EFFECTIVENESS OF BOLLGARD II COTTON VARIETIES AGIANST FOLIAGE AND FRUIT FEEDING CATERPILLARS IN ARKANSAS

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Abstract

The Bollgard II technology tested showed excellent promise in protecting cotton from caterpillar pests. More data is needed on all species of caterpillar pests on cotton to confirm these findings.

Additional work on improving the agronomics of varieties with Bollgard II genetics appears to be needed before the varieties are released commercially.

Introduction

Bollgard cotton varieties became commercially available in 1996. They have provided cotton growers an alternative to foliar insecticides for controlling some of the caterpillar pests of cotton. And, they have removed some of the natural selection for resistance to foliar insecticides. Since their release in 1996, cotton losses from caterpillar pests have not declined in the U.S. or in Arkansas, however (Williams, 1994-9). Nationally, losses to caterpillars 1996-8 were about the same as in the previous three years, 4.5% and 4.4%, respectively. In Arkansas, losses were higher from 1996-8 than from 1993-5, 5.4% and 2.5%, respectively. Certainly, there is room for improvement of the caterpillar management technology.

Bollgard II technology incorporates two *Bacillus thuringiensis* toxins into the cotton plant. It is hoped that the two toxin technology will provide broader spectrum caterpillar control and will slow the development of resistance in caterpillar pests to Bt toxins.

This study was conducted to gain a better understanding of the effectiveness of the Bollgard II technology against caterpillar pests and to investigate the agronomic characteristics and yield potential of these varieties.

Materials and Methods

This study was conducted on the Southeast Branch Experiment Station at Rohwer, AR. Eight replications of four treatments were planted in 4 row x 40 foot plots on 5-21-99. Standard production practices were used except that no insecticides for caterpillar control were used. Treatments were the cotton varieties which were planted. The varieties were, 15813 (Bollgard II), 15985 (Bollgard II), DPL 50B and DPL 50.

The plots were sampled weekly from mid-July to mid-August by counting the plant bugs, boll weevils and boll weevil damage, and Heliothine larvae and damage on 25 terminals, 25 squares and 25 small bolls per plot. On 8-5-99, eight beet armyworm egg masses were stapled to lower canopy leaves in each plot. On 8-16-99 whole plots were searched for beet armyworm hits (hatching egg masses) and larvae. Soybean and cabbage looper populations increased in the plots in September. Six foot beet sheet counts were taken in each plot on 9-15-99. An infestation of Heliothine larvae occurred on late season small bolls. Fifty uppermost small bolls were inspected for the presence of worm damage and larvae on 9-24-99. Larvae found were collected and identified under a dissecting microscope.

The data collected was processed using Agriculture Research Manager and Costat Statistical Software. The data were analyzed using Analysis of Variance and LSD ($P \leq .05$).

Results and Discussion

Bollworm and tobacco budworm populations were low in mid-season this study, therefore no useable bollworm/budworm data were collected during July and August.

Beet armyworm data (after the introduction of egg masses) and late season tobacco budworm data are shown in Table 1. Significantly fewer beet armyworm hits and larvae were seen in the Bollgard II plots as compared with the Bollgard (DPL 50 B) or conventional (DPL 50) plots. No beet armyworm larvae were found in either of the Bollgard II varieties.

The Heliothine larvae collected from bolls in September were 94% *Heliothis virescens.* Significantly fewer tobacco budworm larvae or tobacco budworm damaged bolls were seen in the Bollgard II and Bollgard plots as compared with the conventional cotton. Low level boll damage from tobacco budworm was observed in the DPL 50 B (Bollgard) and 15813 (Bollgard II) plots, while no tobacco budworm damage was seen in the 15985 (Bollgard II) plots.

Looper infestations and damage are shown in Table 2. Significantly fewer cabbage looper larvae were found in the Bollgard II varieties than in the Bollgard or conventional varieties. Very low levels of cabbage loopers were seen in the Bollgard II varieties, however.

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Significantly fewer soybean loopers were seen in the Bollgard II cotton than in the Bollgard or conventional cotton. A very low level of soybean looper presence was observed in the 15813 Bollgard II cotton, however.

Looper damage was significantly lower in the Bollgard II cotton than in the Bollgard or conventional cotton. Bollgard cotton had less damage than the conventional cotton, however.

Conclusions

The Bollgard II varieties tested showed good promise in protecting cotton from caterpillar larvae. The data collected in this study shows that these varieties were protected from beet armyworm, tobacco budworm, soybean looper and cabbage looper. No data was collected on the efficacy of this technology against bollworm. The agronomic characteristics of these varieties are still questionable. In summary, more study is needed on the effectiveness of Bollgard II varieties against caterpillar pests in cotton, and more work needs to be done to get Bollgard II varieties agronomically ready for release to growers.

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Literature Cited

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Table 1. Beet armyworm and late season tobacco budworm larvae and damage on Bollgard II, Bollgard, and conventional cotton varieties[1]. Rowher, AR. 1999.

	Beet Armyworm		Tobacco Budworm	
	Hits per Plot[2]	Larvae per Plot[2]	Larvae per 100 Small Bolls	% Damaged Bolls
15985	0.0 a	0.0 a	0.0 a	0.0 a
15813	0.0 a	0.0 a	0.0 a	0.5 a
DPL 50 B	5.8 b	6.6 b	0.0 a	0.8 a
DPL 50	6.5 b	8.1 b	2.2 b	10.2 b

[1]Means followed by the same letter are not significantly different (P≤.05).
[2]Plots were 4 rows x 40 feet (160 row feet).

Table 2. Cabbage and soybean looper counts[1] and damage[2] on Bollgard II, Bollgard and conventional varieties[3]. Rohwer, AR. 1999.

	Cabbage Loopers per 6 row ft.	Soybean Loopers per 6 row ft.	Looper Damage Rating[2]
15895	0.1 a	0.0 a	0.0 a
15813	0.4 a	0.1 a	0.0 a
DPL 50 B	27.4 b	40.5 b	2.3 b
DPL 50	23.9 b	47.9 b	3.4 c

[1]6 foot beat sheet sample.
[2]Rating 0-5; 0 = no damage, 5 = severe defoliation.
[3]Means followed by the same letter are not significantly different (P≤.05).

Table 3. Agronomic characteristics and yield of Bollgard II, Bollgard and conventional varieties. Rowher, AR. 1999.

	Stand Counts Plants/A[2]	Seedling Vigor Rating[3]	Yield Lbs Lint/A
15985	54,736 b	2.3 b	747 ab
15813	67,346 a	1.6 a	668 b
DPL 50 B	55,023 b	2.3 b	847 a
DPL 50	60,755 ab	1.9 ab	785 a

[1]Means followed by the same letter are not significantly different (P≤.05).
[2]Counts made on 3 row feet/plot on 6-3-99.
[3]Rating 1-5; 1 = very good, 5 = poor.