BT COTTON PERFORMANCE IN WEST TENNESSEE

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Abstract

Commercially available Bt cotton varieties were evaluated for efficacy and yield potential at three locations in West Tennessee in 2000. PM 1218 BG/RR was the yield leader at two of three locations and did not differ from the leader at the third location. Bollworm and tobacco budworm populations were relatively light on the drought-stressed cotton. Bollgard II evaluations were conducted at two locations to determine efficacy and yield potential of the single and two gene systems. Although sprayed plots required two insecticide applications for suppression of bollworm and tobacco budworm, other target caterpillar species of the Bollgard II system were not present in adequate numbers to measure efficacy.

Introduction

Acreage of transgenic Bt cotton plantings has increased each year since Bt cotton was first commercially introduced in 1996. Increased lint yields and reduction of insecticide applications to control lepidopteran pests are some of the reasons that producers have readily accepted this genetically enhanced crop. In areas where eradication of the boll weevil is ongoing and predator densities are reduced due to scheduled insecticide applications, more and more producers are turning to this relatively new method of lepidopteran control.

Materials and Methods

During the 2000 season, experiments evaluating the efficacy and yield potential of commercial and experimental lines of Bt cotton were conducted at three locations in West Tennessee. All locations experienced low rainfall during the growing season and two of three experienced drought conditions.

Nine commercial Bt (including stacked-gene) and three non-Bt (conventional) varieties were evaluated at the Ames Plantation (Ames) at Grand Junction, TN. The test was planted on May 9 in a split-plot design with main plots being insecticide treatment. When threshold levels of bollworm/tobacco budworm occurred on the conventional varieties, then all varieties in the main plot were to be treated with insecticides to control the larvae. Main plots included the 12 varieties (either treated or untreated) and subplots were two 40-inch rows x 30 ft. Treatments were replicated five times. Conventional varieties were monitored during the time when moth flights had peaked. Larval numbers did not occur and insecticides did not have to be applied to the main plots. Plots were harvested September 21 and October 10 with a two-row picker modified to harvest small plots.

Fourteen varieties (11 Bt and three conventional) were planted May 5 at the West Tennessee Experiment Station (WTES) in Jackson. Plots were two 38-inch rows x 30 ft. Treatments (varieties) were replicated five times in a randomized complete block design. Conventional varieties were monitored for bollworm and tobacco budworm and all plots were sprayed based on threshold levels in the conventional varieties. Plots were harvested September 20 and October 3 with a two-row picker modified to harvest small plots.

Seven varieties (five Bt and two conventional) were planted May 9 at the Milan Experiment Station (MES) in Milan. Plots were four 40-inch rows x 30 ft. Treatments were replicated five times in a randomized complete block design which included plots to be sprayed and those left unsprayed based on the bollworm population which developed in the conventional varieties. The two center rows of each plot were harvested September 18 and October 3.

Bollgard II, a Bt cotton line containing two Bt genes (DP 50 B II), was compared to a single gene DP 50 B and the non-transgenic recurrent parent DP 50 in sprayed and unsprayed small plots at WTES and Ames. Plots were planted May 18 and were four 40-inch rows x 30 ft. Treatments were replicated four times in a split-plot design with main plots being insecticide treatment or no treatment based on larval population or percent damaged squares/bolls in the conventional variety. Insecticides were applied August 7 and 15 at WTES and August 9 and 16 at Ames. The two center rows of each plot were harvested September 20 and October 3 at WTES and September 21 and October 10 at Ames.

Results and Discussion

At Ames, bollworm and tobacco budworm populations failed to develop on the conventional varieties and no insecticides were applied. PM 1218 BG/RR produced the highest yield, but was not significantly different from six other Bt varieties (Table 1). PM 1218 BG/RR was the earliest variety, based on percent first harvest, with 93.2% of total lint coming from the first harvest.

PM 1218 BG/RR was the yield leader at WTES (Table 2) and produced significantly more lint than all other varieties except ST 4892 BR. PM 1218 BG/RR was also the earliest variety in the test, but was not statistically earlier than five other varieties.

At MES, bollworm and tobacco budworm populations failed to develop on the conventional varieties and no insecticides were applied to the plots designated for treatment. DP 428 B produced the highest yield, but was not significantly different from PM 1218 BG/RR or the conventional variety, DP 388 (Table 3). DP 388 was significantly earlier than all other varieties.

In the Bollgard II evaluation at Jackson, the highest yield was produced by the single Bt gene variety, DP 50 B, but did not differ in yield from DP 50 B II sprayed or the two Bollgard lines in the unsprayed plots (Table 4). Yield from the unsprayed DP 50 was significantly less than the yield from the unsprayed DP 50 B II or DP 50 B. In the sprayed plot, the conventional variety yield did not differ from DP 50 B II yield. Earliness did not differ among sprayed varieties, but both Bollgard II and DP 50 B were earlier than DP 50 in unsprayed plots.

At the Ames Plantation Bollgard II trial, there were no significant differences in yields or maturity among the sprayed or unsprayed lines (Table 5). Yields were much lower at this location compared to the Jackson location, probably due to drought conditions.

Significant differences were noted in boll damage on all three dates at WTES. Boll damage was highest in the unsprayed DP 50 plots (Table 6). These differences can be attributed to the lack of insect protection, either external (insecticide application) or internal (Bt gene). At Ames, significant differences in boll damage were measured on two of the three dates (Table 7). On August 8, damage in the sprayed DP 50 was highest, while on August 31, the most damage occurred in the unsprayed DP 50. In both cases, the damage did not differ from the other conventional plot on that date.

Summary

PM 1218 BG/RR performed well in small plot evaluations in 2000. This variety was planted by producers on over 50% of Tennessee's acreage because of its agronomic adaptation, yield performance and earliness.

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Nearly 75% of Tennessee's cotton acreage came into the boll weevil eradication program for the first time during 2000. With intense weevil spraying which can significantly reduce beneficial arthropod numbers, producers need good varieties which can withstand potential outbreaks of bollworm and tobacco budworm. Unfortunately, over most of these trials, drought caused greater yield reductions than did insects. The small plot evaluations of Bollgard II did not have the caterpillar complex necessary to demonstrate the efficacy of the two gene system.

Table 1. Yield and maturity of selected cotton varieties. Ames Plantation, Grand Junction, TN. 2000.

Variety	Lbs. lint/acre	Percent 1st harvest
PM 1218 BG/RR	868 a	93.2 a
SG 501 B/RR	844 a	90.0 b-e
DP 428 B	838 a	92.2 ab
ST 4691 B	830 a	90.6 bcd
SG 125 B/RR	778 ab	89.2 cde
ST 4892 BR	776 ab	89.0 cde
DP 451 B/RR	774 ab	90.8 abc
SG 125 R	718 bc	85.4 fg
DP 422 B/RR	710 bc	90.9 abc
DP 388	700 bc	87.5 ef
ST 474	687 bc	88.1 de
PM 1560 BG	652 c	84.2 g

Table 2. Yield and maturity of selected cotton varieties. West Tennessee Experiment Station. Jackson, TN. 2000.

Variety	Lbs. lint/acre	Percent 1st harvest
PM 1218 BG/RR	1342 a	90.9 a
ST 4892 BR	1259 ab	87.2 bc
ST 4691 B	1208 bc	87.4 bc
SG 125 B/RR	1181 bcd	87.7 bc
SG 215 B/RR	1171 bcd	88.4 abc
SG 501 B/RR	1159 b-e	88.3 abc
DP 388	1159 b-e	89.3 ab
PM 1560 BG	1153 b-e	86.4 bc
DP 409 B/RR	1140 cde	89.4 ab
ST 474	1122 cde	85.8 c
DP 451 B/RR	1109 cde	86.8 bc
DP 428 B	1092 cde	87.9 abc
SG 125 R	1077 de	85.5 c
DP 422 B/RR	1040 e	86.4 bc

Table 3. Yield and maturity of selected cotton varieties. Milan Experiment Station, Milan, TN. 2000.

Variety	Lbs. lint/acre	Percent 1st harvest
DP 428 B	848 a	77.1 d
PM 1218 BG/RR	827 ab	83.6 b
DP 388	793 abc	88.1 a
SG 125 B/RR	774 bc	79.6 c
ST 4691 B	756 c	79.4 c
ST 474	744 c	85.4 b
DP 409 B/RR	742 c	83.1 b

Table 4. Yield and maturity of DP 50 lines of cotton. West Tennessee Experiment Station. Jackson, TN. 2000.

Treatment/Variety	Lbs. lint/acre	Percent 1st harvest
S[1/] DP 50 B II	891 ab	88.2 ab
S DP 50 B	933 a	88.4 a
S DP 50	784 bc	90.2 a
U DP 50 B II	905 ab	84.5 b
U DP 50 B	904 ab	87.6 ab
U DP 50	690 c	78.0 c

[1/] S = Sprayed; U = Unsprayed.

Table 5. Yield and maturity of DP 50 lines of cotton. Ames Plantation, Grand Junction, TN. 2000.

Treatment/Variety	Lbs. lint/acre	Percent 1st harvest
S[1/] DP 50 B II	488	80.2
S DP 50 B	565	83.5
S DP 50	592	81.4
U DP 50 B II	505	78.4
U DP 50 B	506	81.8
U DP 50	565	79.9

[1/] S = Sprayed; U = Unsprayed.

Table 6. Boll damage in DP 50 lines of cotton. West Tennessee Experiment Station. Jackson, TN. 2000.

	Damaged bolls/25		
Treatment/Variety	Aug 14	Aug 22	Aug 30
S[1/] DP 50 B II	0.0 b	0.5 b	0.0 b
S DP 50 B	0.3 b	0.0 b	0.0 b
S DP 50	1.3 b	1.5 b	0.8 b
U DP 50 B II	0.0 b	0.3 b	0.0 b
U DP 50 B	0.5 b	1.3 b	0.0 b
U DP 50	6.8 a	12.5 a	7.8 a

[1/] S = Sprayed; U = Unsprayed.

Table 7. Boll damage in DP 50 lines of cotton. Ames Plantation, Grand Junction TN. 2000.

	Damaged bolls/25		
Treatment/Variety	Aug 8	Aug 15	Aug 31
S[1/] DP 50 B II	0.0 b	0.0	0.0 b
S DP 50 B	0.0 b	0.0	0.0 b
S DP 50	2.0 a	0.8	0.8 ab
U DP 50 B II	0.0 b	0.0	0.0 b
U DP 50 B	0.0 b	0.8	0.0 b
U DP 50	1.3 ab	2.0	1.3 a

[1/] S = Sprayed; U = Unsprayed.