EVALUATION OF TRANSGENIC B.t. COTTON CULTIVARS

Texas Agricultural Experiment Station, Nueces County, 2000

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SUMMARY: The B.t. transgenic cotton cultivars evaluated (DPL 50BII, DPL 50B, DPL 33B) contained significantly fewer bollworm and tobacco budworm larvae in terminals, had less terminal and square damage, exhibited lower leaf grazing, and sustained less caterpillar damage to bolls compared to the non-transgenic cultivar (DPL 50). Although not always demonstrated statistically, DPL 50BII sustained less terminal, square and boll damage than the other cultivars. Marked differences were not found in cotton fiber characteristics except for fiber strength which was significantly greater in the DPL 33B cultivar. Bollworm/tobacco budworm damage was not heavy or sustained during the season.

OBJECTIVES: The experiment was conducted to collect insect efficacy data on the Bollgard II cotton cultivar DPL 50BII and to compare it with DPL 50B, DPL 33B and DPL 50. Our objective was to measure effects on caterpillars, along with gathering data on cotton lint fiber characteristics and lint yield.

MATERIALS/METHODS: The field study was planted on the Texas Agricultural Experiment Station at Corpus Christi, Texas on land where corn was grown the previous season. To comply with testing requirements, 12-row cotton buffers on the sides and 40-ft cotton buffers on the ends of the experiment were planted (Buffer rows and the cotton experiment was destroyed following the season). Test cotton was planted 20 Apr 2000 at 60,000 seed/acre in 4 row (38-inch centers) x 40-ft plots arranged in a randomized complete block design with 4 replications. A 4-row research type cone planter was used to distribute seed. Fertilizer consisted of 100-14-0 + 0.6 Zn/acre. Herbicides consisted of Treflan (4 lb ai/gal) was applied and incorporated 9 Nov 99 at 1.0 qt/acre and Staple (85% SP) at 1.2 oz/acre was broadcast following planting. Rainfall during the growing season amounted to 4.84 inches. Beginning 30 Jun and at 3 weekly intervals irrigation water was applied by surface drip irrigation line for a total volume of approximately 8 inches.

Treatment effects were assessed by (1) examining 25 terminals, squares and bolls for caterpillar eggs, larvae and damage, (2) assigning a caterpillar grazing rating to each plot on two dates and (3) harvesting by hand, 10 ft row from each of the center 2 rows/plot on 14 Aug. Seed cotton was processed on a 10-Saw Eagle laboratory machine. Seed obtained from ginning was buried in the field plot as required. Lint samples were sent to the International Textile Center at Lubbock, TX for fiber analysis.

RESULTS/DISCUSSION: Statistical differences were not found in heliothine eggs on any of 4 inspection dates (Table 1). Small caterpillars were not found on plant terminals in any B.t. transgenic cotton variety on the first 3 inspection dates; significantly greater numbers were found in DPL 50 (non transgenic variety) on these dates. Only on the last inspection date (8 Jul) were larvae found on all cotton cultivars. Terminal damage was significantly greater on DPL 50 cultivar on all inspection dates (Table 2). No differences were observed in the B.t. transgenic cultivars until 8 Jul. On that date, significantly greater terminal damage was observed on DPL 50B compared to damage in DPL 50BII. Square damage was reduced in B.t. transgenic cultivars on 17 Jun and 23 Jun, but on 30 Jun and 8 Jul (first date DPL 33B and next date DPL 50B)

square damage was not statistically different from that in DPL 50 cotton. Caterpillar leaf grazing was significantly greater in DPL 50 cotton on both inspection dates (Table 3). Boll damage was also greater in the DPL 50 cultivar on 8 Jul but on 16 Jul, a statistical difference was not found between DPL 50 and DPL 50B. Nevertheless, only low level damage was observed on the DPL 50B.

Micronaire and staple length were lower in DPL 33B but staple length was greater in that cultivar (Table 4). Statistical differences were not observed in plant population but the DPL 33B cultivar was slow to emerge, grew slowly and throughout the season was behind other cultivars in maturity (Table 5). Significant differences were not observed on the harvest date in green or open bolls but it did take significantly greater numbers of bolls to make a lb of lint and the yield was significantly lower in the DPL 33B cultivar. Lint turnout was lowest in DPL 50 but not statistically lower than DPL 50BII. Yield differences were not detected for DPL 50BII and DPL 50B. DPL 50BII yield level was within 1 lb/acre separating statistically from DPL 50 lint yield.

Generally in this experiment, plant growth was terminated too early by drought (in spite of irrigation) to take advantage of the extra yield potential of the B.t transgenic cotton cultivars. It was also evident that caterpillars did not reach the later instars even in DPL 50 (non-transgenic cultivar).

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Table 1. Bollworm/tobacco budworm eggs and larvae on cotton cultivars, Texas Agricultural Experiment Station, Nueces County, TX, 2000.

	Number/100 terminals							
	eggs				larvae			
Variety	6/17	6/23	6/30	7/8	6/17	6/23	6/30	7/8
DPL 50BII	28.8 a	11.3 a	32.5 a	16.3 a	0 b	0 b	0 b	5.0 a
DPL 50B	27.5 a	7.5 a	32.5 a	13.8 a	0 b	0 b	0 b	3.8 a
DPL 50	21.3 a	13.8 a	25.0 a	7.5 a	8.8 a	30.0 a	15.0 a	7.5 a
DPL 33B	23.8 a	7.5 a	37.5 a	13.8 a	0 b	0 b	1.3 b	2.5 a
LSD (P = 0.05)	NS	NS	NS	NS	5.03	10.83	9.07	NS
P > F	.4050	.2722	.5283	.3242	.0027	.0001	.0043	.4731

Means in a column followed by the same letter are not significantly different by ANOVA (LSD).

Table 2. Bollworm/tobacco budworm damaged plant terminals and squares on cotton cultivars, Texas Agricultural Experiment Station, Nueces County, TX, 2000.

	% damage							
	terminals				square			
Variety	6/17	6/23	6/30	7/8	6/17	6/23	6/30	7/8
DPL 50BII	0.0 b	1.3 b	5.0 b	8.8 c	0.0 b	0.0 b	0.0 b	0.0 b
DPL 50B	1.3 b	1.3 b	12.5 b	23.8 b	0.0 b	0.0 b	0.0 b	1.3 ab
DPL 50	8.8 a	43.8 a	55.0 a	83.8 a	5.0 a	10.0 a	13.8 a	7.5 a
DPL 33B	0.0 b	0.0 b	7.5 b	17.5 bc	0.0 b	0.0 b	7.5 ab	0.0 b
LSD (P = 0.05)	7.06	9.82	13.19	[a]	3.27	3.27	[a]	[a]
P > F	.0223	.0001	.0001	.0001	.0059	.0001	.0455	.0445

Means in a column followed by the same letter are not significantly different by ANOVA (LSD).

[a] The P > F in this column is based on transformed [square root (x + 1)] data values. It is inappropriate to list LSD values based on transformed data.

Table 3. Bollworm/tobacco budworm leaf grazing rating and % damaged bolls on cotton cultivars, Texas Agricultural Experiment Station, Nueces County, TX, 2000.

	Caterpillar grazing rating[a]		% damaged bolls	
Variety	6/23	7/8	7/8	7/16
DPL 50BII	0.3 b	0.5 b	0.0 b	0.0 b
DPL 50B	0.3 b	1.0 b	0.0 b	1.3 ab
DPL 50	2.3 a	2.3 a	3.8 a	10.0 a
DPL 33B	0.0 b	1.0 b	0.0 b	0.0 b
LSD (P = 0.05)	.766	.550	[b]	9.26
P > F	.0001	.0001	.0474	.0410

[a] Means in a column followed by the same letter are not significantly different by ANOVA (LSD).

[b] The P > F in this column is based on transformed [square root (x + 1)] data values. It is inappropriate to list LSD values based on transformed data.

Table 4. Fiber characteristics of cotton cultivars, Texas Agricultural Experiment Station, Nueces County, TX, 2000.

Variety	Mic	Lgth	Uniformity	St	Elong
DPL 50BII	4.0 a	1.11 a	84.2 a	29.3 b	7.8 a
DPL 50B	3.9 a	1.11 a	84.6 a	29.9 b	7.9 a
DPL 50	4.0 a	1.08 ab	84.3 a	28.6 b	7.3 a
DPL 33B	3.2 b	1.07 b	82.9 a	33.0 a	7.5 a
LSD (P = 0.05)	.271	.032	NS	1.393	NS
P > F	.0001	.0379	.0826	.0001	.0821

Means in a column followed by the same letter are not significantly different by ANOVA (LSD).

Table 5. Production characteristics of cotton cultivars, Texas Agricultural Experiment Station, Nueces County, TX, 2000.

Variety	Plant vigor rating[a]	1000's per acre plants	green bolls at harvest	harvested bolls	boll/lint lb	% lint turnout	Yield lb lint/acre
DPL 50BII	1.5 b	43.5 a	7.4 a	273 a	332 b	34.5 ab	823 ab
DPL 50B	1.5 b	48.7 a	4.5 a	279 a	336 b	35.2 a	829 a
DPL 50	1.8 b	44.6 a	8.4 a	256 a	329 b	34.1 b	779 b
DPL 33B	3.3 a	39.9 a	7.9 a	276 a	384 a	35.1 a	718 c
LSD (P = 0.05)	.924	NS	NS	NS	33.21	.807	45.0
P > F	.0020	.0808	.1138	.2336	.0051	.0145	.0004

Means in a column followed by the same letter are not significantly different by ANOVA (LSD).

[a] Plant vigor ratings: (1 = rapid seed germination, good plant stand, rapid fruiting and maturity up to 5 = slow plant emergence, reduced plant stand, slow growth and delayed maturity).