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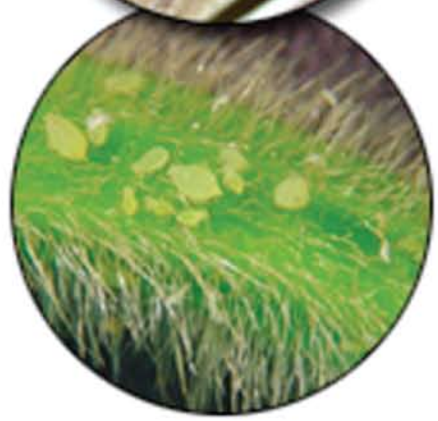
Annual review of University of Illinois insect management trials

2009 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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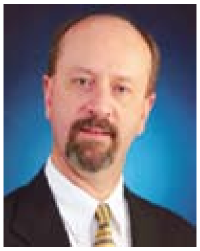

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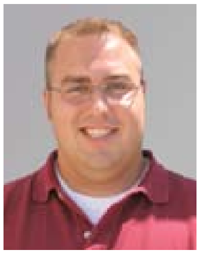

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APPENDICES

SECTION 1

Evaluation of products to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2009

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. Plot size for each treatment was 10 ft (four rows) x 30 ft. Five randomly selected root systems were extracted from the first row of each plot on 20 July at Monmouth and Perry, and on 22 and 29 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). Percentage consistency at two different levels (percentage of roots with a node-injury rating less than 1.0, and with a node injury rating less than 0.25) was determined for each product at each location.

Yields were estimated by harvesting the center two rows of each plot on 5 and 27 October at Perry and Monmouth, respectively, and on 4 and 28 November at Urbana and DeKalb, respectively. Weights were converted to bushels per acre (bu/A) at 15.5% moisture. Plant populations in the harvested rows had been thinned at the V6–V8 growth stage to 30,000 plants per acre at DeKalb, Monmouth, and Urbana.

Planting and Insecticide Application

Trials were planted on 18 and 23 April at Urbana and Perry, respectively, and on 5 and 24 May at Monmouth and DeKalb, respectively. All trials were planted using a four-row, Almaco constructed planter with John Deere 7300 row units and Precision Planting finger pick-up style metering units. 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 to either a 5-inch, slope-compensating bander or into the seed furrow. Liquid insecticides were applied at a spray volume of 5 gal per acre using a CO_2 system. All insecticides were applied in front of the firming wheels on the planter. Cable-mounted tines were attached behind each of the row units to improve insecticide incorporation.

Active ingredients for all chemical insecticides are listed in Appendix II.

Agronomic Information

Agronomic information for all four trials 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 7 (Agricultural Research Manager), revision 7.5.1 (Copyright© 1982–2009 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

DeKalb—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 29 July are presented in Table 1.2. Mean node-injury ratings for the untreated checks (UTCs) were 0.78 (DKC61-22), 1.99 (Mycogen 2T777), and 1.41 (Pioneer 34P87), indicating that corn rootworm larval feeding was moderate to heavy. Mean node-injury ratings for plots with soil-applied insecticides, rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids were statistically similar. Mean node-injury ratings for these treatments were significantly smaller than for their UTCs (with the exception of Lorsban 15G). The percentage of roots with a node-injury rating < 1.0 ranged from 95–100% for plots with soil-applied insecticides, rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids. The percentages of roots with a node-injury rating < 1.0 for the UTCs were 60 (DKC61-22), 15 (Mycogen 2T777), and 30% (Pioneer 34P87).

Mean yields are presented in Table 1.2. Mean yields for the UTCs were 137.1 (DKC61-22), 114.4 (Mycogen 2T777), and 125.1 bu/A (Pioneer 34P87). Although mean yields for plots with soil-applied insecticides were numerically greater than for their UTC (DKC61-22), they were not statistically different. Mean yields for plots with rootworm Bt hybrids were significantly greater than for their respective UTCs and ranged from 138.7–156.8 bu/A. The addition of soil-applied insecticides to plots with rootworm Bt hybrids did not result in significantly greater mean yields.

Monmouth—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 20 July are presented in Table 1.3. Mean node-injury ratings for the UTCs were 0.90 (DKC61-22), 1.11 (Mycogen 2T777), and 2.18 (Pioneer 34P87), indicating that corn rootworm larval feeding was moderate to heavy. Mean node-injury ratings for plots with soil-applied insecticides, rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids were smaller than for their UTCs. With the exception of plots with Counter 20G, mean node-injury ratings for these treatments were statistically similar. Plots with Counter 20G had a significantly greater mean node-injury rating than plots with both rates of Force 2.1CS (0.34 and 0.46 oz.) combined with rootworm Bt hybrids (DKC61-19 [YieldGard VT3] and Pioneer 34P92 [HxXTRA]). The percentage of roots with a node-injury rating < 1.0 was 100% for plots with soil-applied insecticides, rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids. The percentages of roots with a node-injury rating < 1.0 for the UTCs were 70 (DKC61-22), 35 (Mycogen 2T777), and 15% (Pioneer 34P87).

Mean yields are presented in Table 1.3. Mean yields for the UTCs were 238.7 (DKC61-22), 216.4 (Mycogen 2T777), and 231.7 bu/A (Pioneer 34P87). Plots with two of the four soil-applied insecticides (Aztec 2.1G and Lorsban 15G) had significantly greater mean yields than their UTC (DKC61-22). Mean yields for plots with rootworm Bt hybrids were significantly greater than for their respective UTCs, and ranged from 246.5–253.2 bu/A. The addition of soil-applied insecticides to plots with rootworm Bt hybrids resulted in a significantly greater mean yield for only one treatment—Counter 20G combined with YieldGard VT3 (DKC61-19). The mean yield for plots with this combination (269.2 bu/A) was significantly greater than for plots with either Counter 20G (244.5 bu/A) or YieldGard VT3 (DKC61-19) (253.2 bu/A) alone.

Perry—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 20 July are presented in Table 1.4. Mean node-injury ratings for the UTCs were 0.20 (DKC61-22), 0.52 (Mycogen 2T777), and 0.34 (Pioneer

Continued on page 9

TABLE 1.1 • Agronomic information for efficacy trials with products to control corn rootworm larvae, University of Illinois, 2009

	DeKalb	Monmouth	Perry	Urbana
Planting date	24 May	5 May	23 April	18 April
Root evaluation date	29 July	20 July	20 July	22 July
Hybrids[1]	DKC61-19 YieldGard VT3 DKC61-22 RR2 Mycogen 2T789 HxXTRA Mycogen 2T777 RR2 Pioneer 34P92 HxXTRA Pioneer 34P87 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Mycogen 2T789 HxXTRA Mycogen 2T777 RR2 Pioneer 34P92 HxXTRA Pioneer 34P87 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Mycogen 2T789 HxXTRA Mycogen 2T777 RR2 Pioneer 34P92 HxXTRA Pioneer 34P87 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Mycogen 2T789 HxXTRA Mycogen 2T777 RR2 Pioneer 34P92 HxXTRA Pioneer 34P87 RR2
Row spacing	30 inches	30 inches	30 inches	30 inches
Seeding rate	34,000/acre	34,000/acre	34,000/acre	34,000/acre
Previous crop	Trap crop (late-planted corn and pumpkins)	Trap crop (late-planted corn and pumpkins)	Trap crop (late-planted corn and pumpkins)	Trap crop (late-planted corn and pumpkins)
Tillage	Spring—disk	Fall—chisel plow Spring—field cultivator	Fall—chisel plow Spring—field cultivator	Spring—chisel plow Spring—field cultivator

[1] All soil insecticides were applied to DKC61-22 (the non-rootworm trait isoline of DKC61-19 YieldGard VT3), unless otherwise indicated.

TABLE 1.2 ♦ **Evaluation of products to control corn rootworm larvae, DeKalb, University of Illinois, 2009**

Product[1]	Rate[2]	Placement[2]	Mean node-injury rating[3,4,5] 29 July	% consistency < 1.0[6]	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 28 Nov
Soil-applied insecticides						
Aztec 2.1G	6.7	Band	0.21 d	100	70	142.9 cde
Counter 20G	6	SB furrow[12]	0.13 d	100	84	143.3 cde
Force 2.1CS	0.46	Band	0.23 d	100	70	146.0 b–e
Lorsban 15G	8	Band	0.38 cd	95	50	141.1 cde
Rootworm Bt hybrids						
HxXTRA (Mycogen 2T789[10])	—	—	0.05 d	100	95	138.7 ef
HxXTRA (Pioneer 34P92[11])	—	—	0.17 d	100	75	143.7 cde
YieldGard VT3 (DKC61-19[11])	—	—	0.08 d	100	95	156.8 a–d
Soil-applied insecticides + rootworm Bt hybrids						
Aztec 2.1G + YieldGard VT3 (DKC61-19[11])	6.7	Band	0.01 d	100	100	151.0 a–e
Counter 20G + YieldGard VT3 (DKC61-19[11])	4.5	SB furrow[12]	0.08 d	100	90	151.2 a–e
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.34	Band	0.02 d	100	100	149.5 a–e
Force 2.1CS YieldGard VT3 (DKC61-19[11])	0.34	Band	0.01 d	100	100	161.2 ab
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.46	Band	0.01 d	100	100	157.4 abc
Force 2.1CS + YieldGard VT3 (DKC61-19[11])	0.46	Band	0.01 d	100	100	164.2 a
Lorsban 15G + HxXTRA (Mycogen 2T789[10])	8	Furrow	0.03 d	100	95	140.6 de
SmartChoice 5G + YieldGard VT3 (DKC61-19[11])	3.5	SB furrow[12]	0.01 d	100	100	151.7 a–e
Untreated checks (UTCs)						
DKC61-22[11]	—	—	0.78 c	60	40	137.1 ef
Mycogen 2T777[10]	—	—	1.99 a	15	5	114.4 g
Pioneer 34P87[11]	—	—	1.41 b	30	5	125.1 fg

[1] All soil insecticides were applied to DKC61-22 (the non-rootworm trait isoline of DKC61-19 YieldGard VT3), unless otherwise indicated.
[2] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[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] Percentage of roots with a node-injury rating < 1.0.
[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 ($P = 0.1$, Duncan's New Multiple Range Test).
[10] Seed treated with Cruiser 5FS, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified SmartBox metering units.

TABLE 1.3 • Evaluation of products to control corn rootworm larvae, Monmouth, University of Illinois, 2009

Product[1]	Rate[2]	Placement[2]	Mean node-injury rating[3,4,5] 20 July	% consistency < 1.0[6]	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 27 Oct
Soil-applied insecticides						
Aztec 2.1G	6.7	Band	0.21 cd	100	75	256.6 abc
Counter 20G	6	SB furrow[12]	0.32 c	100	61	244.5 c–f
Force 2.1CS	0.46	Band	0.08 cd	100	89	250.3 cde
Lorsban 15G	8	Band	0.28 cd	100	55	253.9 bcd
Rootworm Bt hybrids						
HxXTRA (Mycogen 2T789[10])	—	—	0.09 cd	100	89	251.9 b–e
HxXTRA (Pioneer 34P92[11])	—	—	0.12 cd	100	84	246.5 cde
YieldGard VT3 (DKC61-19[11])	—	—	0.06 cd	100	90	253.2 bcd
Soil-applied insecticides + rootworm Bt hybrids						
Counter 20G + YieldGard VT3 (DKC61-19[11])	4.5	SB furrow[12]	0.03 cd	100	100	269.2 a
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.34	Band	0.01 d	100	100	238.2 ef
Force 2.1CS + YieldGard VT3 (DKC61-19[11])	0.34	Band	0.01 d	100	100	264.7 ab
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.46	Band	0.01 d	100	100	240.7 def
Force 2.1CS + YieldGard VT3 (DKC61-19[11])	0.46	Band	0.00 d	100	100	264.5 ab
Lorsban 15G + HxXTRA (Mycogen 2T789[10])	8	Furrow	0.04 cd	100	100	251.7 b–e
SmartChoice 5G + YieldGard VT3 (DKC61-19[11])	3.5	SB furrow[12]	0.03 cd	100	100	264.5 ab
Untreated checks (UTCs)						
DKC61-22[11]	—	—	0.90 b	70	15	238.7 ef
Mycogen 2T777[10]	—	—	1.11 b	35	0	216.4 g
Pioneer 34P87[11]	—	—	2.18 a	15	5	231.7 f

[1] All soil insecticides were applied to DKC61-22 (the non-rootworm trait isoline of DKC61-19 YieldGard VT3), unless otherwise indicated.
[2] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[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] Percentage of roots with a node-injury rating < 1.0.
[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 ($P = 0.1$, Duncan's New Multiple Range Test).
[10] Seed treated with Cruiser 5FS, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified SmartBox metering units.

TABLE 1.4 • Evaluation of products to control corn rootworm larvae, Perry, University of Illinois, 2009

Product[1]	Rate[2]	Placement[2]	Mean node-injury rating[3,4,5] 20 July	% consistency < 1.0[6]	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 5 Oct
Soil-applied insecticides						
Aztec 2.1G	6.7	Band	0.06 cd	100	100	264.3 ab
Counter 20G (Pioneer 34P87[11])	6	SB furrow[12]	0.26 b	100	57	244.6 bcd
Force 2.1CS	0.46	Band	0.03 cd	100	100	253.2 abc
Lorsban 15G	8	Band	0.18 bcd	100	70	266.6 ab
Rootworm Bt hybrids						
HxXTRA (Mycogen 2T789[10])	—	—	0.02 d	100	100	227.4 d
HxXTRA (Pioneer 34P92[11])	—	—	0.05 cd	100	100	237.9 cd
YieldGard VT3 (DKC61-19[11])	—	—	0.02 d	100	100	253.4 abc
Soil-applied insecticides + rootworm Bt hybrids						
Counter 20G + HxXTRA (Pioneer 34P92[11])	4.5	SB furrow[12]	0.03 cd	100	100	246.1 a–d
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.34	Band	0.01 d	100	100	254.4 abc
Force 2.1CS + YieldGard VT3 (DKC61-19[11])	0.34	Band	0.01 d	100	100	253.2 abc
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.46	Band	0.02 cd	100	100	244.5 bcd
Force 2.1CS + YieldGard VT3 (DKC61-19[11])	0.46	Band	0.01 d	100	100	268.0 a
Lorsban 15G + HxXTRA (Mycogen 2T789[10])	8	Furrow	0.03 cd	100	100	229.3 d
SmartChoice 5G + HxXTRA (Pioneer 34P92[11])	3.5	SB furrow[12]	0.03 cd	100	100	249.1 a–d
Untreated checks (UTCs)						
DKC61-22[11]	—	—	0.20 bc	100	65	236.4 cd
Mycogen 2T777[10]	—	—	0.52 a	85	40	237.0 cd
Pioneer 34P87[11]	—	—	0.34 b	100	50	264.6 ab

[1] All soil insecticides were applied to DKC61-22 (the non-rootworm trait isoline of DKC61-19 YieldGard VT3), unless otherwise indicated.
[2] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[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] Percentage of roots with a node-injury rating < 1.0.
[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 ($P = 0.1$, Duncan's New Multiple Range Test).
[10] Seed treated with Cruiser 5FS, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified SmartBox metering units.

34P87), indicating that corn rootworm larval feeding was minimal. Mean node-injury ratings for plots with soil-applied insecticides were statistically similar to their respective UTCs. Mean node-injury ratings for plots with rootworm Bt hybrids and soil-applied insecticides combined with rootworm Bt hybrids were smaller than for their UTCs. With the exception of plots with Counter 20G, mean node-injury ratings for plots with soil-applied insecticides, rootworm Bt hybrids and soil-applied insecticides combined with rootworm Bt hybrids were statistically similar. Plots with Counter 20G had a significantly greater mean node-injury rating than plots with two of the four soil applied insecticides (Aztec 2.1G and Force 2.1CS), rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids. The percentage of roots with a node-injury rating < 1.0 was 100% for plots with soil-applied insecticides, rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids. The percentages of roots with a node-injury rating < 1.0 for the UTCs were 100 (DKC61-22), 85 (Mycogen 2T777), and 100% (Pioneer 34P87).

Mean yields are presented in Table 1.4. Mean yields for the UTCs were 236.4 (DKC61-22), 237.0 (Mycogen 2T777), and 264.6 bu/A (Pioneer 34P87). Plots with two of the four soil-applied insecticides (Aztec 2.1G and Lorsban 15G) had significantly greater mean yields than their UTC (DKC61-22). Mean yields for plots with rootworm Bt hybrids were statistically similar to their respective UTCs. Addition of soil-applied insecticides to plots with rootworm Bt hybrids did not result in significantly greater mean yields.

Urbana—Mean node-injury ratings and consistency percentages for rootworm injury evaluations on 22 July are presented in Table 1.5. Mean node-injury ratings for the UTCs were 2.16 (DKC61-22), 2.55 (Mycogen 2T777), and 2.42 (Pioneer 34P87), indicating that corn rootworm larval feeding was severe. Mean node-injury ratings for plots with soil-applied insecticides, rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids were smaller than for their UTCs. Plots with rootworm Bt hybrids had numerically greater mean node-injury ratings than plots with soil-applied insecticides, but this trend was only significant for HxXTRA (Mycogen 2T789). The addition of soil-applied insecticide to plots with rootworm Bt hybrids resulted in significantly smaller mean node-injury ratings for four of the eight combination treatments: Counter 20G combined with HxXTRA (Pioneer 34P92), Force 2.1CS (0.34 and 0.46 oz.) combined with HxXTRA (Pioneer 34P92), and Lorsban 15G combined with HxXTRA (Pioneer 34P92). The percentage of roots with a node-injury rating < 1.0 was 100% for plots with soil-applied insecticides, rootworm Bt hybrids, and soil-applied insecticides combined with rootworm Bt hybrids (with the exception of HxXTRA [Mycogen 2T789]). The percentages of roots with a node-injury rating < 1.0 for the UTCs were 5 (DKC61-22), 10 (Mycogen 2T777), and 0% (Pioneer 34P87).

Mean yields are presented in Table 1.5. Mean yields for the UTCs were 94.7 (DKC61-22), 100.6 (Mycogen 2T777), and 78.1 bu/A (Pioneer 34P87). Plots with soil-applied insecticides had significantly greater mean yields than their UTCs. Mean yields for plots with rootworm Bt hybrids were statistically greater than for their respective UTCs. The addition of soil-applied insecticides to plots with rootworm Bt hybrids did not result in significantly greater mean yields, even for the four combination treatments with significantly smaller mean node-injury ratings.

TABLE 1.5 ♦ Evaluation of products to control corn rootworm larvae, Urbana, University of Illinois, 2009

Product[1]	Rate[2]	Placement[2]	Mean node-injury rating[3,4,5] 22 July	% consistency < 1.0[6]	% consistency < 0.25[7]	Mean yield (bu/A)[8,9] 4 Nov
Soil-applied insecticides						
Aztec 2.1G	6.7	Band	0.18 cd	100	68	129.4 bcd
Counter 20G (Pioneer 34P87[11])	6	SB furrow[12]	0.13 cd	100	82	131.2 a–d
Force 2.1CS	0.46	Band	0.18 cd	100	80	127.4 cd
Lorsban 15G	8	Band	0.05 d	100	100	160.0 a
Rootworm Bt hybrids						
HxXTRA (Mycogen 2T789[10])	—	—	0.66 b	75	35	143.0 a–d
HxXTRA (Pioneer 34P92[11])	—	—	0.50 bc	100	20	137.5 a–d
YieldGard VT3 (DKC61-19[11])	—	—	0.25 cd	100	60	128.6 bcd
Soil-applied insecticides + rootworm Bt hybrids						
Aztec 2.1G + YieldGard VT3 (DKC61-19[11])	6.7	Band	0.01 d	100	100	157.3 ab
Counter 20G + HxXTRA (Pioneer 34P92[11])	4.5	SB furrow[12]	0.04 d	100	100	141.0 a–d
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.34	Band	0.02 d	100	100	138.9 a–d
Force 2.1CS + YieldGard VT3 (DKC61-19[11])	0.34	Band	0.01 d	100	100	145.8 a–d
Force 2.1CS + HxXTRA (Pioneer 34P92[11])	0.46	Band	0.01 d	100	100	156.0 abc
Force 2.1CS + YieldGard VT3 (DKC61-19[11])	0.46	Band	0.01 d	100	100	124.8 de
Lorsban 15G + HxXTRA (Mycogen 2T789[10])	8	Furrow	0.03 d	100	95	151.9 a–d
SmartChoice 5G + HxXTRA (Pioneer 34P92[11])	3.5	SB furrow[12]	0.10 cd	100	85	128.4 bcd
Untreated checks (UTCs)						
DKC61-22[11]	—	—	2.16 a	5	0	94.7 f
Mycogen 2T777[10]	—	—	2.55 a	10	0	100.6 ef
Pioneer 34P87[11]	—	—	2.42 a	0	0	78.1 f

[1] All soil insecticides were applied to DKC61-22 (the non-rootworm trait isoline of DKC61-19 YieldGard VT3), unless otherwise indicated.
[2] Rates of application for band and furrow placements are ounces (oz) of product per 1,000 ft of row.
[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] Percentage of roots with a node-injury rating < 1.0.
[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 ($P = 0.1$, Duncan's New Multiple Range Test).
[10] Seed treated with Cruiser 5FS, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] Applied with modified SmartBox metering units.

SECTION 2

Evaluation of soil-applied insecticides plus transgenic rootworm hybrids to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2009

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

Location

We established three trials at University of Illinois research and education centers near DeKalb (DeKalb County), Monmouth (Warren 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 30 ft. Five randomly selected root systems were extracted from the first row of each plot on 20, 27, and 29 July at Monmouth, Urbana, and DeKalb, respectively. The 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). Percentage of lodged plants (plants leaning at 45° or less from the soil surface) was determined on 11, 12, and 17 August at Urbana, Monmouth, and DeKalb, respectively.

Yields were estimated by harvesting the center two rows of each plot on 27 October at Monmouth, and on 24 and 28 November at Urbana and DeKalb, respectively. Weights were converted to bushels per acre (bu/A) at 15.5% moisture. Plant populations in the harvested rows had been thinned to 30,000 plants per acre at the V6–V8 growth stage.

Planting and Insecticide Application

Trials were planted on 5 and 24 May at Monmouth and DeKalb, respectively, and on 5 June at Urbana. All trials were planted using a four-row, Almaco constructed planter with John Deere 7300 row units with Precision Planting finger pick-up style metering units. Aztec 2.1G was applied through modified Noble metering units mounted to each row. Plastic tubes directed the insecticide granules to a 5-inch, slope-compensating bander. Force 2.1CS was applied at a spray volume of 5 gal per acre using a CO_2 system. All insecticides were applied in front of the firming wheels on the planter. Cable-mounted tines were attached behind each of the row units to improve insecticide incorporation.

Active ingredients for all chemical insecticides are listed in Appendix II.

Agronomic Information

Agronomic information is listed in Table 2.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 7 (Agricultural Research Manager), revision 7.5.1 (Copyright© 1982–2009 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean node-injury ratings, percent lodging, and mean yields are presented in Table 2.2. Although all of the data are presented in one table, each of the locations has been analyzed independently.

DeKalb—Mean node-injury ratings for the untreated checks (UTCs) were 0.78 (DKC61-22) and 0.83 (Mycogen 2T777), indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for plots with rootworm Bt hybrids and plots with soil-applied insecticides combined with rootworm Bt hybrids were not statistically different. All plots with some form of protection from corn rootworm larvae (rootworm Bt hybrids alone or combined with soil-applied insecticides) had significantly lower mean node-injury ratings than the UTCs.

With the exception of one of the UTCs (Mycogen 2T777), the percentage of lodged plants (plants leaning at 45° or less from the soil surface) was not significantly different among any of the plots.

Mean yields for the UTCs were 150.33 (DKC61-22) and 141.03 bu/A (Mycogen 2T777). Mean yields in UTC plots with Mycogen 2T777 were significantly lower than those plots with HxXTRA, with or without Aztec 2.1G. Mean yields in UTC plots with DKC61-22 were significantly lower than plots with YieldGard VT3, with or without soil-applied insecticides. Overall, the addition of soil-applied insecticides to plots with rootworm Bt hybrids did not result in significantly higher mean yields.

Monmouth—Mean node-injury ratings for the untreated checks (UTCs) were 0.80 (DKC61-22) and 1.45 (Mycogen 2T777), indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for plots with rootworm Bt hybrids and plots with soil-applied insecticides combined with rootworm Bt hybrids were not statistically different. All plots with some form of protection from corn rootworm larvae (rootworm Bt hybrids alone or combined with soil-applied insecticides) had significantly lower mean node-injury ratings than the UTCs. Mean node-jury ratings for the UTC plots with Mycogen 2T777 had significantly higher node-injury scores than those plots with DKC61-22.

Virtually no (0–3%) lodging was seen in any the plots with rootworm Bt hybrids, with or without soil-applied insecticides. The UTC plots with Mycogen 2T777 had significantly higher lodging (11%) than plots with rootworm Bt hybrids, with or without soil-applied insecticides. Lodging for plots with DKC61-22 (7%) was not significantly different from plots with rootworm Bt hybrids, with or without soil-applied insecticides.

Mean yields for the UTCs were 243.05 (DKC61-22) and 231.70 bu/A (Mycogen 2T777). Mean yields in plots with YieldGard VT3 (DKC61-19) plus an insecticide (Force 2.1CS or Aztec 2.1G) were significantly higher than the UTCs with Mycogen 2T777. Overall, the addition of soil-applied insecticides to plots with rootworm Bt hybrids did not result in significantly higher mean yields.

Urbana—Mean node-injury ratings for the untreated checks (UTCs) were 0.43 (DKC61-22) and 0.01 (Mycogen 2T777), indicating that corn rootworm larval feeding was low. Mean node-injury ratings among all plots (treated and untreated) ranged from 0.01 to 0.48. All of the plots had statistically similar node-injury ratings.

Virtually no (0–1%) lodging was seen in any of the plots, and all of the plots were statistically similar.

Mean yields for the UTCs were 68.33 (DKC61-22) and 75.13 bu/A (Mycogen 2T777). Mean yields in plots with YieldGard VT3 (DKC61-19) or YieldGard VT3 plus Aztec 2.1G had significantly higher yields than the UTCs. Once again, the addition of soil-applied insecticides to plots with rootworm Bt hybrids did not result in significantly higher mean yields.

TABLE 2.1 • Agronomic information for efficacy trials of soil-applied insecticides plus transgenic rootworm hybrids to control corn rootworm larvae, University of Illinois, 2009

	DeKalb	Monmouth	Urbana
Planting date	24 May	5 May	5 June
Root evaluation date	29 July	20 July	27 July
Hybrids	DKC61-19 YieldGard VT3 DKC61-22 RR2 Mycogen 2T789 HxXTRA Mycogen 2T777 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Mycogen 2T789 HxXTRA Mycogen 2T777 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Mycogen 2T789 HxXTRA Mycogen 2T777 RR2
Row spacing	30 inches	30 inches	30 inches
Seeding rate	34,000/acre	34,000/acre	34,000/acre
Previous crop	Corn	Trap crop (late-planted corn and pumpkins)	Trap crop (late-planted corn and pumpkins)
Tillage	Spring—disk	Fall—chisel plow Spring—field cultivator	Spring—chisel plow Spring—field cultivator

TABLE 2.2 • Evaluation of soil-applied insecticides plus transgenic rootworm hybrids to control corn rootworm larvae, University of Illinois, 2009

Product	Rate[1]	Placement	Mean node-injury rating[2,3,4,5]	% lodging[5,6,7]	Mean yield (bu/A)[5,8,9]
DeKalb					
YieldGard VT3 (DKC61-19[10])	—	—	0.02 b	0 b	165.45 ab
Aztec 2.1G + YieldGard VT3 (DKC61-19[10])	6.7	Band	0.01 b	1 b	167.05 ab
Force 2.1CS + YieldGard VT3 (DKC61-19[10])	0.46	Band	0.01 b	0 b	169.48 a
HxXTRA (Mycogen 2T789[11])	—	—	0.09 b	0 b	156.18 bc
Aztec 2.1G + HxXTRA (Mycogen 2T789[11])	6.7	Band	0.02 b	0 b	163.53 ab
Mycogen 2T777 (UTC[11,12])	—	—	0.83 a	6 a	141.03 d
DKC61-22 (UTC[10,12])	—	—	0.78 a	1 b	150.33 cd
Monmouth					
YieldGard VT3 (DKC61-19[10])	—	—	0.04 c	0 b	251.33 ab
Aztec 2.1G + YieldGard VT3 (DKC61-19[10])	6.7	Band	0.01 c	0 b	258.83 a
Force 2.1CS + YieldGard VT3 (DKC61-19[10])	0.46	Band	0.00 c	1 b	259.08 a
HxXTRA (Mycogen 2T789[11])	—	—	0.08 c	3 b	240.18 ab
Aztec 2.1G + HxXTRA (Mycogen 2T789[11])	6.7	Band	0.02 c	0 b	245.25 ab
Mycogen 2T777 (UTC[11,12])	—	—	1.45 a	11 a	231.70 b
DKC61-22 (UTC[10,12])	—	—	0.80 b	7 ab	243.05 ab
Urbana					
YieldGard VT3 (DKC61-19[10])	—	—	0.38 a	0 a	122.23 a
Aztec 2.1G + YieldGard VT3 (DKC61-19[10])	6.7	Band	0.48 a	1 a	122.73 a
Force 2.1CS + YieldGard VT3 (DKC61-19[10])	0.46	Band	0.48 a	1 a	112.43 abc
HxXTRA (Mycogen 2T789[11])	—	—	0.36 a	0 a	97.67 abc
Aztec 2.1G + HxXTRA (Mycogen 2T789[11])	6.7	Band	0.70 a	0 a	119.45 ab
Mycogen 2T777 (UTC[11,12])	—	—	0.01 a	0 a	75.13 bc
DKC61-22 (UTC[10,12])	—	—	0.43 a	0 a	68.33 c

[1] Rates of application 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] Mean node-injury ratings were derived from five root systems per treatment in each of four replications.
[4] Mean node-injury ratings were evaluated on 20, 27, and 29 July at Monmouth, Urbana, and DeKalb, respectively.
[5] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[6] Percentage of plants leaning at 45° or less from the soil surface.
[7] Percent lodging was evaluated on 11, 12, and 17 August at Urbana, Monmouth, and DeKalb, respectively.
[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] Corn was harvested on 27 October at Monmouth, and on 24 and 28 November at Urbana and DeKalb, respectively.
[10] Seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[11] Seed treated with Cruiser 5FS, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[12] UTC = untreated check.

SECTION 3

Evaluation of Force 2.1CS and transgenic rootworm hybrids to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2009

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

Location

We established twelve trials at University of Illinois research and education centers near DeKalb (DeKalb County), Monmouth (Warren County), Perry (Pike County), and Urbana (Champaign County). There were three trials at each location. Each trial evaluated Force 2.1CS and one of three transgenic rootworm hybrids (Agrisure 3000GT, HxXTRA, or YieldGard VT3).

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. Six randomly selected root systems were extracted from the first row of each plot on 20 July at Monmouth and Perry, and on 22 and 29 July at Urbana and DeKalb, respectively. The 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). Percentage of lodged plants (plants leaning at 45° or less from the soil surface) was determined on 12 August at Monmouth and Perry, and on 11 and 17 August at Urbana and DeKalb, respectively.

Yields were estimated by harvesting the center two rows of each plot on 5 and 27 October at Perry and Monmouth, respectively, and on 23 and 28 November at Urbana and DeKalb, respectively. Weights were converted to bushels per acre (bu/A) at 15.5% moisture. Plant populations in the harvested rows had been thinned to 30,000 plants per acre at the V6–V8 growth stage.

Planting and Insecticide Application

Trials were planted on 23 April at Perry, and on 5, 22, and 24 May at Monmouth, Urbana, and DeKalb, respectively. All trials were planted using a four-row, Almaco constructed planter with John Deere 7300 row units with Precision Planting finger pick-up style metering units. Force 2.1CS was applied at a spray volume of 5 gal per acre using a CO_2 system. The insecticide was applied in front of the firming wheels on the planter. Cable-mounted tines were attached behind each of the row units to improve insecticide incorporation.

Active ingredients for all chemical insecticides are listed in Appendix II.

Agronomic Information

Agronomic information is listed in Table 3.1.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using ARM 7 (Agricultural Research Manager), revision 7.5.1 (Copyright© 1982–2009 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Each of the trials was conducted independently, separated by location and rootworm Bt hybrid. The objective of this investigation was to compare the efficacy and yield of each rootworm Bt trait and its isoline, both with and without the addition of a soil-applied insecticide (Force 2.1CS).

Agrisure RW

Mean node-injury ratings, percent lodging, and mean yields are presented in Table 3.2. Although all data are presented in one table, each of the locations has been analyzed independently.

DeKalb—The mean node-injury rating for the untreated check (UTC) was 1.73 (Garst 83X58), indicating that corn rootworm larval feeding was moderate to heavy. Mean node-injury ratings for rootworm Bt hybrid plots and plots with soil-applied insecticides combined with rootworm Bt hybrids were not statistically different. Mean node-injury ratings for plots with the isoline hybrid (Garst 83X58) plus Force 2.1CS (0.09 or 0.12 ounces per 1000 feet of row) were also statistically similar to plots with Agrisure 3000GT (Garst 83X61).

There was a relatively large amount (34%) of lodging in the UTC plots (Garst 83X58). All other plots in the study had no lodging at the time of evaluation.

TABLE 3.1 • Agronomic information for efficacy trials of Force 2.1CS and transgenic rootworm hybrids to control corn rootworm larvae, University of Illinois, 2009

	DeKalb	Monmouth	Perry	Urbana
Planting date	24 May	5 May	23 April	22 May
Root evaluation date	29 July	20 July	20 July	22 July
Hybrids	DKC61-19 YieldGard VT3 DKC61-22 RR2 Garst 83X61 Agrisure 3000GT Garst 83X58 Agrisure CB/LL Pioneer 35F44 HxXTRA Pioneer 35F40 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Garst 83X61 Agrisure 3000GT Garst 83X58 Agrisure CB/LL Pioneer 35F44 HxXTRA Pioneer 35F40 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Garst 83X61 Agrisure 3000GT Garst 83X58 Agrisure CB/LL Pioneer 35F44 HxXTRA Pioneer 35F40 RR2	DKC61-19 YieldGard VT3 DKC61-22 RR2 Garst 83X61 Agrisure 3000GT Garst 83X58 Agrisure CB/LL Pioneer 35F44 HxXTRA Pioneer 35F40 RR2
Row spacing	30 inches	30 inches	30 inches	30 inches
Seeding rate	34,000/acre	34,000/acre	34,000/acre	34,000/acre
Previous crop	Trap crop (late-planted corn and pumpkins)	Trap crop (late-planted corn and pumpkins)	Corn	Trap crop (late-planted corn and pumpkins)
Tillage	Spring—disk	Fall—chisel plow Spring—field cultivator	Fall—chisel plow Spring—field cultivator	Spring—chisel plow Spring—field cultivator

Overall, the mean yields in the trial were relatively low (88–139 bu/A). The mean yield for the UTC plots was 88.1 bu/A (Garst 83X58), and was significantly lower than the mean yields for all other plots in the study. Mean yields in plots with Agrisure 3000GT (Garst 83X61) plus Force 2.1CS (0.09 oz per 1000 row feet) were significantly higher than mean yields in plots with the isoline hybrid (Garst 83X58), with or without the addition of Force 2.1CS.

Monmouth—The mean node-injury rating for the UTC was 0.82 (Garst 83X58), indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for all plots treated with a rootworm control product (a rootworm Bt hybrid, soil-applied insecticide, or a combination of both) were significantly lower that the UTC, but were not statistically different from each other.

The amount of lodging in the study was low, ranging from 0–10%. The percentage of plants lodged in the UTC was significantly higher than the percentage of lodged plants in plots with the isoline (Garst 83X58) plus Force 2.1CS (0.12 oz per 1000 row feet). The percentages of plants lodged in all other plots were statistically similar.

Mean yields in the trial ranged from 231–251 bu/A. The mean yield for the UTC plots was 231.8 bu/A (Garst 83X58), and was significantly lower than the mean yield in the plots with the isoline (Garst 83X58) plus Force 2.1CS (0.12 oz per 1000 row feet) (251.9 bu/A). Mean yields in all other plots were statistically similar.

Perry—The mean node-injury rating for the UTC was 0.02 (Garst 83X58), indicating that corn rootworm larval feeding was very low. Mean node-injury ratings were statistically similar in all of the plots, including the UTC.

The amount of lodging in the study was very low, with all but one of the treatments having no lodging present. The percentage of plants lodged in plots with the isoline (Garst 83X58) plus Force 2.1CS (0.12 oz per 1000 row feet) was 1%, which was not significantly different from any of the other treatments.

Mean yields in the trial ranged from 192–213 bu/A. Although there were numerical differences in mean yields, all of the plots were statistically similar, including the UTC.

Urbana—The mean node-injury rating for the UTC was 1.30 (Garst 83X58), indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for all plots treated with a rootworm control product (a rootworm Bt hybrid, soil-applied insecticide, or a combination of both) were significantly lower than the UTC. The addition of Force 2.1CS to Agrisure 3000GT (Garst 83X61) significantly reduced the mean node-injury ratings when compared to Agrisure 3000GT alone.

The amount of lodging in the study was low, ranging from 0–13%. The percentages of plants lodged were statistically similar in all of the plots, including the UTC.

Mean yields in the trial were very low, ranging from 67–130 bu/A. The mean yield for the UTC plots was 67.2 bu/A (Garst 83X58), and was significantly lower than the mean yields for all plots with a rootworm Bt hybrid (with or without a soil-applied insecticide). Mean yields in plots with Agrisure 3000GT (Garst 83X61) plus Force 2.1CS (0.12 oz per 1000 row feet) were significantly higher than mean yields in plots with the isoline hybrid (Garst 83X58), with or without the addition of Force 2.1CS.

TABLE 3.2 • Evaluation of Force 2.1CS and transgenic rootworm hybrids for control of corn rootworm larvae (Agrisure 3000GT), University of Illinois, 2009

Product[1]	Rate[2]	Placement	Mean node-injury rating[3,4,5,6]	% lodging[6,7,8]	Mean yield (bu/A)[6,9]
DeKalb					
Agrisure 3000GT (Garst 83X61)	—	—	0.22 bc	0 b	130.4 ab
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.12	Band	0.04 c	0 b	129.1 ab
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.09	Band	0.04 c	0 b	139.4 a
Agrisure CB/LL (Garst 83X58)	—	—	1.73 a	34 a	88.1 d
Force 2.1CS + Agrisure CB/LL (Garst 83X58)	0.12	Band	0.45 b	0 b	116.2 c
Force 2.1CS + Agrisure CB/LL (Garst 83X58)	0.09	Band	0.44 b	0 b	121.3 bc
Monmouth					
Agrisure 3000GT (Garst 83X61)	—	—	0.12 b	1 ab	238.8 ab
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.12	Band	0.02 b	1 ab	245.9 ab
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.09	Band	0.02 b	1 ab	234.4 ab
Agrisure CB/LL (Garst 83X58)	—	—	0.82 a	10 a	231.8 b
Force 2.1CS + Agrisure CB/LL (Garst 83X58)	0.12	Band	0.08 b	0 b	251.9 a
Force 2.1CS + + Agrisure CB/LL (Garst 83X58)	0.09	Band	0.09 b	2 ab	251.0 ab
Perry					
Agrisure 3000GT (Garst 83X61)	—	—	0.02 a	0 a	210.8 a
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.12	Band	0.01 a	0 a	192.9 a
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.09	Band	0.01 a	0 a	197.9 a
Agrisure CB/LL (Garst 83X58)	—	—	0.02 a	0 a	212.0 a
Force 2.1CS + Agrisure CB/LL (Garst 83X58)	0.12	Band	0.02 a	1 a	213.2 a
Force 2.1CS + Agrisure CB/LL (Garst 83X58)	0.09	Band	0.01 a	0 a	209.2 a

Table 3.2 continued on page 17

TABLE 3.2 • continued

Product[1]	Rate[2]	Placement	Mean node-injury rating[3,4,5,6]	% lodging[6,7,8]	Mean yield (bu/A)[6,9]
Urbana					
Agrisure 3000GT (Garst 83X61)	—	—	0.62 b	11 a	108.7 ab
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.12	Band	0.04 c	1 a	130.8 a
Force 2.1CS + Agrisure 3000GT (Garst 83X61)	0.09	Band	0.04 c	1 a	110.0 ab
Agrisure CB/LL (Garst 83X58)	—	—	1.30 a	13 a	67.2 c
Force 2.1CS + Agrisure CB/LL (Garst 83X58)	0.12	Band	0.15 bc	0 a	85.3 bc
Force 2.1CS + Agrisure CB/LL (Garst 83X58)	0.09	Band	0.21 bc	2 a	94.2 bc

[1] Seed treated with Cruiser 5FS, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[2] Rates of application are ounces (oz) of product per 1,000 ft of row.
[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 six root systems per treatment in each of four replications.
[5] Mean node-injury ratings were evaluated on 20 July at Monmouth and Perry, and on 22 and 29 July at Urbana and DeKalb, respectively.
[6] Means followed by the same letter for the same location do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[7] Percentage of plants leaning at 45° or less from the soil surface.
[8] Percent lodging was evaluated on 12 August at Monmouth and Perry, and on 11 and 17 August at Urbana and DeKalb, respectively.
[9] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture on 5 and 27 October at Perry and Monmouth, respectively, and on 23 and 28 November at Urbana and DeKalb, respectively.

HxXTRA

Mean node-injury ratings, percent lodging, and mean yields are presented in Table 3.3. Although all data are presented in one table, each of the locations has been analyzed independently.

DeKalb—The mean node-injury rating for the untreated check (UTC) was 1.79 (Pioneer 35F40), indicating that corn rootworm larval feeding was moderate to heavy. Mean node-injury ratings for all plots treated with a rootworm control product (a rootworm Bt hybrid, soil-applied insecticide, or a combination of both) were significantly lower that the UTC, but were not statistically different from each other.

The percentage of lodged plants in the UTC plots (Pioneer 35F40) was relatively high (30%). All other plots in the study were statistically similar and had virtually no lodging (0–1%) at the time of evaluation.

Mean yields in the trial ranged from 134–160 bu/A. The mean yield in plots with HxXTRA (Pioneer 35F44) plus Force 2.1CS (0.09 oz per 1000 row feet) was significantly higher than the UTC, or plots with the isoline (Pioneer 35F40) plus Force 2.1CS (0.09 oz per 100 row feet).

Monmouth—The mean node-injury rating for the untreated check (UTC) was 1.08 (Pioneer 35F40), indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for all plots treated with a rootworm control product (a rootworm Bt hybrid, soil-applied insecticide, or a combination of both) were significantly lower that the UTC. Plots with HxXTRA (Pioneer 35F44) plus Force 2.1CS (0.09 or 0.12 oz per 1000 row feet) had significantly lower mean node-injury ratings than plots with the isoline (Pioneer 35F40) plus Force 2.1CS (0.09 oz per 1000 row feet).

There was a large amount (41%) of lodging in the UTC plots (Pioneer 35F40). All other plots in the study were statistically similar and had virtually no lodging (0–1%) at the time of evaluation.

Mean yields in the trial ranged from 205–237 bu/A. The mean yield for the UTC plots was 205.3 bu/A (Pioneer 35F40), and was significantly lower than the mean yields in the plots with the isoline (Pioneer 35F40) plus Force 2.1CS (0.09 or 0.12 oz per 1000 row feet). Mean yields in all other plots were statistically similar.

Perry—The mean node-injury rating for the untreated check (UTC) was 0.02 (Pioneer 35F40), indicating that corn rootworm larval feeding was very low. Mean node-injury ratings were statistically similar in all of the plots, including the UTC.

There were no lodged plants in any of the plots at the time of evaluation.

Mean yields in the trial ranged from 191–205 bu/A. Although there were numerical differences in mean yields, all of the plots were statistically similar, including the UTC.

Urbana—The mean node-injury rating for the untreated check (UTC) was 0.87 (Pioneer 35F40), indicating that corn rootworm larval feeding was moderate. Plots with HxXTRA (Pioneer 35F44) plus Force 2.1CS (0.09 or 0.12 oz per 1000 row feet) and plots with the isoline (Pioneer 35F40) plus Force 2.1CS (0.12 oz per 1000 row feet) had significantly lower mean node-injury ratings than the UTC.

The amount of lodging in the study was very low, ranging from 0–1%. The percentage of lodged plants in the UTC were significantly greater than all other plots, however, the difference between 0 and 1% is negligible.

Mean yields in the trial ranged from 109–167 bu/A. The mean yield for the UTC plots was 135.2 bu/A (Pioneer 35F40). Mean yields in plots with HxXTRA (Pioneer 35F44), HxXTRA plus Force 2.1CS (0.12 oz per 1000 row feet), and the UTC had significantly higher yields than plots with the isoline (Pioneer 35F40) plus Force 2.1CS (0.09 oz per 1000 row feet).

YieldGard VT3

Mean node-injury ratings, percent lodging, and mean yields are presented in Table 3.4. Although all data are presented in one table, each of the locations has been analyzed independently.

DeKalb—The mean node-injury rating for the untreated check (UTC) was 0.72 (DKC 61-22), indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings in all other plots were statistically similar, with mean node-injury ratings ranging from 0.01–0.20.

TABLE 3.3 • Evaluation of Force 2.1CS and transgenic rootworm hybrids for control of corn rootworm larvae (HxXTRA), University of Illinois, 2009

Product[1]	Rate[2]	Placement	Mean node-injury rating[3,4,5,6]	% lodging[6,7,8]	Mean yield (bu/A)[6,9]
DeKalb					
HxXTRA (Pioneer 35F44)	—	—	0.07 b	0 b	153.5 ab
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.12	Band	0.01 b	0 b	159.7 ab
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.09	Band	0.01 b	1 b	160.4 a
HxI (Pioneer 35F40)	—	—	1.79 a	30 a	143.8 bc
Force 2.1CS + HxI (Pioneer 35F40)	0.12	Band	0.17 b	0 b	155.3 ab
Force 2.1CS + HxI (Pioneer 35F40)	0.09	Band	0.14 b	1 b	134.2 c
Monmouth					
HxXTRA (Pioneer 35F44)	—	—	0.15 bc	0 b	212.6 ab
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.12	Band	0.01 c	0 b	233.2 ab
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.09	Band	0.02 c	1 b	227.0 ab
HxI (Pioneer 35F40)	—	—	1.08 a	41 a	205.3 b
Force 2.1CS + HxI (Pioneer 35F40)	0.12	Band	0.23 bc	0 b	236.7 a
Force 2.1CS + HxI (Pioneer 35F40)	0.09	Band	0.28 b	0 b	235.7 a

Table 3.3 continued on page 19

TABLE 3.3 • continued

Product[1]	Rate[2]	Placement	Mean node-injury rating[3,4,5,6]	% lodging[6,7,8]	Mean yield (bu/A)[6,9]
Perry					
HxXTRA (Pioneer 35F44)	—	—	0.03 a	0 a	195.6 a
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.12	Band	0.03 a	0 a	204.2 a
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.09	Band	0.03 a	0 a	196.4 a
HxI (Pioneer 35F40)	—	—	0.02 a	0 a	201.0 a
Force 2.1CS + HxI (Pioneer 35F40)	0.12	Band	0.02 a	0 a	205.3 a
Force 2.1CS + HxI (Pioneer 35F40)	0.09	Band	0.03 a	0 a	190.6 a
Urbana					
HxXTRA (Pioneer 35F44)	—	—	0.34 ab	0 b	149.1 ab
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.12	Band	0.01 b	0 b	167.0 a
Force 2.1CS + HxXTRA (Pioneer 35F44)	0.09	Band	0.06 b	0 b	122.8 cd
HxI (Pioneer 35F40)	—	—	0.87 a	1 a	135.2 bc
Force 2.1CS + HxI (Pioneer 35F40)	0.12	Band	0.01 b	0 b	120.4 cd
Force 2.1CS + HxI (Pioneer 35F40)	0.09	Band	0.22 ab	0 b	109.0 d

[1] Pioneer 35F44 seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed; Pioneer 35F40 seed treated with Cruiser 5FS, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[2] Rates of application are ounces (oz) of product per 1,000 ft of row.
[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 six root systems per treatment in each of four replications.
[5] Mean node-injury ratings were evaluated on 20 July at Monmouth and Perry, and on 22 and 29 July at Urbana and DeKalb, respectively.
[6] Means followed by the same letter for the same location do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[7] Percentage of plants leaning at 45° or less from the soil surface.
[8] Percent lodging was evaluated on 12 August at Monmouth and Perry, and on 11 and 17 August at Urbana and DeKalb, respectively.
[9] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture on 5 and 27 October at Perry and Monmouth, respectively, and on 23 and 28 November at Urbana and DeKalb, respectively.

The percentage of lodged plants ranged from 0–23%. Although the percentage of plants lodged varied greatly, all treatments in the trial were statistically similar.

Mean yields in the trial ranged from 147–165 bu/A. Although there were numerical differences in mean yields, all of the plots were statistically similar, including the UTC.

Monmouth—The mean node-injury rating for the untreated check (UTC) was 0.81 (DKC 61-22), indicating that corn rootworm larval feeding was moderate. Mean node-injury ratings for all plots treated with a rootworm control product (a rootworm Bt hybrid, soil-applied insecticide, or a combination of both) were significantly lower that the UTC. Plots with YieldGard VT3 (DKC 61-19) with or without Force 2.1CS (0.09 or 0.12 oz per 1000 row feet) had significantly lower mean node-injury ratings than plots with the isoline (DKC 61-22) plus Force 2.1CS (0.09 oz per 1000 row feet).

The amount of lodging in the study was very low, ranging from 0–4%. The percentage of lodged plants in the UTC was significantly greater than all other plots.

Mean yields in the trial ranged from 241–258 bu/A. Although there were numerical differences in mean yields, all of the plots were statistically similar, including the UTC.

Perry—The mean node-injury rating for the untreated check (UTC) was 0.03 (DKC 61-22), indicating that corn rootworm larval feeding was very low. Mean node-injury ratings were statistically similar in all of the plots, including the UTC.

There were no lodged plants in any of the plots at the time of evaluation.

Mean yields in the trial ranged from 195–231 bu/A. The mean yield in plots with YieldGard VT3 (DKC 61-19) plus Force 2.1CS (0.12 oz per 1000 row feet) was significantly higher than all other plots with one exception: plots with the isoline (DKC 61-22) plus Force 2.1CS (0.09 oz per 1000 row feet).

Urbana—The mean node-injury rating for the untreated check (UTC) was 1.62 (DKC 61-22), indicating that corn rootworm larval feeding was moderate to heavy. Mean node-injury ratings in all other plots were statistically similar, with mean node-injury ratings ranging from 0.01–0.54.

The percentage of lodged plants ranged from 0–17%. Although the percentage of plants lodged varied greatly, all treatments in the trial were statistically similar.

Mean yields in the trial ranged from 81–159 bu/A. Mean yields for all plots with YieldGard VT3 (with or without a soil-applied insecticide) were significantly higher than those plots with the isoline (DKC 61-22) plus Force 2.1CS (0.12 oz per 1000 row feet) or the UTC. Plots with the isoline plus Force 2.1CS (0.09 oz per 1000 row feet) also had significantly higher yields than the UTC.

TABLE 3.4 • Evaluation of Force 2.1CS and transgenic rootworm hybrids for control of corn rootworm larvae (YieldGard VT3), University of Illinois, 2009

Product[1]	Rate[2]	Placement	Mean node-injury rating[3,4,5,6]	% lodging[6,7,8]	Mean yield (bu/A)[6,9]
DeKalb					
YieldGard VT3 (DKC61-19)	—	—	0.13 b	0 a	162.7 a
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.12	Band	0.02 b	23 a	159.3 a
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.09	Band	0.01 b	0 a	159.0 a
RR2 (DKC61-22)	—	—	0.72 a	9 a	147.0 a
Force 2.1CS + RR2 (DKC61-22)	0.12	Band	0.13 b	17 a	164.8 a
Force 2.1CS + RR2 (DKC61-22)	0.09	Band	0.20 b	11 a	157.4 a
Monmouth					
YieldGard VT3 (DKC61-19)	—	—	0.05 c	1 b	256.5 a
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.12	Band	0.02 c	0 b	252.4 a
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.09	Band	0.02 c	1 b	258.1 a
RR2 (DKC61-22)	—	—	0.81 a	4 a	240.8 a
Force 2.1CS + RR2 (DKC61-22)	0.12	Band	0.11 bc	0 b	255.4 a
Force 2.1CS + RR2 (DKC61-22)	0.09	Band	0.33 b	1 b	255.7 a

Table 3.4 continued on page 21

TABLE 3.4 • continued

Product[1]	Rate[2]	Placement	Mean node-injury rating[3,4,5,6]	% lodging[6,7,8]	Mean yield (bu/A)[6,9]
Perry					
YieldGard VT3 (DKC61-19)	—	—	0.02 a	0 a	201.7 b
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.12	Band	0.02 a	0 a	231.4 a
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.09	Band	0.03 a	0 a	199.0 b
RR2 (DKC61-22)	—	—	0.03 a	0 a	194.7 b
Force 2.1CS + RR2 (DKC61-22)	0.12	Band	0.02 a	0 a	202.9 b
Force 2.1CS + RR2 (DKC61-22)	0.09	Band	0.03 a	0 a	216.3 ab
Urbana					
YieldGard VT3 (DKC61-19)	—	—	0.35 b	3 a	150.8 ab
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.12	Band	0.01 b	0 a	147.0 ab
Force 2.1CS + YieldGard VT3 (DKC61-19)	0.09	Band	0.06 b	0 a	158.9 a
RR2 (DKC61-22)	—	—	1.62 a	17 a	81.1 d
Force 2.1CS + RR2 (DKC61-22)	0.12	Band	0.29 b	1 a	100.6 cd
Force 2.1CS + RR2 (DKC61-22)	0.09	Band	0.54 b	0 a	116.9 bc

[1] Seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[2] Rates of application are ounces (oz) of product per 1,000 ft of row.
[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 six root systems per treatment in each of four replications.
[5] Mean node-injury ratings were evaluated on 20 July at Monmouth and Perry, and on 22 and 29 July at Urbana and DeKalb, respectively.
[6] Means followed by the same letter for the same location do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[7] Percentage of plants leaning at 45° or less from the soil surface.
[8] Percent lodging was evaluated on 12 August at Monmouth and Perry, and on 11 and 17 August at Urbana and DeKalb, respectively.
[9] Corn was harvested from the center two rows of each plot and converted to bushels per acre (bu/A) at 15.5% moisture on 5 and 27 October at Perry and Monmouth, respectively, and on 23 and 28 November at Urbana and DeKalb, respectively.

SECTION 4

Evaluation of SmartStax, Aztec 2.1G, and other transgenic rootworm hybrids to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2009

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. Five randomly selected root systems were extracted from the first row of each plot on 10 August. The 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

The trial was planted on 26 June using a four-row, Almaco constructed planter with John Deere 7300 row units. Precision cone units were used to plant the seeds. Aztec 2.1G was applied through modified Noble metering units mounted to each row. Plastic tubes directed the insecticide granules to a 5-inch, slope-compensating bander. The insecticide was applied in front of the firming wheels on the planter. Cable-mounted tines were attached behind each of the row units to improve insecticide incorporation.

Active ingredients for all chemical insecticides are listed in Appendix II.

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 7 (Agricultural Research Manager), revision 7.5.1 (Copyright© 1982–2009 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean node-injury ratings in the trial were very low, ranging from 0 to 0.02. These low node-injury ratings were expected due to the very late planting of the experiment. Plots with the isoline hybrid, with or without the addition of Aztec 2.1G, had significantly greater mean node-injury ratings than the other plots in the trial. However, while there were statistical differences among these treatments, there is little biological significance in the varying levels of injury. The highest of the mean node-injury ratings (0.02) represents minor scarring.

TABLE 4.1 • Agronomic information for efficacy trial of SmartStax, Aztec 2.1G and other transgenic rootworm hybrids to control corn rootworm larvae, University of Illinois, 2009

Planting date	26 June
Root evaluation date	10 August
Hybrids/Traits[1]	RR2 (Isoline) HxXTRA YieldGard VT3 PRO SmartStax
Row spacing	30 inches
Seeding rate	34,000/acre
Previous crop	Trap crop (late-planted corn and pumpkins)
Tillage	Spring—chisel plow Spring—field cultivator

[1] Seeds were provided by Dow AgroSciences and were identified by trait only; hybrid numbers were unknown.

TABLE 4.2 • **Evaluation of SmartStax, Aztec 2.1G and other transgenic rootworm hybrids for control of corn rootworm larvae, University of Illinois, 2009**

Product	Rate[1]	Placement	Mean node-injury rating[2,3,4] 10 Aug
RR2 (UTC[5])	—	—	0.02 a
Aztec 2.1G + RR2	6.7	Band	0.01 a
Aztec 2.1G + RR2	3.35	Band	0.01 a
Aztec 2.1G + HxXTRA	6.7	Band	0.00 b
HxXTRA	—	—	0.00 b
Aztec 2.1G + YieldGard VT3 PRO	6.7	Band	0.00 b
YieldGard VT3 PRO	—	—	0.00 b
Aztec 2.1G + SmartStax	6.7	Band	0.00 b
SmartStax	—	—	0.00 b

[1] Rates of application 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] Mean node-injury ratings were derived from five root systems per treatment in each of four replications.
[4] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[5] UTC = untreated check.

SECTION 5

Evaluation of SmartStax and other transgenic rootworm hybrids to control corn rootworm larvae (*Diabrotica spp.*) in Illinois, 2009

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 20 ft (eight rows) x 30 ft. Six randomly selected root systems were extracted from the first row of each plot on 28 July. The 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

The trial was planted on 2 June using a four-row, Almaco constructed planter with John Deere 7300 row units. Precision cone units were used to plant the seeds. Counter 20G was applied through modified SmartBox 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. Cable-mounted tines were attached behind each of the row units to improve insecticide incorporation.

Active ingredients for all chemical insecticides are listed in Appendix II.

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 7 (Agricultural Research Manager), revision 7.5.1 (Copyright© 1982–2009 Gylling Data Management, Inc., Brookings, SD).

Results and Discussion

Mean node-injury ratings in the trial were very low, ranging from 0.00 to 0.04. The small amount of injury was likely caused by a later than normal planting date, combined with a relatively wet spring. There were no significant differences in root damage among any of the treatments or the untreated check.

TABLE 5.1 • Agronomic information for efficacy trial of SmartStax and other transgenic rootworm hybrids to control corn rootworm larvae, University of Illinois, 2009

Planting date	2 June
Root evaluation date	28 July
Hybrids	DKC61-22 RR2 DKC61-19 YieldGard VT3 NC6214QGV1 HxXTRA/RR2 NC6214MQK1 YieldGard VT3 PRO DKC61-21 SmartStax
Row spacing	30 inches
Seeding rate	36,000/acre
Previous crop	Trap crop (late-planted corn and pumpkins)
Tillage	Spring—chisel plow Spring—field cultivator

TABLE 5.2 • Evaluation of SmartStax and other transgenic rootworm hybrids for control of corn rootworm larvae, University of Illinois, 2009

Product	Rate[1]	Placement	Mean node-injury rating[2,3,4] 28 July
Counter 20G + DKC 61-22 (UTC[5,6])	8	SB furrow[8]	0.00 a
YieldGard VT3 (DKC61-19[6])	—	—	0.00 a
HxXTRA/RR2 (NC6214QGV1[6])	—	—	0.04 a
YieldGard VT3 PRO (NC6214MQK1[6])	—	—	0.00 a
SmartStax (DKC61-21[6])	—	—	0.00 a
SmartStax (DKC61-21[7])	—	—	0.00 a

[1] Rates of application 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] Mean node-injury ratings were derived from six root systems per treatment in each of four replications.
[4] Means followed by the same letter do not differ significantly ($P = 0.05$, Duncan's New Multiple Range Test).
[5] UTC = untreated check.
[6] Seed treated with Poncho 250, 0.25 milligrams (mg) of active ingredient (a.i.) per seed.
[7] Seed treated with Poncho 500, 0.50 milligrams (mg) of active ingredient (a.i.) per seed.
[8] Applied with modified SmartBox metering units.

SECTION 6

Evaluation of resistant soybean lines to control soybean aphids (*Aphis glycines*) in Illinois, 2009

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

Location

We established one trial to evaluate the efficacy of several resistant soybean lines to control soybean aphids. The trial was located 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. Each treatment was repeated twice within each replication. Six experimental soybean lines were provided from the soybean breeding program at the University of Illinois. The resistant lines LD06-16721 and LD06-16727 contained the *Rag1* resistance gene (their susceptible near-isoline was Dwight). The resistant lines LD08-89063a and LD08-89117a contained the *Rag2* gene (their susceptible near-isoline was LD02-4485).

Densities of soybean aphids were determined by counting the total number of soybean aphids on each of three plants in each plot. Densities of soybean aphids were assessed on 17 July; 6, 19, and 28 August; and 4, 11, and 18 September. Two rows of each plot were mechanically harvested on 7 November, and the weights were adjusted to bushels per acre (bu/A) at 13% moisture.

Planting Information

The trial was planted on 29 May using a four-row, Almaco constructed planter with John Deere 7300 row units. Precision cone units were used to plant the seeds.

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 SAS (Statistical Analysis System), version 9.2 (Copyright© 2002–2008 SAS Institute, Cary, NC).

Results and Discussion

Mean densities of soybean aphids are reported in Table 6.2. Mean densities of soybean aphids remained small until 19 August, when the mean number of soybean aphids per plant reached 129.1 and 114.5 in susceptible plots. Mean densities of soybean aphids peaked on 11 September, when the mean number of soybean aphids per plant reached 952.5 and 729.5 in susceptible plots. These numbers were well above the current economic threshold of 250 soybean aphids per plant (Ragsdale et al. 2007). Mean densities decreased after this date until senescence began on 25 September.

When mean densities of soybean aphids were greatest, the resistant lines had fewer soybean aphids per plant than their susceptible counterparts. On 11 September, the resistant lines LD06-16721 and LD06-16727 had significantly smaller mean densities of soybean aphids (169.6 and 109.8, respectively) than their susceptible near-isoline Dwight (952.5). Additionally, the resistant lines LD08-89063a and LD08-89117a had fewer soybean aphids per plant (72.0 and

TABLE 6.1 • Agronomic information for efficacy trial of resistant soybean lines to control soybean aphids, Morrison, University of Illinois, 2009

Planting date	29 May
Row spacing	30 inches
Seeding rate	180,000/acre
Previous crop	Corn
Tillage	Fall—Turbo-till vertical tillage Spring—disk
Harvest date	7 November

88.0, respectively) than their susceptible near-isoline LD02-4485 (729.5).

Yields are reported in Table 6.2. The resistant lines LD06-16721 and LD06-16727 had greater mean yields (40.4 and 40.4 bu/acre, respectively) than their susceptible near-isoline Dwight. The resistant line LD08-89117a had a greater mean yield (44.2 bu/acre) than its susceptible near-isoline LD02-4485 (33.9 bu/acre); however, the resistant line LD08-89063a did not (35.5 bu/acre).

The resistant lines supported populations of soybean aphids, but their densities were well below the economic threshold (250 soybean aphids per plant). Although the outbreak of soybean aphids in this trial occurred late in the growing season, a yield-benefit was associated with 3 of the 4 resistant lines. Additionally, the resistant lines that contained *Rag1* appeared to have numerically greater mean densities of soybean aphids (139.7, $N = 48$) than the resistant lines that contained *Rag2* (80.0, $N = 48$) when densities of soybean aphids were greatest. The difference was not statistically significant.

TABLE 6.2 • Evaluation of resistant soybean lines to control soybean aphids, Morrison, University of Illinois, 2009

Soybean line	Resistant	Mean no. aphids per plant[1,2]							Mean yield (bu/acre)[3]
		17 July	6 Aug	19 Aug	28 Aug	4 Aug	11 Sept	18 Sept	7 Nov
Dwight	No	0.0 a	4.8 a	129.1 a	289.2 a	478.0 a	952.5 a	312.9 a	35.1 c
LD06-16721	Yes	0.0 a	1.3 a	35.3 ab	98.0 b	129.3 b	169.6 b	132.2 b	40.4 b
LD06-16727	Yes	0.0 a	0.3 a	17.7 b	16.8 b	51.2 b	109.8 b	73.0 b	40.4 b
LD02-4485	No	0.5 a	3.8 a	114.5 a	225.3 a	381.5 a	729.5 a	302.2 a	33.9 c
LD08-89063a	Yes	0.0 a	0.7 a	20.4 b	60.3 b	46.0 b	72.0 b	53.9 b	35.5 c
LD08-89117a	Yes	0.0 a	1.6 a	25.5 b	35.3 b	64.0 b	88.0 b	77.4 b	44.2 a

[1] Means were derived from the numbers of soybean aphids on three plants in two plots in each replication. Means for the same date and followed by the same letter do not differ significantly ($P = 0.1$, PROC MIXED, SAS).
[2] Statistical analyses were conducted using a square-root transformation; actual means are shown.
[3] Soybeans were harvested from the center two rows of each plot, and weights were converted to bushels per acre (bu/A) at 13% moisture. Means followed by the same letter do not differ significantly ($P = 0.1$, PROC MIXED, SAS).

SECTION 7

Evaluation of foliar-applied insecticides to control insect pests of alfalfa in Illinois, 2009

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

Location

We established two trials, each located on a University of Illinois Animal Sciences farm near Urbana (Champaign County).

Experimental Design and Methods

The experimental design for both trials was a randomized complete block with four replications. The plot size for each treatment was 20 ft x 20 ft. Insecticides were applied to designated plots on 23 June for the first trial and on 17 July for the second trial. Densities of potato leafhoppers and other insects were assessed prior to the application of foliar insecticides by taking 20 sweeps per plot with a 15-inch diameter sweep net. After the application of foliar insecticides, densities of potato leafhoppers and other insects were assessed on 30 June (7 days after treatment, DAT) and 7 July (14 DAT) for the first trial and on 23 July (6 DAT), 30 July (14 DAT), and 7 July (21 DAT) for the second trial.

Insecticide Application

Insecticides were applied on 23 June for the first trial and on 17 July for the second trial with a CO_2 sprayer and a 20-ft tractor-mounted boom. TeeJet 8004VS spray tips were calibrated to deliver a volume of 20 gal per acre.

Active ingredients for all chemical insecticides are listed in Appendix II.

Climatic Conditions

Temperature and precipitation data are presented in Appendix III.

Statistical Analysis

Data were analyzed using SAS (Statistical Analysis System), version 9.2 (Copyright© 2002–2008 SAS Institute, Cary, NC).

Results and Discussion

Densities of potato leafhoppers, grasshoppers, blister beetles, and tarnished plant bugs collected from the first and second trials are presented in Tables 7.1 and 7.2, respectively. Although there were some differences in densities of insects among treatments before foliar insecticides were applied, the focus of this discussion will be on the densities of insects on the dates following the applications of foliar insecticides.

First trial—On 30 June (7 DAT), mean densities of potato leafhoppers declined for all treatments except Lorsban 4E and the untreated check (UTC) when compared with the previous date. Mean densities of potato leafhoppers increased for all treatments on 7 July (14 DAT). On 30 June and 7 July, plots with Lorsban 4E and the UTC had the greatest mean densities of potato leafhoppers. There were some significant differences in mean densities of potato leafhoppers among the remainder of the treatments on 30 June, but these differences were not observed on 7 July. Although mean densities of grasshoppers declined after application of foliar insecticides, there were no significant differences among the treatments on either 30 June or 7 July. Overall densities of blister beetles were too small for meaningful comparisons to be made. For most treatments, mean densities of tarnished plant bugs increased on both 30 June and 7 July. On 30 June, only two treatments (Mustang Max and Warrior II) had significantly smaller mean densities of tarnished plant bugs than the UTC. On 7 July, no treatment had a significantly smaller mean density of tarnished plant bugs when compared with the UTC.

Second trial—On 23 July (6 DAT), mean densities of potato leafhoppers declined for all treatments, including the UTC, when compared with the previous date. Mean densities of potato leafhoppers increased for most treatments on 30 July (14 DAT) and 7 August (21 DAT). There were no significant differences in mean densities of potato leafhoppers among the foliar insecticide treatments on any sampling date following their application on 17 July. Overall densities of grasshoppers and blister beetles were too small for meaningful comparisons to be made. Although there was a general trend for mean densities of tarnished plant bugs to decline on 23 July and then rebound on 30 July and 7 August, there were no significant differences in mean densities of tarnished plant bugs among any of the treatments on all sampling dates following application of foliar insecticides.

TABLE 7.1 • Evaluation of products to control insect pests of alfalfa (first trial), Urbana, University of Illinois, 2009

Product	Rate[1]	23 June[2,3]	30 June (7 DAT[2,4])	7 July (14 DAT[2,4])
Potato leafhoppers				
Cobalt 2.55EC	38	15.0 a	2.5 b	13.5 b
Mustang Max	4	10.7 a	2.3 bc	5.3 b
Warrior II	1.92	9.5 a	0.0 c	5.5 b
Lorsban 4E	32	8.3 a	11.5 a	30.5 a
Lorsban 4E + Mustang Max	16 2.24	10.8 a	2.5 b	8.5 b
Lorsban 4E + Warrior II	16 1.28	9.0 a	1.5 bc	9.3 b
Untreated check	—	10.8 a	12.5 a	31.0 a
Grasshoppers				
Cobalt 2.55EC	38	0.3 b	0.3 a	0.3 a
Mustang Max	4	1.7 ab	0.0 a	0.3 a
Warrior II	1.92	1.8 a	0.0 a	0.5 a
Lorsban 4E	32	1.0 ab	0.3 a	0.0 a
Lorsban 4E + Mustang Max	16 2.24	0.3 b	0.0 a	0.3 a
Lorsban 4E + Warrior II	16 1.28	0.8 ab	0.0 a	0.0 a
Untreated check	—	1.3 ab	0.0 a	0.3 a
Blister beetles				
Cobalt 2.55EC	38	0.0 b	0.0 b	0.0 b
Mustang Max	4	0.0 b	0.0 b	0.0 b
Warrior II	1.92	0.0 b	0.0 b	0.0 b
Lorsban 4E	32	0.5 a	0.3 a	0.0 b
Lorsban 4E + Mustang Max	16 2.24	0.0 b	0.0 b	0.0 b
Lorsban 4E + Warrior II	16 1.28	0.0 b	0.0 b	0.0 b
Untreated check	—	0.0 b	0.0 b	0.8 a
Tarnished plant bugs				
Cobalt 2.55EC	38	1.5 ab	3.8 a	4.8 ab
Mustang Max	4	0.3 b	1.0 cd	3.7 ab
Warrior II	1.92	1.8 ab	0.0 d	6.8 a
Lorsban 4E	32	2.0 ab	2.5 abc	6.0 ab
Lorsban 4E + Mustang Max	16 2.24	2.3 a	1.5 bc	5.0 ab
Lorsban 4E + Warrior II	16 1.28	0.3 b	0.8 cd	2.8 b
Untreated check	—	1.3 ab	3.0 ab	3.8 ab

[1] Rates of application of foliar-applied insecticides are ounces (oz) of product per acre.
[2] Means were derived from the number of insects per 20 sweeps using a 15-inch diameter sweep net; means followed by the same letter, for the same pest, and on the same date do not differ significantly ($P = 0.1$, PROC GLM, SAS).
[3] Date of application of foliar-applied insecticides.
[4] DAT = days after treatment (with foliar-applied insecticides).

TABLE 7.2 • Evaluation of products to control insect pests of alfalfa (second trial), Urbana, University of Illinois, 2009

Product	Rate[1]	17 July[2,3]	23 July (6 DAT[2,4])	30 July (14 DAT[2,4])	7 Aug (21 DAT[2,4])
Potato leafhoppers					
Cobalt 2.55EC	38	9.0 a	0.0 a	5.5 a	6.0 ab
Mustang Max	4	6.3 ab	1.5 a	5.3 a	6.8 ab
Warrior II	1.92	7.8 a	2.5 a	7.3 a	6.0 ab
Lorsban 4E	32	4.0 b	1.8 a	5.3 a	12.0 a
Lorsban 4E + Mustang Max	16 2.24	4.5 b	0.3 a	5.8 a	8.5 ab
Lorsban 4E + Warrior II	16 1.28	9.5 a	1.5 a	9.0 a	7.3 ab
Untreated check	—	7.3 ab	2.0 a	14.0 a	3.8 b
Grasshoppers					
Cobalt 2.55EC	38	0.0 a	0.0 b	0.3 a	0.3 a
Mustang Max	4	0.0 a	0.0 b	0.0 b	0.0 a
Warrior II	1.92	0.0 a	0.0 b	0.0 b	0.3 a
Lorsban 4E	32	0.0 a	0.0 b	0.0 b	0.3 a
Lorsban 4E + Mustang Max	16 2.24	0.0 a	0.0 b	0.0 b	0.3 a
Lorsban 4E + Warrior II	16 1.28	0.0 a	0.0 b	0.0 b	0.0 a
Untreated check	—	0.0 a	0.3 a	0.0 b	0.0 a
Blister beetles					
Cobalt 2.55EC	38	0.0 a	0.0 a	0.0 a	0.0 a
Mustang Max	4	0.0 a	0.0 a	0.0 a	0.0 a
Warrior II	1.92	0.0 a	0.0 a	0.0 a	0.3 a
Lorsban 4E	32	0.0 a	0.0 a	0.0 a	0.0 a
Lorsban 4E + Mustang Max	16 2.24	0.0 a	0.0 a	0.0 a	0.0 a
Lorsban 4E + Warrior II	16 1.28	0.0 a	0.0 a	0.0 a	0.3 a
Untreated check	—	0.0 a	0.0 a	0.0 a	0.0 a
Tarnished plant bugs					
Cobalt 2.55EC	38	1.0 abc	0.0 a	4.3 a	8.0 a
Mustang Max	4	0.8 bc	1.0 a	6.5 a	6.3 a
Warrior II	1.92	0.3 c	0.8 a	7.3 a	8.5 a
Lorsban 4E	32	0.8 bc	0.5 a	5.5 a	9.3 a
Lorsban 4E + Mustang Max	16 2.24	0.5 c	0.8 a	6.5 a	6.0 a
Lorsban 4E + Warrior II	16 1.28	1.5 ab	0.8 a	7.3 a	5.8 a
Untreated check	—	1.8 a	1.3 a	9.5 a	7.5 a

[1] Rates of application of foliar-applied insecticides are ounces (oz) of product per acre.
[2] Means were derived from the number of insects per 20 sweeps using a 15-inch diameter sweep net; means followed by the same letter, for the same pest, and on the same date do not differ significantly (*P* = 0.1, PROC GLM, SAS).
[3] Date of application of foliar-applied insecticides.
[4] DAT = days after treatment (with foliar-applied insecticides).

APPENDIX I • References Cited

Hills, T. M., and D. C. Peters. 1971. A method of evaluating postplanting insecticide treatments for control of western corn rootworm larvae. Journal of Economic Entomology 64: 764–765.

Oleson, J. D., Y. L. Park, T. M. Nowatzki, and J. J. Tollefson. 2005. Node-injury scale to evaluate root injury by corn rootworms (Coleoptera: Chrysomelidae). Journal of Economic Entomology 98: 1–8.

Ragsdale, D. W., B. P. McCornack, R. C. Venette, B. D. Potter, I. V. MacRae, E. W. Hodgson, M. E. O'Neal, K. D. Johnson, R. J. O'Neil, C. D. DiFonzo, T. E. Hunt, P. A. Glogoza, and E. M. Cullen. 2007. Economic threshold for soybean aphid (Hemiptera: Aphididae). Journal of Economic Entomology 100: 1258–1267.

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 • Common Names of Pesticides

Product name	Common name
Aztec 2.1G	tebupirimphos + cyfluthrin
Cobalt 2.55EC	chlorpyrifos + gamma-cyhalothrin
Counter 20G	terbufos
Cruiser 5FS	thiamethoxam
Force 3G	tefluthrin
Force 2.1CS	tefluthrin
Lorsban 15G	chlorpyrifos
Lorsban 4E	chlorpyrifos
Mustang Max	zeta-cypermethrin
Poncho 250	clothianidin
Poncho 500	clothianidin
SmartChoice 5G	chlorethoxyfos + bifenthrin
Warrior II	lambda-cyhalothrin

APPENDIX III • Temperature and Precipitation

2009 Daily Weather Data for DeKalb, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
April 1	0.37	42
April 2	T	43
April 3	0.11	44
April 4	T	40
April 5	0.07	43
April 6	0.16	36
April 7	0.00	36
April 8	0.00	38
April 9	0.00	41
April 10	0.00	45
April 11	0.00	41
April 12	0.00	38
April 13	0.00	43
April 14	0.62	37
April 15	0.00	40
April 16	0.00	48
April 17	0.00	53
April 18	0.00	55
April 19	T	62
April 20	1.33	48
April 21	0.10	44
April 22	0.11	40
April 23	0.00	50
April 24	0.28	52
April 25	0.00	65
April 26	0.12	58
April 27	0.37	60
April 28	0.39	56
April 29	0.02	49
April 30	0.30	52
Total	**4.35**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for DeKalb, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
May 1	0.60	57
May 2	0.05	50
May 3	0.00	54
May 4	0.00	58
May 5	0.00	59
May 6	0.00	62
May 7	0.90	64
May 8	T	64
May 9	0.20	64
May 10	T	51
May 11	0.00	53
May 12	0.00	53
May 13	0.38	59
May 14	0.61	59
May 15	0.07	59
May 16	0.63	55
May 17	0.00	49
May 18	0.00	52
May 19	0.00	55
May 20	0.00	66
May 21	0.00	67
May 22	0.00	71
May 23	0.00	62
May 24	0.00	71
May 25	0.00	64
May 26	0.08	59
May 27	1.27	68
May 28	0.02	60
May 29	0.00	59
May 30	0.00	62
May 31	0.00	64
Total	**4.81**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for DeKalb, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
June 1	0.39	64
June 2	0.18	63
June 3	0.30	56
June 4	0.00	57
June 5	0.00	60
June 6	0.00	61
June 7	T	59
June 8	2.20	67
June 9	0.04	67
June 10	T	62
June 11	0.00	65
June 12	0.00	61
June 13	0.46	66
June 14	0.92	60
June 15	0.00	66
June 16	0.00	71
June 17	0.02	67
June 18	0.20	70
June 19	0.04	70
June 20	1.17	76
June 21	0.00	77
June 22	0.17	77
June 23	0.00	80
June 24	0.00	84
June 25	0.00	84
June 26	T	81
June 27	0.00	77
June 28	0.07	77
June 29	0.00	70
June 30	0.00	66
Total	**6.16**	—

M=Missing
T=Trace

2009 Daily Weather Data for DeKalb, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
July 1	T	60
July 2	0.00	61
July 3	0.00	66
July 4	T	71
July 5	0.22	68
July 6	0.07	70
July 7	0.00	73
July 8	0.01	69
July 9	0.54	61
July 10	T	67
July 11	0.57	68
July 12	0.00	68
July 13	0.00	68
July 14	0.00	69
July 15	0.25	68
July 16	0.00	72
July 17	0.01	66
July 18	0.00	61
July 19	0.00	62
July 20	0.00	63
July 21	0.00	68
July 22	0.04	69
July 23	0.29	68
July 24	0.14	68
July 25	0.29	72
July 26	0.00	69
July 27	M	M
July 28	0.17	73
July 29	0.00	68
July 30	0.00	68
July 31	0.00	67
Total	**2.60**	—

M=Missing
T=Trace

2009 Daily Weather Data for DeKalb, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
August 1	0.00	69
August 2	0.05	62
August 3	0.00	68
August 4	0.02	73
August 5	0.00	71
August 6	0.00	68
August 7	T	69
August 8	0.90	67
August 9	T	79
August 10	0.01	77
August 11	0.00	74
August 12	0.00	70
August 13	0.00	68
August 14	0.00	70
August 15	0.00	74
August 16	0.00	74
August 17	0.36	70
August 18	0.07	72
August 19	0.00	69
August 20	0.96	70
August 21	0.02	69
August 22	0.66	62
August 23	0.02	61
August 24	0.00	64
August 25	0.00	66
August 26	0.60	69
August 27	1.97	64
August 28	0.53	61
August 29	0.05	60
August 30	0.00	58
August 31	0.00	55
Total	**6.22**	—

M=Missing
T=Trace

2009 Daily Weather Data for DeKalb, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
September 1	0.00	58
September 2	0.00	61
September 3	0.00	63
September 4	0.00	64
September 5	0.00	64
September 6	0.06	66
September 7	T	67
September 8	0.00	66
September 9	0.00	66
September 10	T	69
September 11	0.00	71
September 12	0.00	68
September 13	0.00	66
September 14	0.00	65
September 15	0.00	69
September 16	0.00	71
September 17	0.00	61
September 18	0.00	60
September 19	0.00	65
September 20	0.00	65
September 21	0.54	66
September 22	0.02	M
September 23	0.44	68
September 24	0.00	68
September 25	0.00	68
September 26	0.12	63
September 27	T	59
September 28	0.00	62
September 29	0.00	53
September 30	0.00	52
Total	**1.18**	—

M=Missing
T=Trace

2009 Daily Weather Data for DeKalb, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
October 1	0.00	51
October 2	0.96	49
October 3	0.27	48
October 4	0.06	50
October 5	0.00	49
October 6	0.10	53
October 7	0.08	52
October 8	0.00	51
October 9	0.14	49
October 10	0.25	38
October 11	0.00	36
October 12	0.00	35
October 13	0.00	39
October 14	M	M
October 15	0.28	43
October 16	0.16	39
October 17	0.00	41
October 18	0.08	40
October 19	0.00	43
October 20	0.00	53
October 21	0.07	54
October 22	0.01	62
October 23	1.68	50
October 24	0.06	46
October 25	M	M
October 26	0.43	53
October 27	0.09	45
October 28	0.01	46
October 29	0.00	52
October 30	1.18	56
October 31	0.41	52
Total	**6.32**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Monmouth, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
April 1	0.00	43
April 2	0.00	45
April 3	0.00	37
April 4	0.00	42
April 5	0.10	48
April 6	0.09	38
April 7	0.00	34
April 8	0.00	37
April 9	0.00	43
April 10	0.00	49
April 11	0.00	43
April 12	0.00	43
April 13	0.95	45
April 14	0.11	38
April 15	0.00	42
April 16	0.00	49
April 17	0.00	54
April 18	0.00	61
April 19	0.25	61
April 20	0.53	48
April 21	0.11	46
April 22	0.00	46
April 23	M	55
April 24	0.71	61
April 25	0.00	68
April 26	0.50	62
April 27	0.35	69
April 28	0.29	57
April 29	0.00	51
April 30	1.61	55
Total	**5.60**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Monmouth, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
May 1	T	59
May 2	0.00	52
May 3	0.00	55
May 4	0.00	60
May 5	0.00	60
May 6	0.00	65
May 7	0.02	65
May 8	0.08	64
May 9	T	63
May 10	0.00	53
May 11	0.00	53
May 12	0.00	56
May 13	0.38	64
May 14	0.92	60
May 15	1.11	58
May 16	2.13	53
May 17	0.00	48
May 18	0.00	54
May 19	0.00	59
May 20	0.00	68
May 21	0.00	69
May 22	0.00	70
May 23	0.00	71
May 24	0.10	72
May 25	0.00	68
May 26	0.06	61
May 27	0.42	71
May 28	0.00	59
May 29	0.00	56
May 30	0.00	65
May 31	0.00	64
Total	**5.22**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Monmouth, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
June 1	0.00	70
June 2	1.08	71
June 3	0.12	61
June 4	0.00	59
June 5	0.00	61
June 6	0.00	69
June 7	0.10	71
June 8	1.04	71
June 9	0.00	66
June 10	0.02	62
June 11	0.57	66
June 12	0.00	65
June 13	0.08	68
June 14	0.00	65
June 15	0.00	67
June 16	0.20	71
June 17	0.60	71
June 18	1.80	74
June 19	0.00	76
June 20	0.35	78
June 21	0.00	78
June 22	0.65	76
June 23	0.00	81
June 24	0.00	79
June 25	0.00	79
June 26	0.00	80
June 27	0.00	77
June 28	1.92	78
June 29	0.00	69
June 30	0.00	69
Total	**8.53**	—

M=Missing
T=Trace

2009 Daily Weather Data for Monmouth, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
July 1	0.00	69
July 2	0.00	65
July 3	0.00	65
July 4	1.00	71
July 5	0.16	63
July 6	0.00	69
July 7	0.01	72
July 8	0.32	73
July 9	T	69
July 10	0.00	69
July 11	0.28	74
July 12	0.00	71
July 13	0.00	67
July 14	0.00	72
July 15	0.66	72
July 16	0.00	72
July 17	0.15	67
July 18	0.00	62
July 19	0.00	60
July 20	0.00	61
July 21	0.00	69
July 22	0.25	64
July 23	T	67
July 24	0.00	71
July 25	0.70	73
July 26	0.00	70
July 27	0.00	71
July 28	0.05	75
July 29	T	69
July 30	0.00	70
July 31	T	67
Total	**3.58**	—

M=Missing
T=Trace

2009 Daily Weather Data for Monmouth, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
August 1	0.00	68
August 2	0.40	64
August 3	0.00	66
August 4	0.25	74
August 5	0.03	71
August 6	0.00	68
August 7	T	70
August 8	0.40	71
August 9	0.00	82
August 10	0.93	77
August 11	0.00	72
August 12	0.00	71
August 13	0.00	73
August 14	0.00	72
August 15	0.00	73
August 16	0.00	76
August 17	1.58	72
August 18	0.06	69
August 19	0.00	71
August 20	1.36	72
August 21	0.00	68
August 22	0.52	63
August 23	0.00	62
August 24	0.00	66
August 25	0.00	67
August 26	0.00	73
August 27	0.08	71
August 28	1.17	69
August 29	0.00	64
August 30	0.00	59
August 31	0.00	56
Total	**6.78**	—

M=Missing
T=Trace

2009 Daily Weather Data for Monmouth, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
September 1	M	M
September 2	0.00	61
September 3	0.00	62
September 4	0.00	66
September 5	0.00	67
September 6	0.00	67
September 7	0.22	67
September 8	0.00	68
September 9	0.00	68
September 10	0.00	67
September 11	0.00	70
September 12	0.00	70
September 13	0.00	67
September 14	0.00	63
September 15	0.00	67
September 16	0.00	68
September 17	0.00	64
September 18	0.00	59
September 19	0.00	63
September 20	0.00	66
September 21	0.22	61
September 22	0.23	65
September 23	0.00	63
September 24	0.00	68
September 25	0.74	65
September 26	0.14	63
September 27	0.00	58
September 28	0.00	65
September 29	0.00	55
September 30	0.00	51
Total	**1.55**	—

M=Missing
T=Trace

2009 Daily Weather Data for Monmouth, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
October 1	0.03	55
October 2	1.00	52
October 3	0.00	48
October 4	0.21	44
October 5	0.00	48
October 6	0.21	57
October 7	0.02	52
October 8	0.00	52
October 9	0.29	49
October 10	0.13	37
October 11	0.00	32
October 12	0.00	36
October 13	0.00	39
October 14	0.31	39
October 15	0.24	43
October 16	0.04	42
October 17	0.00	40
October 18	0.00	41
October 19	0.00	45
October 20	0.00	57
October 21	0.04	63
October 22	0.35	63
October 23	1.17	53
October 24	0.15	47
October 25	0.00	46
October 26	0.42	55
October 27	0.01	40
October 28	0.02	44
October 29	0.00	52
October 30	1.73	58
October 31	0.04	51
Total	**6.41**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Morrison, Illinois (Vantage Point Network)

Date	Precipitation (inches)	Mean Temperature (°F)
April 1	0.00	46
April 2	0.00	44
April 3	0.00	42
April 4	0.00	44
April 5	0.66	40
April 6	T	38
April 7	0.00	40
April 8	0.00	47
April 9	0.00	42
April 10	0.00	46
April 11	0.00	43
April 12	0.00	42
April 13	0.43	40
April 14	0.00	44
April 15	0.00	47
April 16	0.00	49
April 17	0.00	54
April 18	0.00	58
April 19	1.21	52
April 20	0.05	46
April 21	0.02	46
April 22	0.00	50
April 23	0.37	56
April 24	0.00	63
April 25	0.35	60
April 26	0.36	63
April 27	0.13	63
April 28	0.03	53
April 29	0.00	55
April 30	0.76	63
Total	**4.37**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Morrison, Illinois (Vantage Point Network)

Date	Precipitation (inches)	Mean Temperature (°F)
May 1	0.00	54
May 2	0.00	55
May 3	0.00	56
May 4	0.00	59
May 5	0.00	64
May 6	1.13	66
May 7	0.12	67
May 8	0.10	64
May 9	0.00	55
May 10	0.00	54
May 11	0.00	53
May 12	0.08	59
May 13	0.65	62
May 14	0.00	59
May 15	1.57	57
May 16	0.01	53
May 17	0.00	52
May 18	0.00	53
May 19	0.00	67
May 20	0.00	70
May 21	0.00	72
May 22	0.00	67
May 23	0.00	70
May 24	0.00	68
May 25	0.06	64
May 26	0.25	70
May 27	0.12	62
May 28	0.00	59
May 29	0.00	63
May 30	0.00	65
May 31	0.00	64
Total	**4.09**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Morrison, Illinois (Vantage Point Network)

Date	Precipitation (inches)	Mean Temperature (°F)
June 1	0.10	68
June 2	0.14	57
June 3	0.00	57
June 4	0.00	60
June 5	0.00	64
June 6	0.06	67
June 7	0.25	73
June 8	1.25	72
June 9	0.00	66
June 10	0.00	65
June 11	0.00	66
June 12	0.10	68
June 13	0.12	64
June 14	0.00	67
June 15	0.00	68
June 16	0.11	69
June 17	0.00	73
June 18	0.35	73
June 19	0.82	78
June 20	0.00	77
June 21	0.01	75
June 22	0.01	83
June 23	0.00	84
June 24	0.00	82
June 25	0.00	82
June 26	0.00	80
June 27	0.45	77
June 28	0.00	74
June 29	0.00	69
June 30	0.00	60
Total	**3.77**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Morrison, Illinois (Vantage Point Network)

Date	Precipitation (inches)	Mean Temperature (°F)
July 1	0.00	62
July 2	0.00	66
July 3	0.00	67
July 4	0.36	64
July 5	0.00	70
July 6	0.00	69
July 7	0.03	71
July 8	0.59	64
July 9	0.00	67
July 10	0.82	77
July 11	0.01	74
July 12	0.00	68
July 13	0.00	72
July 14	0.00	68
July 15	0.46	74
July 16	0.05	70
July 17	0.00	61
July 18	0.00	64
July 19	0.00	63
July 20	0.00	64
July 21	1.14	63
July 22	0.01	71
July 23	0.00	72
July 24	1.07	73
July 25	0.00	72
July 26	0.00	72
July 27	0.39	73
July 28	0.00	73
July 29	0.00	67
July 30	T	66
July 31	0.00	73
Total	**4.93**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Morrison, Illinois (Vantage Point Network)

Date	Precipitation (inches)	Mean Temperature (°F)
August 1	0.15	64
August 2	0.00	67
August 3	0.00	74
August 4	0.00	73
August 5	0.00	69
August 6	0.00	69
August 7	1.10	67
August 8	0.00	79
August 9	0.17	81
August 10	0.11	75
August 11	0.00	76
August 12	0.00	73
August 13	T	73
August 14	0.00	76
August 15	0.00	77
August 16	0.32	75
August 17	0.61	76
August 18	0.00	69
August 19	0.88	65
August 20	0.05	70
August 21	0.09	67
August 22	0.00	63
August 23	0.00	65
August 24	0.00	66
August 25	0.00	68
August 26	0.63	67
August 27	1.38	64
August 28	0.00	68
August 29	0.00	62
August 30	0.00	57
August 31	0.00	57
Total	**5.49**	—

M=Missing
T=Trace

2009 Daily Weather Data for Morrison, Illinois (Vantage Point Network)

Date	Precipitation (inches)	Mean Temperature (°F)
September 1	0.00	57
September 2	0.00	60
September 3	0.00	63
September 4	0.00	65
September 5	0.00	66
September 6	0.00	68
September 7	0.00	68
September 8	0.00	69
September 9	0.00	66
September 10	0.00	70
September 11	0.00	68
September 12	0.00	67
September 13	0.00	64
September 14	0.00	69
September 15	0.00	70
September 16	0.00	65
September 17	0.00	60
September 18	0.00	61
September 19	0.00	66
September 20	0.56	63
September 21	0.00	65
September 22	1.12	67
September 23	0.00	66
September 24	0.00	64
September 25	0.18	60
September 26	0.00	58
September 27	0.00	61
September 28	0.00	57
September 29	0.00	54
September 30	0.00	54
Total	**1.86**	—

M=Missing
T=Trace

2009 Daily Weather Data for Morrison, Illinois (Vantage Point Network)

Date	Precipitation (inches)	Mean Temperature (°F)
October 1	0.92	51
October 2	0.32	53
October 3	0.03	53
October 4	0.00	52
October 5	0.00	53
October 6	0.23	56
October 7	0.01	53
October 8	0.04	51
October 9	0.20	43
October 10	0.01	37
October 11	0.00	35
October 12	0.37	42
October 13	0.00	40
October 14	0.05	43
October 15	0.36	43
October 16	0.01	46
October 17	0.37	42
October 18	0.00	45
October 19	0.00	55
October 20	0.00	56
October 21	0.05	65
October 22	1.47	53
October 23	0.17	50
October 24	0.02	49
October 25	0.19	56
October 26	0.18	52
October 27	0.00	47
October 28	0.01	54
October 29	0.82	57
October 30	0.25	56
October 31	0.00	43
Total	**6.08**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Perry, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
April 1	0.00	47
April 2	T	48
April 3	0.06	44
April 4	0.00	43
April 5	0.03	53
April 6	0.11	45
April 7	T	35
April 8	0.00	40
April 9	0.00	45
April 10	1.24	46
April 11	0.00	41
April 12	0.00	45
April 13	0.68	48
April 14	0.01	41
April 15	0.01	41
April 16	0.00	52
April 17	0.00	52
April 18	0.00	62
April 19	0.28	63
April 20	0.14	51
April 21	0.00	51
April 22	0.00	49
April 23	0.00	58
April 24	0.00	65
April 25	0.02	78
April 26	0.08	77
April 27	0.05	67
April 28	1.92	59
April 29	0.01	54
April 30	1.02	60
Total	**5.66**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Perry, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
May 1	0.01	57
May 2	0.00	55
May 3	0.00	55
May 4	0.00	58
May 5	0.00	60
May 6	0.00	62
May 7	0.00	67
May 8	0.00	70
May 9	0.00	63
May 10	0.00	55
May 11	0.00	59
May 12	0.00	58
May 13	0.00	63
May 14	0.00	65
May 15	0.04	65
May 16	1.49	60
May 17	0.03	50
May 18	0.00	53
May 19	0.00	59
May 20	0.00	68
May 21	0.00	68
May 22	0.00	71
May 23	0.00	73
May 24	0.00	74
May 25	0.09	70
May 26	0.80	63
May 27	0.05	72
May 28	0.20	66
May 29	0.01	60
May 30	0.04	69
May 31	0.00	66
Total	**2.76**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Perry, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
June 1	0.00	70
June 2	0.00	76
June 3	0.50	69
June 4	0.00	59
June 5	0.00	62
June 6	0.03	72
June 7	0.07	72
June 8	0.22	73
June 9	0.00	70
June 10	1.07	67
June 11	0.79	72
June 12	0.30	65
June 13	0.00	68
June 14	0.00	70
June 15	0.03	71
June 16	0.65	70
June 17	0.01	76
June 18	0.01	80
June 19	0.00	82
June 20	0.65	79
June 21	0.00	80
June 22	0.04	82
June 23	0.00	87
June 24	0.00	84
June 25	0.00	87
June 26	0.00	84
June 27	0.00	80
June 28	1.10	81
June 29	0.00	73
June 30	0.00	72
Total	**5.47**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Perry, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
July 1	0.00	70
July 2	M	M
July 3	0.00	68
July 4	0.50	74
July 5	0.25	69
July 6	0.00	72
July 7	0.00	75
July 8	0.00	75
July 9	0.00	75
July 10	0.00	75
July 11	0.03	77
July 12	0.00	73
July 13	0.00	68
July 14	0.00	74
July 15	1.13	73
July 16	0.00	76
July 17	0.00	68
July 18	M	M
July 19	M	M
July 20	0.00	64
July 21	0.38	72
July 22	0.14	68
July 23	0.00	69
July 24	0.00	71
July 25	0.03	77
July 26	0.00	73
July 27	0.00	73
July 28	0.00	77
July 29	0.60	73
July 30	M	M
July 31	M	M
Total	**3.06**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Perry, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
August 1	M	M
August 2	M	M
August 3	0.00	70
August 4	M	M
August 5	0.05	73
August 6	0.01	70
August 7	0.00	71
August 8	M	M
August 9	M	M
August 10	0.11	80
August 11	0.00	78
August 12	0.00	72
August 13	0.00	74
August 14	0.00	72
August 15	0.00	73
August 16	0.01	78
August 17	1.90	73
August 18	0.85	73
August 19	0.00	74
August 20	1.13	72
August 21	M	M
August 22	0.20	65
August 23	0.00	63
August 24	0.00	65
August 25	0.00	68
August 26	0.00	70
August 27	M	M
August 28	0.66	75
August 29	0.00	72
August 30	0.04	72
August 31	M	M
Total	**4.96**	—

M=Missing
T=Trace

2009 Daily Weather Data for Perry, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
September 1	0.00	58
September 2	0.00	60
September 3	0.00	63
September 4	0.00	67
September 5	0.00	70
September 6	0.34	69
September 7	0.03	68
September 8	0.00	68
September 9	0.00	67
September 10	M	M
September 11	0.00	69
September 12	M	M
September 13	M	M
September 14	0.00	65
September 15	0.00	67
September 16	0.00	69
September 17	0.00	67
September 18	0.00	60
September 19	0.00	60
September 20	0.20	69
September 21	0.48	62
September 22	0.14	71
September 23	0.00	70
September 24	0.01	73
September 25	0.22	65
September 26	M	M
September 27	M	M
September 28	0.00	65
September 29	0.00	55
September 30	0.00	49
Total	**1.42**	—

M=Missing
T=Trace

2009 Daily Weather Data for Perry, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
October 1	0.12	55
October 2	0.27	54
October 3	0.01	53
October 4	0.00	48
October 5	0.00	49
October 6	0.51	54
October 7	0.00	53
October 8	M	M
October 9	1.23	50
October 10	0.19	39
October 11	0.00	41
October 12	0.13	41
October 13	0.01	45
October 14	0.84	43
October 15	0.18	45
October 16	0.01	44
October 17	M	M
October 18	M	M
October 19	0.00	50
October 20	0.00	60
October 21	0.00	61
October 22	0.05	61
October 23	1.45	54
October 24	M	M
October 25	M	M
October 26	0.53	58
October 27	0.01	47
October 28	0.17	46
October 29	0.00	53
October 30	2.12	59
October 31	0.03	50
Total	**7.86**	—

M=Missing
T=Trace

2009 Daily Weather Data for Urbana, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
April 1	0.00	47
April 2	0.18	58
April 3	0.63	46
April 4	0.00	47
April 5	0.74	49
April 6	0.09	36
April 7	0.00	40
April 8	0.00	45
April 9	0.00	49
April 10	0.47	49
April 11	0.00	44
April 12	0.00	45
April 13	0.90	47
April 14	0.13	43
April 15	0.00	46
April 16	0.00	53
April 17	0.00	57
April 18	0.00	61
April 19	0.53	63
April 20	0.53	51
April 21	0.10	43
April 22	0.00	53
April 23	0.00	58
April 24	0.00	71
April 25	0.00	73
April 26	0.00	74
April 27	1.06	72
April 28	0.61	58
April 29	0.00	60
April 30	1.14	66
Total	**7.11**	—

M=Missing
T=Trace

2009 Daily Weather Data for Urbana, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
May 1	0.17	60
May 2	0.00	57
May 3	0.00	58
May 4	0.00	61
May 5	0.00	63
May 6	0.00	65
May 7	0.07	69
May 8	0.51	63
May 9	0.00	61
May 10	0.00	57
May 11	0.00	57
May 12	0.00	60
May 13	3.03	63
May 14	0.40	64
May 15	0.08	67
May 16	1.73	61
May 17	0.00	52
May 18	0.00	55
May 19	0.00	64
May 20	0.00	69
May 21	0.00	74
May 22	0.00	78
May 23	0.00	74
May 24	0.01	75
May 25	0.27	69
May 26	0.00	70
May 27	0.01	74
May 28	0.25	67
May 29	0.00	69
May 30	0.00	69
May 31	0.06	67
Total	**6.59**	—

M=Missing
T=Trace

2009 Daily Weather Data for Urbana, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
June 1	0.08	77
June 2	0.21	74
June 3	0.61	63
June 4	0.00	59
June 5	0.00	64
June 6	0.00	72
June 7	0.00	72
June 8	0.13	75
June 9	0.00	71
June 10	0.00	73
June 11	2.69	73
June 12	0.00	68
June 13	0.00	73
June 14	0.00	71
June 15	0.01	71
June 16	0.11	73
June 17	0.00	77
June 18	1.77	76
June 19	1.20	80
June 20	0.22	78
June 21	0.00	81
June 22	0.35	82
June 23	0.00	84
June 24	0.00	85
June 25	0.00	86
June 26	0.00	84
June 27	0.00	80
June 28	M	M
June 29	M	M
June 30	0.00	70
Total	**7.38**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Urbana, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
July 1	0.00	65
July 2	0.00	69
July 3	0.00	70
July 4	1.22	71
July 5	0.04	72
July 6	0.00	75
July 7	0.24	76
July 8	1.21	68
July 9	0.59	71
July 10	0.00	77
July 11	0.51	78
July 12	0.00	73
July 13	0.00	74
July 14	0.00	72
July 15	1.15	76
July 16	0.00	74
July 17	0.00	70
July 18	0.00	66
July 19	0.00	68
July 20	0.00	70
July 21	0.00	71
July 22	0.00	70
July 23	0.00	73
July 24	0.00	74
July 25	0.83	73
July 26	0.00	72
July 27	0.03	74
July 28	0.00	78
July 29	0.25	73
July 30	0.00	71
July 31	0.00	72
Total	**6.07**	**—**

M=Missing
T=Trace

2009 Daily Weather Data for Urbana, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
August 1	0.00	70
August 2	0.03	69
August 3	0.00	73
August 4	0.46	74
August 5	0.00	75
August 6	0.00	71
August 7	0.08	71
August 8	0.00	78
August 9	0.00	84
August 10	0.00	79
August 11	0.00	79
August 12	0.00	72
August 13	0.00	73
August 14	0.00	76
August 15	0.00	79
August 16	1.09	81
August 17	0.90	79
August 18	0.12	76
August 19	0.47	76
August 20	0.28	72
August 21	0.22	69
August 22	0.00	64
August 23	0.00	66
August 24	0.00	67
August 25	0.00	71
August 26	0.00	74
August 27	0.00	77
August 28	3.32	74
August 29	0.00	67
August 30	0.00	61
August 31	0.00	59
Total	**6.97**	—

M=Missing
T=Trace

2009 Daily Weather Data for Urbana, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
September 1	0.00	61
September 2	0.00	64
September 3	0.00	69
September 4	0.00	69
September 5	0.02	68
September 6	0.04	71
September 7	0.00	69
September 8	0.01	68
September 9	0.00	70
September 10	0.00	72
September 11	0.00	71
September 12	0.00	69
September 13	0.00	67
September 14	0.00	68
September 15	0.00	72
September 16	0.00	70
September 17	0.00	64
September 18	0.00	64
September 19	0.00	68
September 20	0.30	65
September 21	0.00	71
September 22	0.42	73
September 23	0.00	72
September 24	0.08	70
September 25	0.03	66
September 26	0.00	67
September 27	0.00	64
September 28	0.00	62
September 29	0.00	56
September 30	0.00	59
Total	**0.90**	—

M=Missing
T=Trace

2009 Daily Weather Data for Urbana, Illinois (Midwest Climate Center)

Date	Precipitation (inches)	Mean Temperature (°F)
October 1	0.65	53
October 2	0.32	54
October 3	0.01	52
October 4	0.00	52
October 5	0.00	54
October 6	0.38	59
October 7	0.00	53
October 8	1.41	55
October 9	1.21	50
October 10	0.00	45
October 11	0.00	41
October 12	0.07	47
October 13	0.00	49
October 14	0.51	45
October 15	0.17	43
October 16	0.05	43
October 17	0.00	45
October 18	0.00	45
October 19	0.00	53
October 20	0.00	59
October 21	0.00	60
October 22	0.28	58
October 23	1.67	56
October 24	0.02	48
October 25	0.00	56
October 26	0.08	57
October 27	0.18	51
October 28	0.07	53
October 29	0.04	57
October 30	1.57	61
October 31	0.00	48
Total	**8.69**	**—**

M=Missing
T=Trace