	0.4 a
LD09-15179a	Yes[7]	—	0.2 a	1.1 a	4.2 a	0.7 b	0.0 a	0.0 a	0.3 a	0.0 a	0.3 a	0.0 a
Dwight + Cobalt	No	13	2.5 a	0.2 a	0.1 a	0.5 b	0.0 a	0.4 a	0.0 a	0.0 a	0.3 a	0.1 a
LD05-16657a + Cobalt	Yes[6]	13	1.1 a	1.6 a	7.7 a	26.8 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a	0.0 a
LD06-16721a + Cobalt	Yes[6]	13	0.4 a	0.5 a	1.2 a	0.0 b	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.0 a
LD02-4485 + Cobalt	No	13	2.6 a	3.3 a	3.2 a	0.5 b	0.0 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a
LD09-15081a + Cobalt	Yes[7]	13	0.4 a	0.3 a	0.3 a	0.2 b	0.0 a	0.0 a	0.0 a	0.0 a	0.3 a	0.3 a
LD09-15179a + Cobalt	Yes[7]	13	0.2 a	0.5 a	4.3 a	1.7 b	0.3 a	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of soybean aphids on three plants in each subplot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] Means were derived from the numbers of insects per 20 sweeps in each subplot in each of four replications.
[5] DAT = days after treatment (with insecticide).
[6] Resistance was conferred by the *Rag1* gene.
[7] Resistance was conferred by the *Rag2* gene.
[8] Soybeans were harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 13% moisture.
[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).

TABLE 10.2 (CONTINUED) • Evaluation of resistant soybean lines and Cobalt to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Product	Resistance to Soybean Aphids	Rate[1]	Mean no. grasshoppers per plot[3,4]		Mean no. green cloverworms per plot[3,4]		Mean no. green stink bugs per plot[3,4]		Mean no. Japanese beetles per plot[3,4]		Mean no. soybean loopers per plot[3,4]		Mean yield (bu/acre)[8,9]
			19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	19 Aug (0 DAT[5])	27 Aug (8 DAT[5])	6 Oct
Dwight	No	—	5.0 a	0.0 a	0.3 a	0.0 a	1.3 a	0.8 a	4.3 a	3.0 a	0.3 a	0.0 a	39.3 cd
LD05-16657a	Yes[6]	—	3.3 a	0.0 a	0.0 a	0.5 a	0.3 a	1.3 a	2.5 a	1.8 a	0.0 a	0.0 a	36.8 d
LD06-16721a	Yes[6]	—	6.3 a	0.3 a	0.0 a	0.0 a	1.3 a	0.1 a	9.3 a	4.4 a	0.3 a	0.0 a	36.7 d
LD02-4485	No	—	4.8 a	0.0 a	0.0 a	0.0 a	1.8 a	1.8 a	2.3 a	1.1 a	0.0 a	0.0 a	44.4 a
LD09-15081a	Yes[7]	—	4.5 a	0.3 a	0.0 a	0.0 a	0.0 a	0.1 a	4.0 a	2.4 a	0.0 a	0.0 a	43.0 ab
LD09-15179a	Yes[7]	—	1.8 a	0.0 a	0.5 a	0.0 a	0.3 a	1.0 a	2.8 a	2.5 a	0.5 a	0.0 a	37.3 d
Dwight + Cobalt	No	13	1.0 a	0.3 a	0.3 a	0.0 a	1.5 a	0.5 a	2.3 a	0.1 a	0.0 a	0.0 a	42.8 ab
LD05-16657a + Cobalt	Yes[6]	13	5.3 a	0.0 a	0.3 a	0.3 a	0.3 a	0.8 a	4.3 a	3.3 a	0.0 a	0.0 a	37.3 d
LD06-16721a + Cobalt	Yes[6]	13	6.5 a	0.5 a	0.0 a	0.0 a	1.5 a	0.8 a	4.8 a	1.5 a	0.0 a	0.0 a	36.8 d
LD02-4485 + Cobalt	No	13	2.0 a	0.3 a	0.5 a	0.3 a	1.0 a	0.3 a	2.0 a	0.5 a	0.0 a	0.0 a	41.3 bc
LD09-15081a + Cobalt	Yes[7]	13	3.0 a	0.0 a	0.3 a	0.0 a	0.8 a	0.3 a	4.3 a	2.5 a	0.0 a	0.0 a	40.5 bc
LD09-15179a + Cobalt	Yes[7]	13	1.8 a	0.3 a	0.0 a	0.5 a	0.3 a	0.5 a	3.8 a	0.5 a	0.0 a	0.0 a	42.2 abc

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of soybean aphids on three plants in each subplot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] Means were derived from the numbers of insects per 20 sweeps in each subplot in each of four replications.
[5] DAT = days after treatment (with insecticide).
[6] Resistance was conferred by the *Rag1* gene.
[7] Resistance was conferred by the *Rag2* gene.
[8] Soybeans were harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 13% moisture.
[9] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).

SECTION 11

Evaluation of experimental and commercially available foliar-applied insecticides to control soybean aphids (*Aphis glycines*) in Illinois, 2011

Ronald E. Estes, Nicholas A. Tinsley, and Michael E. Gray

Location

We established one trial at the Adam Yoeckel Farm near Morrison (Whiteside County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 10 ft (four rows) x 30 ft. Insecticides were applied to designated plots on 19 August. Prior to insecticide application, densities of soybean aphids were estimated by counting the total number of aphids on 20 randomly selected plants in the trial area. After the application of insecticides, densities of soybean aphids were estimated by counting the total number of aphids on five plants in each plot. Soybean aphid densities were assessed on 27 August, and on 3 and 10 September (7, 14, and 21 days after treatment [DAT], respectively).

Planting, Insecticide Application, and Yield

The trial was planted on 10 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1 inch. Insecticides were applied on 20 August with a CO_2 backpack sprayer and a four-row boom. TeeJet TTJ60-1102VP spray tips were calibrated to deliver a volume of 20 gallons per acre (gal/A). Active ingredients for all insecticides, including those not registered for commercial use, are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each plot on 6 October. Weights were converted to bushels per acre (bu/A) at 13% moisture.

Agronomic Information

Agronomic information is listed in Table 11.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean percent phytotoxicity, densities of soybean aphids, and yield are reported in Table 11.2.

No plant phytotoxicity was observed following insecticide application, indicating that the experimental compound Transform caused no observable damage to plant health.

Densities of soybean aphids were extremely small across all sampling dates and never exceeded 3 aphids per plant. No significant differences in numbers of soybean aphids were observed throughout the duration of the study.

Due to the low number of soybean aphids, no significant differences in yield were observed among any of the treatments. This observation further justifies the value of scouting and the economic threshold (250 soybean aphids per plant, Ragsdale et al. 2007) and demonstrates that there is no guaranteed benefit from "insurance applications" of insecticides.

TABLE 11.1 • Agronomic information for efficacy trial of experimental and commercially available foliar-applied insecticides to control soybean aphids, Morrison, University of Illinois, 2011

Planting date	10 May
Harvest date	6 October
Soybean variety	Pioneer 92Y80
Row spacing	30 inches
Seeding rate	140,000/acre
Previous crop	Corn
Tillage	Spring—vertical tillage

TABLE 11.2 • Evaluation of experimental and commercially available foliar-applied insecticides to control soybean aphids, Morrison, University of Illinois, 2011

Product	Rate[1]	% Phytotoxicity 27 Aug (7 DAT[4])	Mean no. soybean aphids per plant[2,3]			Mean yield (bu/acre)[5,6] 6 Oct
			27 Aug[3] (7 DAT[4])	3 Sep[3] (14 DAT[4])	10 Sep[3] (21 DAT[4])	
Cobalt Advanced	13	0.0 a	0.0 a	2.2 a	0.4 a	46 a
Lorsban Advanced	16	0.0 a	0.1 a	0.0 a	0.7 a	43 a
Transform[7]	0.43	0.0 a	0.1 a	0.6 a	0.0 a	42 a
Transform[7]	0.51	0.0 a	0.0 a	0.1 a	0.0 a	48 a
Transform[7]	0.71	0.0 a	0.0 a	0.4 a	0.2 a	45 a
Warrior II	1.28	0.0 a	0.0 a	0.0 a	0.8 a	47 a
UTC[8]	—	0.0 a	0.3 a	0.3 a	2.6 a	46 a

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of soybean aphids on five plants in each plot in each of four replications.
[3] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] DAT = days after treatment (with insecticide).
[5] Soybeans were harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 13% moisture.
[6] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[7] Transform is not registered for commercial use.
[8] UTC = untreated check.

SECTION 12

Evaluation of insecticidal seed treatments to control soybean aphids (*Aphis glycines*) and other insect pests of soybean in Illinois, 2011

Nicholas A. Tinsley, Ronald E. Estes, and Michael E. Gray

Location

We established one trial at the Adam Yoeckel Farm near Morrison (Whiteside County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 10 ft (four rows) x 30 ft. Densities of soybean aphids were determined by counting the total number of soybean aphids on each of three plants in each plot. Densities of other insect pests were determined by taking 20 sweeps per plot with a 15-inch diameter sweep net. Densities of soybean aphids were assessed on 17 and 27 August, and on 3 and 10 September. Densities of other insect pests were assessed on 4, 11, 19, and 27 August.

Planting and Yield

The trial was planted on 10 May using a four-row, vacuum style planter constructed by Seed Research Equipment Solutions (SRES). Seeds were planted in 30-inch rows at an approximate depth of 1 inch. Active ingredients for all insecticidal seed treatments are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each subplot on 6 October. Weights were converted to bushels per acre (bu/A) at 13% moisture.

Agronomic Information

Agronomic information is listed in Table 12.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean densities of soybean aphids, other insect pests, and yield are reported in Table 12.2. Although a number of insect pests were surveyed, only corn rootworm beetles, green stink bugs, and Japanese beetles were recovered in sweep samples.

Across all sampling dates, densities of soybean aphids were very low and never exceeded 66 soybean aphids per plant—no significant differences were observed among treatments, including the untreated check (UTC). Densities were well below the economic threshold of 250 soybean aphids per plant (Ragsdale et al. 2007). Across all sampling dates, no significant differences in mean densities of corn rootworm beetles, green stink bugs, and Japanese beetles were observed.

Although some significant differences in mean yield were observed, yields were most likely unaffected by the low densities of pests we observed.

TABLE 12.1 • Agronomic information for efficacy trial of insecticidal seed treatments to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011

Planting date	10 May
Harvest date	6 October
Variety	Stine 27RA02
Row spacing	30 inches
Seeding rate	140,000/acre
Previous crop	Corn
Tillage	Spring—vertical tillage

TABLE 12.2 • **Evaluation of insecticidal seed treatments to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011**

Product	Rate[1]	Mean no. soybean aphids per plant[2,3]				Mean no. corn rootworm beetles per plot[3,4]			
		17 Aug	27 Aug	3 Sep	10 Sep	4 Aug	11 Aug	19 Aug	27 Aug
Cruiser	0.5	5.5 a	19.5 a	29.8 a	55.3 a	0.8 a	0.3 a	0.3 a	0.0 a
Gaucho	0.63	3.4 a	13.3 a	33.1 a	52.2 a	0.8 a	0.8 a	0.3 a	0.3 a
Gaucho + Poncho VOTiVO	0.63 0.13	3.7 a	14.5 a	49.9 a	29.0 a	0.3 a	0.5 a	0.0 a	0.0 a
Poncho VOTiVO	0.13	3.8 a	12.7 a	47.4 a	65.7 a	0.5 a	0.3 a	0.3 a	0.3 a
UTC[7]	—	6.0 a	8.6 a	56.7 a	53.7 a	0.3 a	0.5 a	0.8 a	0.0 a

[1] Rates of application are milligrams (mg) active ingredient (a.i.) per seed.
[2] Means were derived from the numbers of soybean aphids on three plants in each plot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly (*P* = 0.05, Duncan's New Multiple Range Test).
[4] Means were derived from the numbers of insects per 20 sweeps in each plot in each of four replications.
[5] Soybeans were harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 13% moisture.
[6] Means followed by the same letter do not differ significantly (*P* = 0.10, Duncan's New Multiple Range Test).
[7] UTC = untreated check.

TABLE 12.2 (CONTINUED) • **Evaluation of insecticidal seed treatments to control soybean aphids and other insect pests of soybean, Morrison, University of Illinois, 2011**

Product	Rate[1]	Mean no. green stink bugs per plot[3,4]				Mean no. Japanese beetles per plot[3,4]				Mean yield (bu/acre)[5,6]
		4 Aug	11 Aug	19 Aug	27 Aug	4 Aug	11 Aug	19 Aug	27 Aug	6 Oct
Cruiser	0.5	0.5 a	0.8 a	0.3 a	0.5 a	11.0 a	6.8 a	2.0 a	2.0 a	36 b
Gaucho	0.63	0.0 a	0.0 a	0.0 a	0.5 a	11.5 a	7.0 a	1.5 a	1.3 a	44 a
Gaucho + Poncho VOTiVO	0.63 0.13	0.0 a	0.0 a	0.0 a	0.3 a	10.5 a	6.5 a	3.8 a	2.3 a	36 b
Poncho VOTiVO	0.13	0.0 a	0.0 a	0.5 a	1.0 a	9.0 a	5.3 a	5.3 a	2.0 a	43 a
UTC[7]	—	0.0 a	0.3 a	0.3 a	0.5 a	9.5 a	5.5 a	3.3 a	1.3 a	40 a

[1] Rates of application are milligrams (mg) active ingredient (a.i.) per seed.
[2] Means were derived from the numbers of soybean aphids on three plants in each plot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly (*P* = 0.05, Duncan's New Multiple Range Test).
[4] Means were derived from the numbers of insects per 20 sweeps in each plot in each of four replications.
[5] Soybeans were harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 13% moisture.
[6] Means followed by the same letter do not differ significantly (*P* = 0.10, Duncan's New Multiple Range Test).
[7] UTC = untreated check.

SECTION 13

Evaluation of foliar-applied insecticides to control leaf-feeding insect pests of soybean in Illinois, 2011

Ronald E. Estes, Nicholas A. Tinsley, and Michael E. Gray

Location

We established one trial at the University of Illinois Agricultural Engineering Farm near Urbana (Champaign County). Funding for this experiment was provided by the Illinois Soybean Association.

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 10 ft (four rows) x 30 ft. Insecticides were applied to designated plots on 22 July. Prior to and following insecticide application, densities of insect pests were determined by taking 20 sweeps per plot with a 15-inch diameter sweep net. Pest densities were assessed on22 and 29 July, and on 5 and 12 August (0, 7, 14, and 21 days after treatment [DAT], respectively).

Trial Establishment, Insecticide Application, and Yield

The trial was established in an existing soybean field where insect pests were abundant. No information about seed variety, planting date, or seeding rate was available.

Insecticides were applied on 22 July with a CO_2 backpack sprayer and a four-row boom. TeeJet TTJ60-1102VP spray tips were calibrated to deliver a volume of 20 gallons per acre (gal/A). Active ingredients for all insecticides are listed in Appendix II.

Yields were estimated by harvesting the center two rows of each plot on 11 October. Weights were converted to bushels per acre (bu/A) at 13% moisture.

Agronomic Information

Agronomic information is listed in Table 13.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean numbers of bean leaf beetles, grasshoppers, Japanese beetles, southern corn rootworm beetles, western corn rootworm beetles, and yield are presented in Table 13.2.

On 29 July (7 DAT), Leverage 360, Mustang Max, and Warrior II had significantly fewer bean leaf beetles than Sevin XLR Plus. In addition, on this date (29 July), all treatments had significantly lower densities of Japanese beetles and grasshoppers than the untreated check (UTC). No significant differences in pest densities were observed for any other pest on any date. No significant differences in yield were observed in the study.

TABLE 13.1 • Agronomic information for efficacy trial of foliar-applied insecticides to control leaf-feeding insect pests of soybean in Illinois, Urbana, University of Illinois, 2011

Harvest date	11 October
Row spacing	30 inches
Previous crop	Corn
Tillage	Fall—chisel plow Spring—filed cultivator

TABLE 13.2 • Evaluation of foliar-applied insecticides to control leaf-feeding insect pests of soybean in Illinois, Urbana, University of Illinois, 2011

Product	Rate[1]	Mean no. bean leaf beetles per plot[2,3]				Mean no. grasshoppers per plot[2,3]				Mean no. Japanese beetles per plot[2,3]			
		22 July (0 DAT[4])	29 July (7 DAT[4])	5 Aug (14 DAT[4])	12 Aug (21 DAT[4])	22 July (0 DAT[4])	29 July (7 DAT[4])	5 Aug (14 DAT[4])	12 Aug (21 DAT[4])	22 July (0 DAT[4])	29 July (7 DAT[4])	5 Aug (14 DAT[4])	12 Aug (21 DAT[4])
Cobalt	32	26.3 a	2.0 ab	5.0 a	14.3 a	7.0 a	0.5 b	0.5 a	0.0 a	4.5 a	0.5 b	1.0 a	0.8 a
Leverage 360	2.8	22.5 ab	0.8 b	3.0 a	4.8 a	4.5 a	0.0 b	0.3 a	0.3 a	3.5 a	0.5 b	1.8 a	0.5 a
Mustang Max	4	20.5 ab	0.3 b	6.0 a	9.0 a	6.3 a	0.3 b	0.0 a	0.0 a	2.0 a	0.0 b	2.5 a	1.3 a
Nufos 4E	32	14.8 b	1.0 b	4.0 a	14.8 a	4.0 a	0.3 b	0.3 a	0.0 a	3.0 a	0.0 b	1.3 a	1.3 a
Sevin XLR Plus	32	14.3 b	3.5 a	4.3 a	14.5 a	2.8 a	0.0 b	0.0 a	0.3 a	2.3 a	0.8 b	1.3 a	0.5 a
Warrior II	1.92	20.0 ab	0.5 b	5.3 a	11.8 a	6.0 a	0.5 b	0.0 a	0.0 a	1.8 a	0.3 b	1.0 a	1.8 a
UTC[7]	13	18.8 ab	1.8 ab	4.3 a	12.8 a	6.0 a	1.8 a	0.0 a	0.0 a	2.8 a	2.0 a	1.8 a	0.5 a

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of insects per 20 sweeps in each plot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] DAT = days after treatment (with insecticide).
[5] Soybeans were harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 13% moisture.
[6] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[7] UTC = untreated check.

TABLE 13.2 (CONTINUED) • Evaluation of foliar-applied insecticides to control leaf-feeding insect pests of soybean in Illinois, Urbana, University of Illinois, 2011

Product	Rate[1]	Mean no. southern corn rootworm beetles per plot[2,3]				Mean no. western corn rootworm beetles per plot[2,3]				Mean yield (bu/acre)[5,6] 6 Oct
		22 July (0 DAT[4])	29 July (7 DAT[4])	5 Aug (14 DAT[4])	12 Aug (21 DAT[4])	22 July (0 DAT[4])	29 July (7 DAT[4])	5 Aug (14 DAT[4])	12 Aug (21 DAT[4])	
Cobalt	32	0.0 a	0.3 a	0.5 a	0.5 a	0.0 a	0.3 a	1.0 a	2.5 a	46 a
Leverage 360	2.8	0.5 a	0.0 a	0.3 a	0.5 a	0.0 a	0.5 a	0.8 a	1.8 a	49 a
Mustang Max	4	0.0 a	0.3 a	0.0 a	0.3 a	0.0 a	0.0 a	0.5 a	2.5 a	45 a
Nufos 4E	32	0.0 a	0.0 a	0.5 a	0.5 a	0.0 a	0.8 a	0.8 a	2.3 a	47 a
Sevin XLR Plus	32	0.0 a	0.3 a	0.3 a	0.3 a	0.3 a	0.8 a	1.0 a	1.5 a	47 a
Warrior II	1.92	0.3 a	0.3 a	0.0 a	0.3 a	0.0 a	0.5 a	0.5 a	2.8 a	48 a
UTC[7]	13	0.0 a	0.3 a	0.0 a	0.0 a	0.0 a	0.0 a	1.5 a	1.3 a	48 a

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of insects per 20 sweeps in each plot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] DAT = days after treatment (with insecticide).
[5] Soybeans were harvested from the center two rows of each subplot and converted to bushels per acre (bu/A) at 13% moisture.
[6] Means followed by the same letter do not differ significantly ($P = 0.10$, Duncan's New Multiple Range Test).
[7] UTC = untreated check.

SECTION 14

Evaluation of foliar-applied insecticides to control potato leafhoppers (*Empoasca fabae*) and tarnished plant bugs (*Lygus lineolaris*) in Illinois, 2011

Nicholas A. Tinsley, Ronald E. Estes, and Michael E. Gray

Location

We established one trial located on a University of Illinois Animal Sciences farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design was a randomized complete block with four replications. The plot size for each treatment was 20 ft x 20 ft. Densities of potato leafhoppers and tarnished plant bugs were estimated by taking 25 sweeps per plot with a 15-inch diameter sweep net. After the application of insecticides, densities were assessed on 5, 12, and 18 August (7, 14, and 20 days after treatment [DAT], respectively).

Insecticide Application

Insecticides were applied on 26 July with a CO_2 backpack sprayer and a four-row boom. TeeJet TTJ60-1102VP spray tips were calibrated to deliver a volume of 20 gallons per acre (gal/A). Active ingredients for all insecticides are listed in Appendix II.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 8 (Agricultural Research Manager), revision 8.3.4 (Copyright© 1982–2011 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean numbers of potato leafhoppers and tarnished plant bugs per plot are reported in Table 14.1. Densities of both potato leafhoppers and tarnished plant bugs were minimal during this trial. Significant differences in the mean number of these insects per plot were only observed on 12 August (14 DAT) for tarnished plant bugs. The mean number of tarnished plant bugs for the Nufos + Warrior II treatment was greater than for the Cobalt, Mustang Max, and untreated check (UTC) treatments. However, this trend was not observed on the subsequent sampling date (20 DAT).

TABLE 14.1 • Evaluation of foliar-applied insecticides to control potato leafhoppers and tarnished plant bugs, Urbana, University of Illinois, 2011

Product	Rate[1]	Mean no. potato leafhoppers per plot[2,3]				Mean no. tarnished plant bugs per plot[2,3]			
		29 July (0 DAT[4])	5 Aug (7 DAT[4])	12 Aug (14 DAT[4])	18 Aug (20 DAT[4])	29 July (0 DAT[4])	5 Aug (7 DAT[4])	12 Aug (14 DAT[4])	18 Aug (20 DAT[4])
Cobalt	38	1.0 a	7.0 a	13.0 a	19.0 a	0.0 a	1.5 a	1.5 b	3.8 a
Mustang Max	4	1.5 a	4.3 a	0.8 a	8.5 a	0.0 a	0.3 a	0.5 b	5.3 a
Nufos	32	0.0 a	1.0 a	2.3 a	5.5 a	0.0 a	1.8 a	2.0 ab	5.3 a
Nufos + Mustang Max	16 2.24	0.0 a	2.3 a	5.0 a	13.5 a	0.0 a	1.5 a	2.5 ab	5.0 a
Nufos + Warrior II	16 1.28	1.0 a	3.8 a	3.3 a	9.8 a	0.0 a	1.8 a	3.8 a	5.8 a
Warrior II	1.92	0.0 a	4.3 a	4.8 a	6.3 a	0.0 a	0.3 a	1.8 ab	4.0 a
UTC[5]	—	0.5 a	2.0 a	2.3 a	4.5 a	0.0 a	2.0 a	0.8 b	5.3 a

[1] Rates of application for foliar insecticide are ounces (oz) of product per acre.
[2] Means were derived from the numbers of insects per 25 sweeps in each plot in each of four replications.
[3] Means for the same date and followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[4] DAT = days after treatment (with insecticide).
[5] UTC = untreated check.

APPENDIX I • References Cited

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Node-injury Scale (from Oleson et al. 2005)

0.0 No feeding damage

1.0 One node (circle of roots), or the equivalent of an entire node, pruned back to within approximately 3.8 cm (1.5 in) of the stalk (or soil line if roots originate from above ground nodes)

2.0 Two complete nodes pruned

3.0 Three or more complete nodes pruned (highest rating that can be given)

Damage in between complete nodes pruned is noted as the percentage of the node missing, e.g., 1.50 = 1½ nodes pruned.

For a complete explanation of the node-injury scale and a comparison with the Iowa State University 1-to-6 root rating scale (Hills and Peters 1971), visit the "Interactive Node-Injury Scale" Web site, *http://www.ent.iastate.edu/pest/rootworm/nodeinjury/nodeinjury.html*.

APPENDIX II • Trade Names and Active Ingredients

Product name	Active ingredient(s)
Aztec 2.1G	tebupirimphos + cyfluthrin
Baythroid XL	beta-cyfluthrin
Cobalt	chlorpyrifos + gamma-cyhalothrin
Cobalt Advanced	chlorpyrifos + lambda-cyhalothrin
Counter 20G	terbufos
Cruiser	thiamethoxam
Declare	gamma-cyhalothrin
Endigo ZC	lambda-cyhalothrin + thiamethoxam
Endigo ZCX1	lambda-cyhalothrin + thiamethoxam
Force 2.1CS	tefluthrin
Force 3G	tefluthrin
Gaucho	imidacloprid
Hero	zeta-cypermethrin + bifenthrin
Leverage 360	imidacloprid + beta-cyfluthrin
Lorsban 4E	chlorpyrifos
Lorsban Advanced	chlorpyrifos
Mustang Max	zeta-cypermethrin
Nufos 4E	chlorpyrifos
Poncho VOTiVO	clothianidin
Sevin XLR Plus	carbaryl
SmartChoice 5G	chlorethoxyfos + bifenthrin
Transform1	sulfoxaflor
Voliam Xpress	chlorantraniliprole + lambda-cyhalothrin
Warrior II	lambda-cyhalothrin

[1] This product is not registered for commercial use.

APPENDIX III • Temperature and Precipitation

2011 and Historical Monthly Weather Data[1] for DeKalb, Illinois.

Month	Mean temperature (°F)			Cumulative modified growing degree days (base 50°F, ceiling 86°F)			Total precipitation (in)		
	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference
April	46.1	49.0	–2.9	105	181	–76	4.41	3.35	+1.06
May	58.9	59.2	–0.3	457	531	–74	5.54	5.16	+0.38
June	69.9	69.4	+0.5	1,041	1,111	–70	4.71	4.46	+0.25
July	77.6	72.8	+4.7	1,870	1,810	+60	5.28	4.19	+1.09
August	72.0	71.2	+0.7	2,548	2,466	+82	5.29	4.36	+0.93
September	60.4	64.3	–3.9	2,900	2,924	–24	3.82	3.16	+0.66
October	53.0	51.7	+1.4	3,070	3,142	–72	1.28	2.78	–1.50

[1] Data were compiled by the Midwest Regional Climate Center.

2011 and Historical Monthly Weather Data[1] for Monmouth, Illinois.

Month	Mean temperature (°F)			Cumulative modified growing degree days (base 50°F, ceiling 86°F)			Total precipitation (in)		
	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference
April	49.1	51.3	–2.2	155	206	–51	2.61	4.66	–2.05
May	60.8	61.4	–0.6	557	608	–51	4.78	5.31	–0.53
June	69.9	70.5	–0.6	1,151	1,221	–70	6.01	4.95	+1.06
July	78.7	73.5	+5.2	2,004	1,936	+68	2.24	2.47	–0.23
August	73.5	72.4	+1.2	2,719	2,625	+94	0.32	3.68	–3.36
September	60.6	65.2	–4.7	3,104	3,113	–9	1.49	3.48	–1.99
October	55.6	53.0	+2.6	3,331	3,363	–32	0.86	2.54	–1.68

[1] Data were compiled by the Midwest Regional Climate Center.

2011 and Historical Monthly Weather Data[1] for Morrison, Illinois.

Month	Mean temperature (°F)			Cumulative modified growing degree days (base 50°F, ceiling 86°F)			Total precipitation (in)		
	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference
April	48.1	50.3	–2.2	153	212	–59	4.73	3.70	+1.03
May	59.2	60.5	–1.3	521	602	–81	5.40	4.45	+0.95
June	69.0	70.0	–1.1	1,087	1,196	–109	4.17	4.70	–0.53
July	76.6	73.5	+3.1	1,887	1,900	–13	7.29	3.96	+3.33
August	71.1	71.7	–0.5	2,542	2,562	–20	1.69	4.50	–2.81
September	59.7	64.2	–4.5	2,888	3,027	–139	3.72	2.92	+0.80
October	53.0	51.9	+1.2	3,051	3,270	–219	0.51	3.00	–2.49

[1] Data were compiled by the Midwest Regional Climate Center.

2011 and Historical Monthly Weather Data[1] for Perry, Illinois.

Month	Mean temperature (°F)			Cumulative modified growing degree days (base 50°F, ceiling 86°F)			Total precipitation (in)		
	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference
April	53.5	53.3	+0.2	236	257	–21	4.04	3.60	+0.44
May	62.1	63.2	–1.1	676	707	–31	4.84	4.05	+0.79
June	72.3	71.9	+0.4	1,331	1,354	–23	11.56	4.85	+6.71
July	80.4	75.6	+4.8	2,196	2,112	+84	1.32	3.74	–2.42
August	75.0	74.2	+0.8	2,927	2,832	+95	0.29	3.38	–3.09
September	64.1	66.4	–2.3	3,386	3,350	+36	1.05	3.62	–2.57
October	55.3	54.5	+0.9	3,596	3,639	–43	1.07	3.29	–2.22

[1] Data were compiled by the Midwest Regional Climate Center.

2011 and Historical Monthly Weather Data[1] for Urbana, Illinois.

Month	Mean temperature (°F)			Cumulative modified growing degree days (base 50°F, ceiling 86°F)			Total precipitation (in)		
	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference	2011	15-year average (1996–2010)	Difference
April	53.5	52.8	+0.7	231	241	–10	7.42	3.27	+4.15
May	61.9	62.7	–0.9	655	675	–20	4.93	4.63	+0.30
June	73.1	71.9	+1.1	1,331	1,322	+9	4.18	4.58	–0.40
July	80.8	74.7	+6.1	2,200	2,069	+131	1.58	4.62	–3.04
August	75.8	73.7	+2.1	2,961	2,790	+171	1.76	3.73	–1.97
September	64.1	67.2	–3.0	3,387	3,317	+70	2.73	3.20	–0.47
October	55.5	54.6	+1.0	3,609	3,588	+21	2.46	3.13	–0.67

[1] Data were compiled by the Midwest Regional Climate Center.