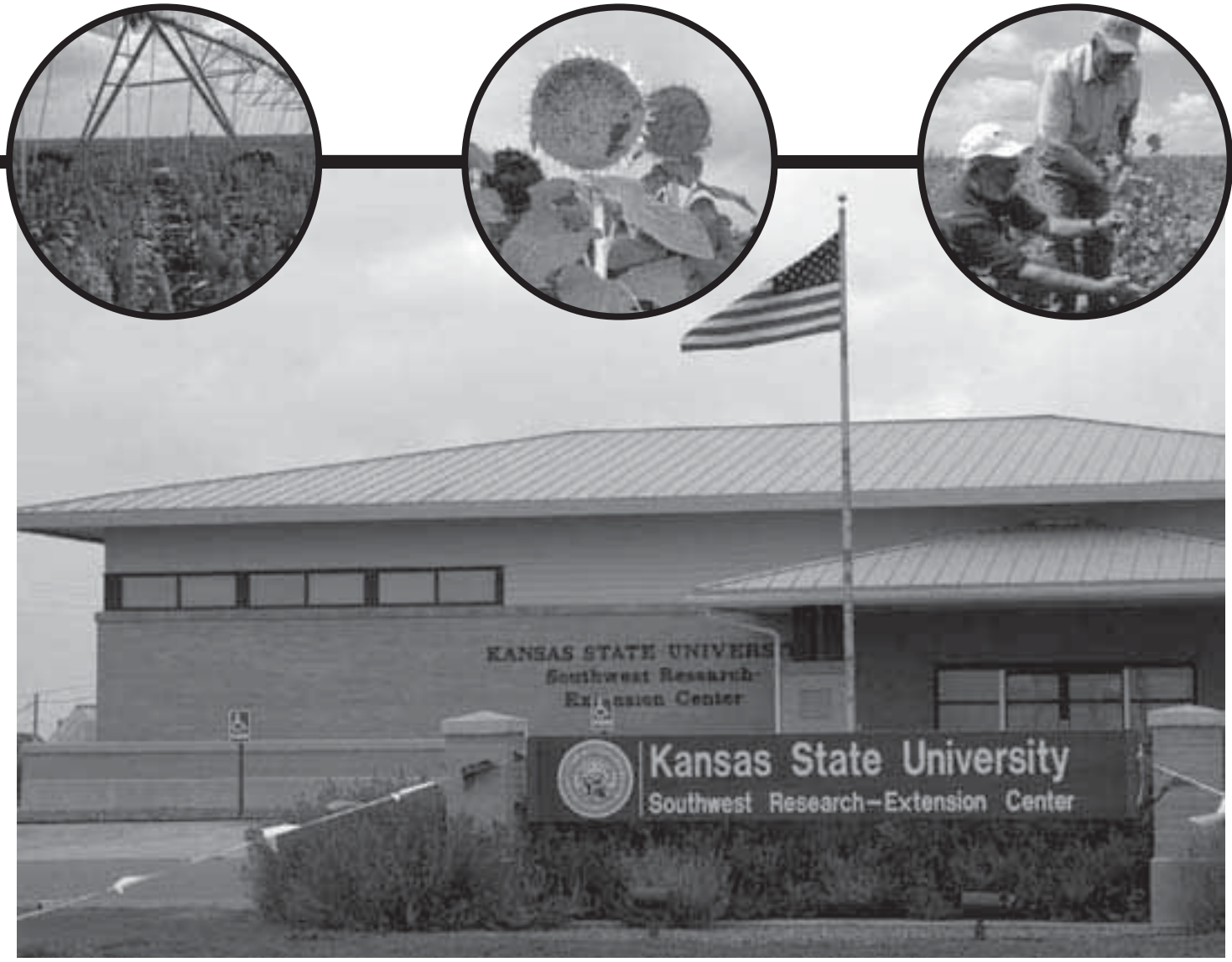
FIELD DAY 2008



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EFFICACY OF MONSANTO STACKED EVENT CORN HYBRIDS FOR CONTROL OF SOUTHWESTERN CORN BORER AND CORN EARWORM, 2007

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SUMMARY

This trial was conducted to evaluate the efficacy of corn hybrids containing events MON89034 (YGVTPRO), MON810 (YGCB) and TC1507 (HXCB) for controlling the corn earworm (CEW), *Helicoverpa zea* (Bobbie), and the southwestern corn borer (SWCB), *Diatraea grandiosella* Dyar. All three of the Bt hybrids gave excellent control of SWCB. Efficacy of the YGVTPRO event was outstanding against both SWCB and CEW. A significant proportion of kernel damage appeared to be attributable to the Dusky Sap Beetle (DSB), *Carpophilus lugubris* Murray, and none of the Bt corn hybrids had efficacy on this insect.

PROCEDURES

Experimental corn seed (supplied by Monsanto) was machine planted on May 21 at the Southwest Research-Extension Center, Garden City, KS. Plots were eight rows wide and 20 ft long. There were 10-ft-wide alleys at each end of the plots. The study design was a randomized block with four replicates. Four rows of non-Bt corn were planted around the experimental plots as a border and windbreak. On July 13, 15 plants in two designated SWCB rows were infested with ≈45 SWCB first instars. On August 10, the rest of the plants in the SWCB rows were infested with ≈15 SWCB first instars. The SWCB eggs were from a laboratory colony provided by Monsanto. A few WBCW first instars from a field-collected egg mass were used to infest two plants in the two WBCW rows in the first three replicates.

On July 24, the 15 SWCB infested plants were evaluated for feeding damage using the Guthrie Rating (1-9). Plants had tasseled at this time. On August 6 and 7, 15 ears from the outside rows in each plot were evaluated for CEW. This was done to catch the CEW before they reached maturity and left the ear. On August 9, a set of five infested plants was dissected to record SWCB damage in the stalks and CEW damage in the ears. In October, another 20 plants were dissected to record end-of-season SWCB damage; five of the plants had been infested on July 13, and 15 had been infested on August 10. There was a significant difference in damage recorded for the two groups of plants, so data are reported separately. Ears were also evaluated for CEW damage. At this stage, however, there was also significant damage from DSB so an effort was made to separate CEW damage from DSB damage. Ear tip damage was measured using the Winstrom scale (cm of feeding penetration plus 1 for silk feeding). The number of harvestable kernels removed by CEW feeding or DSB feeding was counted. Some SWCB damage in the ear base was present and was reported separately from damage at the ear tip, which was associated with CEW or DSB feeding. Tunneling in the stalk or shank was also recorded. Data were analyzed by ANOVA, and means were separated by LSD.

RESULTS AND DISCUSSION

There was considerable variability in the maturity of plants across replicates. On July 20, Treatment 2 (YGCB) had slightly fewer plants showing tassels but difference in maturity across treatments was not significant ($P = 0.1099$).

First-generation SWCB feeding damage was significantly higher in the check than in the Bt corn hybrids (Table 1, Photo 1). Guthrie ratings were lower (4.6) than in other years (up to 7 or 8) because plants were much larger when infested than in other years (Fig. 1). When plants were dissected (August 9), there were significantly more SWCB larvae and more tunneling damage in the check than in the Bt corn hybrids (Table 2, Fig. 2). Results were similar in October; there were significantly more SWCB larvae and more SWCB tunneling damage in the check than in the Bt corn hybrids (Tables 3 and 4).

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Feral CEW pressure was quite high, as usual; 93% of check ears were infested on August 6 and 7 (Tables 1 and 2), and 100% were infested later in the season. On August 6 and 7, CEW larvae were significantly larger (larger instars) in the check than in the Bt corn hybrids, and larvae in Treatment 1, (YGVTPRO) were significantly smaller than those in the Bt corn hybrids (Table 1, Fig. 3). The number of first, second, and third instars did not differ significantly across hybrids, but the number of fourth, fifth, and sixth instars was significantly higher in the check than in the Bt corn hybrids. The number of damaged kernels also was significantly higher in the check than in the Bt corn hybrids, but the number of damaged kernels in Treatment 1 (YGCB) was significantly lower than in the check hybrid (Tables 1 and 2). It is interesting that when kernel damage was assigned to CEW or DSB, the DSB appeared to be responsible for 20% to 40% of kernel damage (Tables 3 and 4, Fig. 4). The DSB damage was not suppressed by any of the Bt corn hybrids, but CEW damage was significantly suppressed by Treatment 1 (YGVTPRO). This year's Winstrom ratings were moderate, reaching 4.9 to 11.3.

Only three western been cutworms *Loxagrotis albicosta* (Smith) were recorded; they were on the control and standard Bt hybrids. A total of 13 DSB larvae were recorded, all on the Bt hybrids. The CEW larvae might have eliminated the larvae from control ears.

Because plant stand and growing conditions were variable, grain yield was variable and there were no significant differences among hybrids. The SWCB row yielded 142.95 bu/a (P = 0.4180), and the CEW row yielded 128.14 bu/a (P = 0.9313).

Efficacy of the all the Bt hybrids was outstanding on SWCB. Efficacy of YGVTPRO was outstanding on both SWCB and CEW. A significant proportion of kernel damage could be attributed to DSB; none of the Bt corn hybrids had efficacy on this insect.

Photo 1. Corn earworm damage on corn ears in the different treatments.
Photos by Larry Buschman

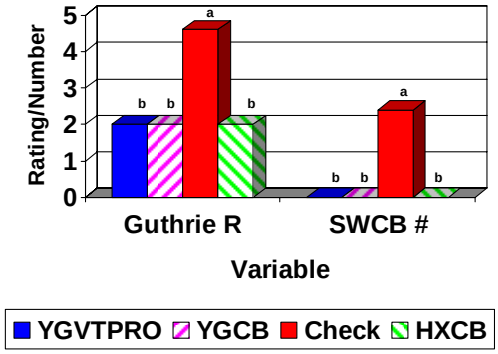

Figure 1. First generation ratings and numbers of southwestern corn borer

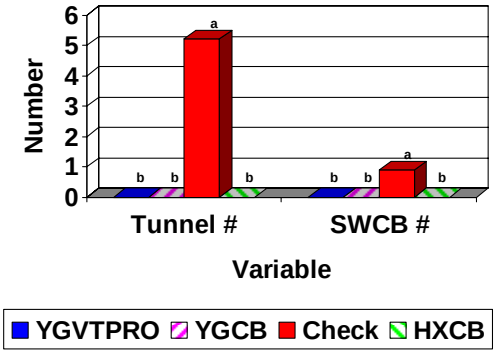

Figure 2. Second generation southwestern corn borer tunnels and numbers of larvae

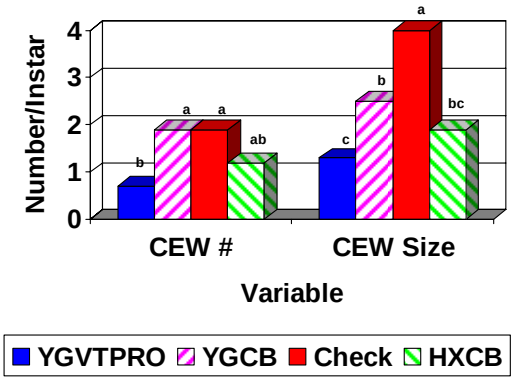

Figure 3. Corn earworms in the ear and corn earworm size

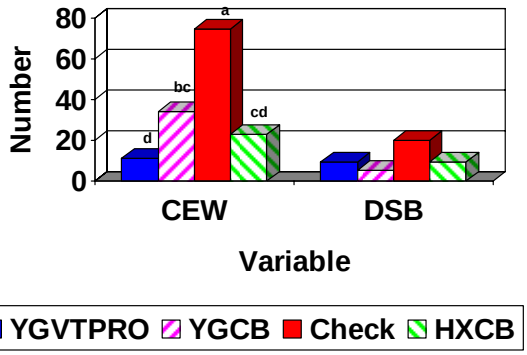

Figure 4. Kernels damaged by corn earworms and dusky sap beetles

Table 1. Southwestern corn borer (SWCB) damage ratings on July 24 and corn earworm (CEW) observations on August 6 and 7

	Means				ANOVA	
	YGVTPRO	YGCB	Check	HXCB	P-value	CV
SWCB (Guthrie Rating 1-9)	2.0[b]	2.0[a]	4.6[a]	2.0[b]	<0.0001	13
CEW (% Ears Infested)	50.5[b]	88.3[a]	93.3[a]	62.3[b]	<0.0225	25
CEW Larvae/Ear	0.7[c]	1.9[ab]	1.9[ab]	1.2[bc]	<0.0067	31
CEW Mean Instar	1.3[c]	2.5[b]	4.0[a]	1.9[bc]	<0.0001	18
Damaged Kernels/Ear	1.0[c]	8.3[b]	34.3[a]	5.8[bc]	<0.0003	27
Mean Damaged Kernels/Damaged Ear	1.5[c]	9.8[b]	38.3[a]	7.0[bc]	<0.0021	29
CEW 1st-3rd Instars/Ear	0.7	1.6	0.6	1.1	<0.1109	26
CEW 4th-6th Instars/Ear	0.0[c]	0.3[b]	1.3[a]	0.1[bc]	<0.0001	28

Within rows, means without a common superscript differ (P < 0.05).

Table 2. Corn earworm (CEW) and southwestern corn borer (SWCB) observations on August 9 from five plants infested with SWCB on July 11

	Means				ANOVA	
	YGVTPRO	YGCB	Check	HXCB	P-value	CV
CEW Larvae/Plant	0.8[b]	2.0[a]	2.3[a]	2.2[a]	0.0001	25
CEW Mean Instar	1.8[c]	3.3[b]	4.9[a]	3.0[bc]	0.0032	25
Damaged Kernels/Ear Tip	2.3[c]	16.9[bc]	88.9[a]	15.7[bc]	0.0002	57
SWCB Larvae/Plant	0.0[b]	0.0[b]	2.4[a]	0.0[b]	0.0001	24
% of Plants With Ear Tongue Feeding	0.0[b]	1.5[b]	80.5[a]	0.0[b]	0.0001	30
SWCB Stalk Tunnels, no.	0.0[b]	0.0[b]	2.6[a]	0.0[b]	0.0001	8
SWCB Stalk Tunnels, cm/plant	0.0[b]	0.0[b]	19.4[a]	0.0[b]	0.0001	12
SWCB Shank Tunnels, no.	0.0[b]	0.0[b]	0.6[a]	0.0[b]	0.0001	16
SWCB Shank Tunnels, cm/plant	0.0[b]	0.0[b]	3.7[a]	0.0[b]	0.0001	33
SWCB Damage Ear Base, cm/plant	0.0[b]	0.0[b]	12.7[a]	0.0[b]	0.0001	40
Damaged Kernels/ Plant Ear Base	0.0[b]	0.4[b]	12.7[a]	0.0[b]	0.0001	52

Within rows, means without a common superscript differ (P < 0.05).

Table 3. End-of-season observations on southwestern corn borer (SWCB), corn earworm (CEW), and dusky sap beetle (DSB) from five plants infested with SWCB on both July 11 and August 10

	Means				ANOVA	
	YGVTPRO	YGCB	Check	HXCB	P-value	CV
SWCB Larvae/Plant	0.0[b]	0.0[b]	0.9[a]	0.0[b]	<0.0001	14
SWCB Stalk Tunnels, no.	0.0[b]	0.0[b]	5.2[a]	0.0[b]	<0.0001	4
SWCB Stalk Tunnels, cm/plant	0.0[b]	0.0[b]	44.5[a]	0.0[b]	<0.0001	16
SWCB Shank Tunnels, no.	0.0[b]	0.0[b]	0.6[a]	0.0[b]	<0.0001	78
SWCB Shank Tunnels, cm/plant	0.0[b]	0.0[b]	1.2[a]	0.0[b]	<0.0001	62
SWCB Damage Ear Base, cm/plant	0.0[b]	0.0[b]	1.5[a]	0.0[b]	<0.0014	150
CEW Winstrom Rating Ear Tip cm/Plant	2.7[c]	5.1[bc]	11.3[a]	4.5[bc]	<0.0012	15
CEW Kernel Damage Ear Tip/Plant	11.3[d]	34.2[bc]	74.7[a]	23.2[cd]	<0.0034	15
DSB Kernel Damage/Plant	9.6	5.2	20.1	9.4	<0.4175	50
Total Kernel Damage/Plant	20.9[c]	39.4[bc]	94.9[a]	32.6[bc]	<0.0058	9

Within rows, means without a common superscript differ (P < 0.05).

Table 4. End-of-season observations on southwestern corn borer (SWCB), corn earworm (CEW), and dusky sap beetle (DSB) from 5 plants infested with SWCB on August 10

	Means				ANOVA	
	YGVTPRO	YGCB	Check	HXCB	P-value	CV
SWCB Larvae/Plant	0.0[b]	0.0[b]	0.9[a]	0.0[b]	<0.0001	31
SWCB Stalk Tunnels, no.	0.0[b]	0.1[b]	2.3[a]	0.0[b]	<0.0001	50
SWCB Stalk Tunnels, cm/plant	0.0[b]	0.3[b]	27.9[a]	0.0[b]	<0.0001	50
SWCB Shank Tunnels, no.	0.0[b]	0.0[b]	0.3[a]	0.0[b]	<0.0005	116
SWCB Shank Tunnels, cm/plant	0.0[b]	0.0[b]	0.5[a]	0.0[b]	<0.0002	108
SWCB Damage Ear Base, cm/plant	0.0[b]	0.1[b]	0.3[a]	0.0[b]	<0.0007	91
CEW Winstrom Rating Ear Tip cm/Plant	2.1[c]	4.2[bc]	4.9[a]	2.8[bc]	<0.0364	20
CEW Kernel Damage Ear Tip/Plant	6.3[b]	26.3[a]	33.9[a]	10.6[b]	<0.0246	14
DSB Kernel Damage/Plant	12.5	18.4	23.5	17.1	<0.6358	12
Total Kernel Damage/Plant	20.3[b]	44.7[a]	57.9[a]	30.2[b]	<0.0130	6

Within rows, means without a common superscript differ (P < 0.05).

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