

# FIELD 2005AY



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# KANSAS Southwest Research-Extension Center

## EFFICACY OF VIP- AND CRY1AB-EVENT CORN HYBRIDS FOR THE CONTROL OF SOUTHWESTERN CORN BORER AND CORN EARWORM

by  
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### SUMMARY

This trial was conducted to evaluate the efficacy of corn hybrids containing Cry1Ab events, and hybrids containing Cry1Ab events stacked with a VIP event, for controlling southwestern corn borer (SWCB), *Diatraea grandiosella* Dyar, and corn earworm (CEW), *Helicoverpa zea* (Bobbie). The efficacy of the Cry1Ab experimental event (3243M) against SWCB was equal to that of current Bt11 and TC1507 events. The addition of the VIP event stacked with a Cry1Ab event significantly improved efficacy against the corn earworm.

### PROCEDURES

Experimental corn seed (supplied by Syngenta) and commercial standard seed (added by the authors) was machine-planted May 28 at the Southwest Research-Extension Center, Garden City, Kansas. The plots were 4 rows wide and 20 ft long. The experimental seed was planted in a single row (row 2) and the other rows were planted to a commercial Bt corn seed. There were 10-ft-wide alleys at each end of the plots. The design was a randomized block design with 4 replicates. Four to 12 rows of Bt and non-Bt corn were planted around the experimental plots as a border and windbreak. One isoline and one TC1507 hybrid were treated for second-generation SWCB and CEW with Warrior T® at 3.84 oz/acre by using a 2-gallon hand sprayer on August 31. The spray was directed at the plants while the nozzle was moved up and down to treat the whole plant. The 10 largest plants in each plot were identified and then infested with 5 SWCB neonates between June 12 and 20 (first generation) and were infested with another 2 to 3 neonates between July 16 and 23 (second generation). The second-generation SWCB infestation seemed to result mostly from free-flying feral moths.

First-generation SWCB leaf-feeding damage was evaluated on August 9 according to the Guthrie scale (1 = no damage, and 10 = dead-heart). Two sets of

second-generation SWCB and CEW observations were made. The first observations were made between September 1 and 15 on 10 non-infested plants. The second observations were made on October 18 and 19 on the ten plants that had been infested with first-generation neonates. Tunneling that could be attributed to first-generation SWCB was excluded (first-generation tunneling typically had pupal case remains or very dark tissues around the tunnels). This was particularly important for treatment 6, which was susceptible during first-generation infestation—before the insecticide treatments were made. The ears from both sets of dissected plants were examined for corn earworm damage. Ear tip damage was measured according to the Winstrom scale (cm of feeding penetration, plus 1 for silk feeding). The number of harvestable kernels removed by CEW feeding on the first set of 10 plants was counted (or estimated). The number of CEW traces (tunnels) and the cm for each were estimated. Some SWCB damage in the ear base was present but it was minor and is not reported.

### RESULTS AND DISCUSSION

First-generation SWCB feeding damage in infested plants was light, but it still allowed the evaluation of plant resistance to first-generation SWCB. Guthrie ratings averaged 2.05 and 2.88 in the non-Bt isoline treatments (5 and 6)(Table 1). All transgenic hybrids (1 through 4 and 7 through 9) had significantly lower Guthrie ratings than at least one of the isoline hybrids (5 and 6) (Table 1).

Corn earworm damage was moderate, only reaching 4.03 to 4.25 on the Winstrom scale (Table 2). Only the two treatments with stacked Cry1Ab/VIP3a events (1 and 2) had significantly lower Winstrom ratings than did the susceptible isoline. The stacked Cry1Ab/VIP3a event hybrids (1 and 2) had only 0.8 to 1.0 damaged kernels, significantly fewer than the 56 damaged kernels on the susceptible isoline (5 and 6) (Table 2). The other Cry1ab and Cry1F event hybrids (3 through 5 and 7 through 9) had 22 to

28 damaged kernels, a significant reduction in damaged kernels, compared with the 56 damaged kernels on the susceptible isoline (Table 2). The insecticide treatment had 43 damaged kernels, and this was also a significant reduction in damaged kernels. Observations during the first week of September indicated that most CEW were still present in susceptible ears. By the second week, however, many CEW had left the ears of the susceptible isoline. Therefore, the numbers of CEW present probably do not represent CEW activity well (Table 2). The numbers of CEW traces (tunnels) and cm of CEW traces also indicate a significant reduction for the stacked Cry1Ab/VIP3a event hybrids.

The second-generation SWCB population averaged only 0.5 larvae per plant in the untreated non-Bt hybrid (6) (Table 1). During the first two weeks of September, about 25% of the SWCB were

found in the ear or shank, but by October all SWCB were found in the stem, and most were found at the base of the plant. All the Cry1Ab and Cry1F hybrids (1 through 4 and 7 through 9) and the insecticide-treated plots (6) had significantly reduced the numbers of SWCB larvae, to very low populations (Table 3). There was an average of 0.9 tunnels and 5.7 cm of tunneling per untreated non-Bt plant (5) (Table 3). All treatments significantly reduced the number of SWCB larvae and the amount of tunneling. A few SWCB were found in the Cry1F plants (8 and 9) (Table 3). The efficacy of the experimental Cry1Ab hybrids was outstanding against SWCB and seemed equal to that of the current commercial Bt11 and Cry1F corn hybrids. The efficacy of the VIP3a event stacked with a Cry1Ab event was also outstanding against the corn earworm.

**Table 1. Early-season observations on plant stand, plant maturity, and first-generation corn borer feeding, Southwest Research-Extension Center, Garden City, Kansas, 2004.**

Treatment number	Hybrid code (event)	Warrior treatment	Maturity* (% Silking)	Maturity* (% Tasseling)	Infested (/10 Plants)	Guthrie* rating
1	SPS1001L (Bt11 & MIR152V)	—	49 b	66	1.00 c	1.10 c
2	SPS1002L (3243M & MIR152V)	—	51 b	55	2.25 bc	1.25 c
3	SPS1005L (3243M)	—	100 a	95	3.50 bc	1.42 bc
4	SPS1007L (Bt11)	—	46 b	75	1.00 c	1.19 c
5	SPS1008L (none)	—	100 a	95	4.25 b	2.05 b
6	SPS1008L (none)	—	56 b	80	7.50 a	2.88 a
7	N4640 (Bt11)	—	46 b	69	1.25 bc	1.20 c
8	P34N42 (CH351)	—	39 b	63	0.25 c	1.03 c
9	P34N42 (CH351)	—	39 b	68	1.75 bc	1.20 c

P-value 0.0136 0.5148 0.0015 0.0001

LSD 40.00 NS 3.05 0.673

Means, within column, followed by the same letter are not significantly different ( $P \leq 0.05$ , LSD).

\*Guthrie (1-9 scale) and Maturity Ratings taken 9 Aug. 2004.

<b>Table 2. Observations on corn earworm feeding taken on primary corn ears, Southwest Research-Extension Center, Garden City, Kansas, 2004.</b>									
Treatment number	Hybrid code (event)	Warrior treatment	Winstrom ratings		Kernels damaged (mean/ear)	CEW larvae (/10 ears)	CEW mean instar	CEW traces (/10 ears)	CEW mean (cm/ear)
			mean						
			9/1-14	10/18-19					
1	SPS1001L (Bt11 & MIR152V)	—	0.32 c	1.50 c	0.8 d	0.15	2.68	0.23 d	0.10 c
2	SPS1002L (3243M & MIR152V)	—	0.70 c	0.78 c	1.0 d	0.20	3.08	0.47 d	0.23 c
3	SPS1005L (3243M)	—	3.20 ab	3.20 b	23.2 c	1.00	3.15	1.78 ab	3.23 b
4	SPS1007L (Bt11)	—	3.10 ab	3.80 ab	28.3 c	0.78	3.33	1.63 b	3.28 ab
5	SPS1008L (none)	—	4.03 a	3.93 ab	56.2 a	0.65	4.03	2.10 ab	4.95 ab
6	SPS1008L (none)	8/31	3.90 ab	4.25 a	43.3 b	0.48	3.85	1.70 b	5.30 ab
7	N4640 (Bt11)	—	3.05 b	3.83 ab	19.7 c	1.05	3.55	1.53 c	3.43 ab
8	P34N42 (CH351)	—	3.33 ab	2.83 ab	23.9 c	1.28	3.60	2.30 a	5.43 a
9	P34N42 (CH351)	8/31	3.50 ab	3.45 ab	21.6 c	1.18	3.70	2.15 ab	5.23 ab
P-value			>0.0001	>0.0001	>0.0001	0.0899	0.2188	>0.0001	>0.0001
LSD			0.949	0.994	13.029	NS	NS	0.546	2.178
Means, within column, followed by the same letter are not significantly different ( $P \leq 0.05$ , LSD).									

Table 3. Observations on second- generation southwestern corn borer feeding on corn plants, Southwest Research-Extension Center, Garden City, Kansas, 2004.									
Treatment number	Hybrid code (event)	Warrior treatment	2nd gen.* SWCB (/20 plants)	Tunnels (/20 plants)*			Tunnels (cm/20 plants)*		
				Stalk	Shank	Total	Stalk	Shank	Total
1	SPS1001L (Bt11 & MIR152V)	—	0.00 c	0.0 c	0.0 b	0.0 c	0.0 c	0.0 c	0.0 c
2	SPS1002L (3243M & MIR152V)	—	0.00 c	0.0 c	0.0 b	0.0 c	0.0 c	0.0 c	0.0 c
3	SPS1005L (3243M)	—	0.00 c	0.0 c	0.0 b	0.0 c	0.0 c	0.0 c	0.0 c
4	SPS1007L (Bt11)	—	0.00 c	0.0 c	0.0 b	0.0 c	0.0 c	0.0 c	0.0 c
5	SPS1008L (none)	—	9.75 a	11.8 a	5.5 a	17.3 a	99.0 a	13.5 a	113.5 a
6	SPS1008L (none)	8/31	4.50 b	7.3 b	4.0 a	9.8 b	50.4 b	8.3 b	57.4 b
7	N4640 (Bt11)	—	0.00 c	0.0 c	0.0 b	0.0 c	0.0 c	0.0 c	0.0 c
8	P34N42 (CH351)	—	0.00 c	0.1 c	0.3 b	0.5 c	0.1 c	0.1 c	0.3 c
9	P34N42 (CH351)	8/31	0.25 c	0.5 c	0.0 b	0.5 c	4.0 c	4.0 c	4.0 c
	P-value		>0.0001	>0.0001	>0.0001	>0.0001	>0.0001	0.0001	>0.0001
	LSD		1.775	1.982	1.283	3.696	15.442	0.160	17.715
Means, within column, followed by the same letter are not significantly different ( $P \leq 0.05$ , LSD).									
*Plants dissected Sept. 1-14 and Oct. 18-19.									

