

EFFICACY OF B.t. CORN HYBRIDS AGAINST CORN EARWORMS AND FALL ARMYWORMS

Texas Agricultural Experiment Station, Corpus Christi, TX, 1999

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OBJECTIVES: The study was a comparison between corn hybrids genetically expressing the caterpillar B.t. toxin and hybrids without the B.t. gene. The objectives were to (1) measure damage in corn whorls, stalks and ears caused by caterpillars, (2) evaluate direct effects on caterpillars, (3) determine aflatoxin levels in hybrids and (4) obtain yield data.

MATERIALS/METHODS: Test hybrids were arranged in a RCB design with 4 replications on the Texas Agricultural Experiment Station near Corpus Christi, Texas. Individual plots were 8 rows (38-inch centers) X 200 ft. Fertilizer applied to the site was 99-14-0 + .6 Zn and atrazine 4L (1 qt/acre) + Dual 8E (1.5 pt/acre) were applied for weed control. In May, atrazine 4L (1 qt/acre) + Banvel (8 oz/acre) were applied for additional weed control. The experiment was planted 22 Mar and Counter 15G (6.0 lb formulated/acre) was applied at planting. Plants were thinned to 1.8/row ft in Apr.

Irrigation of 0.5 inches/acre were applied on 25-26 Mar and again on 19-20 Apr. On 26 May corn kernels (1.0 Kg) infested with *Aspergillus flavus* containing aflatoxin were distributed between two rows (50 ft/row).

Treatment effects were assessed by (1) counting the number of corn earworms (CEW) and fall armyworms (FAW) in 20 plant whorls/plot on 21 Apr (8th true leaf) and again on 30 Apr (11th true leaf), (2) examining 15 ears/plot for caterpillars on 7 Jun and weighing CEW and FAW larvae to determine their weight, (3) evaluating stalk and ear damage in 15 stalks and ears on 1 Jul, (4) harvesting 13.75 ft row at each of two locations per plot on 27 Jul, and (5) measuring aflatoxin levels. Table 1 is a list of phenological and sampling events.

RESULTS/DISCUSSION: Fewer CEW were found in whorls of the B.t. hybrids on two inspection dates (Table 2). Although significant differences were not found in FAW numbers, numerically fewer were found in the B.t. compared with the non-B.t. hybrids. Greater numbers of CEW larvae were found in the B.t. corn hybrid plots (Table 3) but the average weight of these larvae was greatly reduced on the B.t. hybrids (Table 4). No differences were found in FAW or sugarcane borer (SCB) numbers or larval weights. Mexican rice borer (MRB), FAW and ear shank injury were not different (Table 5), but overall numbers of these insects were too low to obtain significant data. Stalk tunneling was greatest in the Pioneer P3223 non-B.t. hybrid but overall numbers were again too low to obtain sufficient separation of hybrids. Ear injury ratings (Windstrom method) were not lower in the B.t. hybrid compared with its isogenic counterpart (Table 6). The lowest aflatoxin level was in the non-B.t. hybrid, P3223, significantly less than in its isogenic counterpart as well as less than in other tested hybrids. Evidently, there are agronomic differences other than insect resistance affecting propensity for aflatoxin expression. In contrast, tests in 1998 generally showed lower aflatoxin levels in some of these same B.t. hybrids compared with their isogenic counterparts. Statistical differences did not occur in yields.

ACKNOWLEDGMENTS: Thanks are extended to Pioneer Hi-Bred International, Garst Seed Company, Novartis Seed Company and Triumph Seed Company for providing corn hybrids used in this study.

NOTE: A more extensive report with additional data will be forthcoming.

Table 1. Time table of phenological and sampling events, Bt corn test, Texas Agricultural Experiment Station, Corpus Christi, TX, 1999.

Event	Date	DAP ^a
Planting	3/22	0
Whorl rating (1)	4/21	30
Whorl rating (2)	4/30	39
Whorl rating (3)	5/17	56
Tasseling/silking	5/22	61
Inoculation with <u>A. flavus</u>	5/26	65
Full silk	5/28	67
Ear sample for insects	6/7	77
Stalk/ear sample for insects	7/1	101
Ear injury and aflatoxin rating	8/2	133
Harvest	7/27	126

^a DAP = Days after planting

Table 2. Number of corn earworm (CEW), fall armyworm (FAW) and sugar cane borer (SCB) larvae in whorls of corn hybrids at 8th leaf (V8) and 11th leaf (VII) stage of growth, Texas Agricultural Experiment Station, Corpus Christi, TX, 1999.

Hybrid	Number per 20 whorls					
	V8			VII		
	CEW	FAW	SCB	CEW	FAW	SCB
P3223	4.0 b	1.5	0	1.3 a	2.8	0
P31B13 Bt	0.0 c	1.0	0	0.0 b	1.8	0
G8325	6.8 a	1.8	0	1.5 a	4.5	0
G8325 Bt	0.0 c	1.8	0	0.0 b	2.0	0
NK7639 Bt	0.0 c	0.3	0	0.0 b	0.3	0
T1866 Bt	0.0 c	0.8	0	0.0 b	1.3	0
LSD (P=0.05)	1.1647	NS	NS	1.2484	NS	NS
P>F	0.0001	.8010		0.0462	.1846	

Means in a column followed by the same letter are not significantly different by ANOVA, Fisher's protected LSD, NS = Non significant.

Table 3. Number of corn earworm (CEW), fall armyworm (FAW) and sugarcane borer (SCB) larvae in ears of different corn hybrids at soft/hard dough stage, Texas Agricultural Experiment Station, Corpus Christi, TX, 1999.

Hybrid	Number per 15 ears		
	CEW	FAW	SCB
P3223	29.3 bc	4.8	0
P31B13 Bt	44.0 a	1.8	0
G8325	20.3 c	2.8	0
G8325 Bt	42.3 a	2.8	0
NK7639 Bt	47.8 a	3.0	0
T1866 Bt	39.3 ab	2.3	0
LSD (P=0.05)	10.842	NS	NS
P>F	0.0006	.3168	

Means in a column followed by the same letter are not significantly different by ANOVA, Fisher's protected LSD, NS = Non significant.

Table 4. Average larval weight (mg) of corn earworm (CEW) and fall armyworm (FAW) in 60 ears of six corn hybrids at soft/hard dough stage, Texas Agricultural Experiment Station, Corpus Christi, TX, 1999.

Hybrid	Larval weight (mg)			
	CEW	(n)	FAW	(n)
P3223	200 b	(117)	85	(19)
P31B13 Bt	34 e	(176)	27	(7)
G8325	276 a	(81)	65	(11)
G8325 Bt	99 c	(169)	47	(11)
NK7639 Bt	52 de	(191)	129	(12)
T1866 Bt	81 cd	(157)	149	(9)
LSD (P=0.05)	30.4		NS	
P>F	0.0001		.2365	

Means in a column followed by the same letter are not significantly different by ANOVA, Fisher's protected LSD, NS = Non significant.

Table 5. Stalk/ear injury and tunneling in corn hybrids at harvest, Texas Agricultural Experiment Station, Corpus Christi, TX, 1999.

Hybrid	Amount per 15 plants			
	MRB ^a	FAW ^b	Stalk tunneling (cm) ^c	Shank injury ^d
P3223	1 a	0.0	11.8 a	1.5
P31B13 Bt	0 b	0.8	0 b	1.5
G8325	0 b	0.8	0 b	0.3
G8325 Bt	0 b	0.5	0 b	0.3
NK7639 Bt	0 b	0.3	0 b	0.8
T1866 Bt	0 b	0.0	0 b	0.0
LSD (P=0.05)	.5024	NS	5.4429	NS
P>F	.003	.4979	.0014	.2235

Means in a column followed by the same letter are not significantly different by ANOVA, Fisher's protected LSD, NS = Non significant.

^a Mexican rice borers found inside the stalk.

^b Fall armyworms found inside the ears.

^c Stalk tunneling measured in cm.

^d Number of shanks injured.

Table 6. Ear injury, aflatoxin content and yield of corn hybrids, Texas Agricultural Experiment Station, Corpus Christi, TX, 1999.

Hybrid	Ear injury (Widstrom scale)	Aflatoxin (ppb)	Yield (lb/acre)
P3223	5.3 c	27.5 c	5218 (93.2) ^b
P31B13 Bt	5.3 c	107.5 b	5306 (94.7)
G8325	6.9 a	125.0 b	4943 (82.3)
G8325 Bt	6.6 a	167.5 ab	4875 (87.1)
NK7639 Bt	5.8 b	312.5 a	4956 (88.5)
T1866 Bt	6.7 a	265.0 a	4772 (85.2)
LSD (P=0.05)	.4729	^a	NS
P>F	.0001	.001	.1273

Means in a column followed by the same letter are not significantly different by ANOVA, Fisher's protected LSD, NS = Non significant.

^a Natural log transformation before ANOVA and LSD. Untransformed data presented here.

^b Numbers in parenthesis are yields expressed in bu/acre.