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EFFECTIVENESS OF INSECTICIDES FOR CONTROL OF CATERPILLARS IN TEXAS COASTAL BEND COTTON

Roy D. Parker
Texas Cooperative Extension
Corpus Christi, TX

Abstract

Data from 2 field studies are summarized that evaluate insecticide use on non-transgenic and transgenic B.t. cotton. Effect of the insecticides on square and boll damage, aphid infestation, mite damage, and yield are reported. The newer insecticides Denim, Steward, and Tracer were generally found to provide effective caterpillar control. Karate and Leverage were not effective on tobacco budworm in 2000, but Asana and Leverage were effective on caterpillars (higher level of bollworms) in 2001. Transgenic B.t. cotton (DPL 33B) was highly effective on caterpillars in both years. Asana and Karate treated cotton contained higher levels of aphids, Leverage prevented aphid outbreaks, and Denim eliminated spider mites. Although not demonstrated statistically, DPL 33B cotton with and without insecticides and all insecticide treated non-transgenic (DPL 5415) cotton produced higher yields in the 2001 test (42-158 lint lb/acre) compared with untreated DPL 5415.

Objectives

Field studies were conducted in 2000 and 2001 to compare insecticides for effectiveness in controlling caterpillars on non-transgenic variety cotton and to further evaluate the same insecticides applied to a cotton variety genetically expressing caterpillar B.t. (Bacillus thuringiensis) Cry1Ac toxin. Primary objectives were to (1) measure caterpillar numbers and damage in varieties, (2) compare insecticides for effectiveness, and (3) determine impact on cotton production. This paper represents a selected summary of the work published by Parker and Livingston (2000 and 2001).

Materials and Methods

The experiments were conducted on the Texas Agricultural Experiment Station, Meaney Annex in Nueces County in 2000 and 2001. Test varieties were planted in rows spaced on 38-inch centers on April 17, 2000 and on April 6, 2001, in alternating 8-row plots which were then subdivided for insecticide treatment in order that each foliar treatment was applied to 4 rows of DPL 5415 (non-transgenic) and 4 rows of DPL 33B (transgenic B.t.) cotton. Insecticide treatments were applied to 40-ft plots arranged in a randomized complete block design with 4 replications. Insecticides were applied to all 8 rows in each plot with a self-propelled Lee Company Spider Trac on June 18, 22, and 28 in 2000 and on June 18 and 25 in 2001. Total spray volumes were 5.7 and 5.3 gpa in 2000 and 2001, respectively. Two 8X (2000) and 4X (2001) hollow cone nozzles were spaced on 19-inch centers on the boom for broadcast application.

Treatments were assessed by (1) examining 20 terminals/plot for heliothine eggs, larvae and damage, (2) inspecting 20, approximately ½ grown squares per plot for caterpillar damage, (3) assigning a visual caterpillar leaf feeding score of 1=none observed up to 5=20% (2000) or 10% (2001) leaf loss in the two years, respectively, (4) determining the number of caterpillar damaged bolls by inspecting 20 per plot, (5) estimating average aphid numbers on 5 leaves per plot in 2000 or assigning an aphid damage rating (1 = no damage up to 5 = severe damage) in 2001, (6) assigning a mite damage rating (1=no damage up to 5 = severe damage) to each plot, and (7) harvesting 10 ft row from 1 of the 2 center rows in each 4-row plot on Aug 4, 2000 or by harvesting 1 entire row/plot with a spindle picker on Aug 10, 2001. Seed cotton samples were ginned on a 10-saw laboratory machine in order to calculate lint weights.

Results and Discussion

Caterpillars examined 2 DAT-2 and 5 DAT-3 in the 2000 experiment were tobacco budworm (TBW). Worm damaged squares were significantly reduced 5 DAT-3 in all insecticide treatments and the untreated DPL 33B compared to the untreated DPL 5415 cotton (Table 1). Tracer and Denim (0.01 lb ai/acre) treatments were statistically as effective as DPL 33B in limiting square damage. Tracer, Steward and Denim treated DPL 5415 cotton sustained significantly fewer damaged bolls compared with the Karate, Leverage and untreated plots of the DPL 5415 cotton. There was no statistical difference in DPL 33B and these 3 insecticides in boll protection. Karate and Leverage were not effective in reducing boll damage, likely due to the TBW.

Two insecticide treatments were applied in the 2001 experiment. By 4 DAT-1 square damage was found to be significantly less in all insecticide treatments, except Denim, in the DPL 5415 variety (Table 2). No damaged squares were found in the DPL 33B variety on this inspection date. Damaged boll counts 5 DAT-2 were significantly lower in all treatments compared with that in untreated DPL 5415 plots. Only Asana and Leverage treated cotton sustained boll damage statistically as low as that in DPL 33B plots. A higher percentage of bollworm (BW) instead of TBW had been observed when the first treatment was made, but by the time the 2nd application was made, TBW was the dominant species.

Statistical differences were observed in the 2001 experiment lint yield data (Table 3), but significant differences in yields were not observed in the DPL 5415 treatments. The least significant difference (LSD) was 93.4 lb/acre at the P = 0.05 level. DPL 33B treatments, except for Leverage and Denim, produced significantly more lint compared to untreated DPL 5415. Although not shown statistically, all variety and insecticide combinations produced more lint than untreated DPL 5415. These yield increases ranged from 42 to 158 lint lb/acre and averaged 90 lb/acre. It averaged 62 lb/acre in the DPL 5415 variety and 115 lb/acre in the DPL 33B variety.

Effects by insecticides worthy of note were observed on cotton aphids and spider mites in both years (Tables 1 & 2). Aphid numbers were highest in Karate treatments and lowest in Leverage treatments in the 2000 test (Table 1). Likewise, aphid damage was observed in the Asana treatments (another pyrethroid), and again Leverage plots had a low aphid damage rating in the 2001 experiment (Table 2). However, in 2001 the aphid damage rating was also low in several other variety/insecticide treatment combinations. Denim was striking in both years in eliminating spider mites.

Conclusions

- Tracer, Denim, and Steward insecticides, and DPL 33B cotton provided effective control of TBW (2000).
- Asana, Leverage, Tracer, Steward, Steward + Asana, and DPL 33B cotton reduced BW/TBW square damage (2001).
- All insecticides tested and DPL 33B cotton reduced worm damage to bolls (2001).
- Karate and Leverage were not effective on TBW (2000).
- Leverage was effective in preventing cotton aphid increase.
- Asana and Karate use resulted in increased aphid numbers.
- Denim eliminated spider mites in both years.

References

Parker, Roy D. and Stephen D. Livingston. 2000. Evaluation of insecticides on non-transgenic and transgenic B.t. cotton cultivars for impact on tobacco budworm, aphids and spider mites. pp. 33-39, *in*, Results of Insect Control Evaluations on Corn, Sorghum and Cotton in Texas Coastal Bend Counties. Texas Cooperative Extension. Corpus Christi, TX.

Parker, Roy D. and Stephen D. Livingston. 2001. Comparison of insecticides for control of bollworm and tobacco budworm on non-transgenic and transgenic B.t. cotton cultivars. pp. 57-62, *in*, Results of Insect Control Evaluations on Corn, Sorghum and Cotton in Texas Coastal Bend Counties. Texas Cooperative Extension. Corpus Christi, TX.

Table 1. Bollworm/tobacco budworm damage, aphid numbers, and mite damage rating following insecticide treatments, Nueces County, TX, 2000.

Treatment[a]	Rate lb ai/acre	5 days after treatment 3			% worm da.
		% da. squares	aphids/leaf	mite da. rating[b]	bolls (7/10)
		DPL 5415 (non-transgenic)			
Karate 1E	.03	16.3 b	46.3 a	1.0 c	6.3 b
Leverage 2.75E	.08	12.5 bc	0.5 g	3.3 b	10.0 a
Tracer 4SC	.06	0.0 g	4.3 fg	4.0 ab	0.0 c
Steward 1.25SC	.075	7.5 cde	15.3 bc	3.5 ab	2.3 c
Steward 1.25SC	.09	6.3 def	13.8 bcd	4.3 a	2.3 c
Denim 0.16E	.0075	11.3 bcd	4.5 fg	1.0 c	2.3 c
Denim 0.16E	.01	2.5 efg	5.5 efg	1.0 c	0.0 c
Untreated		28.8 a	10.0 cdef	3.8 ab	8.8 ab
		DPL 33B (transgenic B.t.)			
Karate 1E	.03	1.3 fg	20.0 b	1.3 c	0.0 c
Leverage 2.75E	.08	1.3 fg	0.0 g	3.3 b	0.0 c
Tracer 4SC	.06	0.0 g	4.0 fg	3.8 ab	0.0 c
Steward 1.25SC	.075	0.0 g	16.5 bc	4.3 a	0.0 c
Steward 1.25SC	.09	0.0 g	13.3 bcde	3.8 ab	0.0 c
Denim 0.16E	.0075	0.0 g	2.8 fg	1.0 c	0.0 c
Denim 0.16E	.01	0.0 g	6.0 defg	1.3 c	1.3 c
Untreated		0.0 g	7.3 defg	4.3 a	0.0 c
LSD (P = 0.05)		5.88	7.794	.834	2.84
Prob. > F		.0001	.0001	.0001	.0001

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

[a] Treatments applied on June 16, 22, and 28.

[b] Mite damage ratings: 1 = no damage to 5 = severe damage.

Table 2. Bollworm/tobacco budworm damaged fruit, aphid damage rating, and mite damage rating following insecticide treatments, Nueces County, TX, 2001.

		% da. squares	5 days after treatment 2		
Treatment[a]	**Rate lb ai/acre**	**4 DAT-1[c]**	**% da. bolls**	**aphid da. rating[e]**	**mite da. rating[e]**
			DPL 5415 (non-transgenic)		
Asana XL 0.66E	.06[b]	3.8 b	3.8 bc	2.75 ab	2.50 abc
Leverage 2.75E	.08	6.3 b	2.5 bc	1.25 de	3.00 a
Tracer 4SC	.06	6.3 b	5.0 b	2.00 c	1.75 cd
Denim 0.16E	.01	12.5 a	6.3 b	1.00 e	1.00 d
Steward 1.25SC	.11	3.8 b	6.3 b	1.75 cd	2.00 bc
Steward + Asana	.09 + .036	5.0 b	6.3 b	2.75 ab	2.50 abc
Untreated		13.8 a	16.3 a	1.75 cd	2.50 abc
			DPL 33B (transgenic B.t.)		
Asana XL 0.66E	.06[b]	0.0 c	0.0 c	3.25 a	2.50 abc
Leverage 2.75E	.08	0.0 c	0.0 c	1.00 e	2.50 abc
Tracer 4SC	.06	0.0 c	0.0 c	1.25 de	2.25 abc
Denim 0.16E	.01	0.0 c	0.0 c	1.00 e	1.00 d
Steward 1.25SC	.11	0.0 c	0.0 c	2.25 bc	2.75 ab
Steward + Asana	.09 + .036	0.0 c	0.0 c	2.75 ab	2.75 ab
Untreated		0.0 c	0.0 c	1.25 de	1.75 cd
LSD (P = 0.05)		[d]	[d]	.726	.792
Prob. > F		.0001	.0001	.0001	.0001

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

[a] Treatments applied on 6/18 and 6/25.

[b] Asana was applied at 1.5X intended rate.

[c] DAT = days after treatment.

[d] The Prob. > F is based on transformed data [square root ($x + 1$)]; it is inappropriate to list LSD values based on transformed data.

[e] Damage ratings range from 1 = no damage up to 5 = severe damage.

Table 3. Lint yield in non-transgenic and transgenic B.t. cotton cultivars treated for bollworm/tobacco budworm with various insecticides, Nueces County, TX, 2001.

Treatment[a]	**Rate lb ai/acre**	**Yield lb lint/acre**	**Lb above DPL 5415 UTC**
		DPL 5415 (non-transgenic)	
Asana XL 0.66E	.06[b]	812 bcd	64
Leverage 2.75E	.08	790 cd	42
Tracer 4SC	.06	835 abcd	87
Denim 0.16E	.01	802 bcd	54
Steward 1.25SC	.11	802 bcd	54
Steward + Asana	.09 + .036	816 abcd	68
Untreated		748 d	
		DPL 33B (transgenic B.t.)	
Asana XL 0.66E	.06[b]	886 ab	138
Leverage 2.75E	.08	840 abcd	92
Tracer 4SC	.06	851 abc	103
Denim 0.16E	.01	820 abcd	72
Steward 1.25SC	.11	906 a	158
Steward + Asana	.09 + .036	869 abc	121
Untreated		869 abc	121
LSD (P = 0.05)		93.4	
Prob. > F		.0142	

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

[a] Treatments applied on 6/18 and 6/25.

[b] Asana was applied at 1.5X intended rate