

DETERMINING THE VALUE OF TRANSGENIC (Bt) COTTON VARIETIES IN THE SOUTHERN ROLLING PLAINS OF TEXAS

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Abstract

Replicated cotton variety trials were conducted from 1996 to 2002 in both dryland and irrigated fields. The trials are an important showcase for new varieties and are used by producers to make varietal selections. With the Southern Rolling Plains (SRP) being declared functionally eradicated in 2000, secondary pests like bollworm (*Helicoverpa zea* (Boddie)) have become less of a problem. The decline in bollworm problems would seem to lessen the value of cotton varieties containing the Bt (*Bacillus thuringiensis*) gene. However, even under reduced insect pressure, varieties containing the Bt gene Bollgard[®] perform well in variety tests. The increased yields are partially due to insect control but primarily are a function of improved varieties. Producers in the SRP should make their variety choices based on yield and fiber qualities. The addition of the Bt gene should be considered a type of insurance. For irrigated producers, the Bt gene represents a low risk management tool where the payoff is high and the loss is low. For dryland producers, the payoff is not as high but the loss is still low.

Introduction

The Southern Rolling Plains (SRP) of Texas plants approximately 200,000 acres of cotton annually. The area consists primarily of dryland production with ten percent of the acreage in some type of irrigation. Due to limited rainfall (18 to 20 inches per year) and limited irrigation, the SRP relies on limited inputs to produce a cotton crop. The limited inputs include the use of insecticides.

Boll weevil eradication, initiated in the fall of 1994, has eliminated the boll weevil as an economic pest. The eradication of the boll weevil (*Anthonomus grandis* (Boheman)) has resulted in fewer insecticides being used for bollworm and other secondary pests. The decline in bollworm problems would seem to lessen the value of cotton varieties containing the Bt gene.

Trials in Texas and other parts of the cotton belt indicate variable results with value of the Bt gene. Bryant et al. (2002) showed the Bt gene had higher value in the southern regions of Arkansas but the gene was not profitable for the northern regions where bollworm pressure was less and varieties were not as well adapted. Trials in Georgia showed that varieties containing the Bollgard[®] had higher net returns than those without the gene even in the absence of insect pressure (May et al., 2002). In trials in the High Plains of Texas, varieties with the Bollgard[®] gene had an average \$57.85 benefit to similar varieties without the gene (Boman, et al., 2002).

The following analysis was conducted to look at the value of the Bt gene in seven years of variety trials in a low input system.

Materials and Methods

A total of 21 replicated variety trials were planted in Runnels and Tom Green Counties from 1996 to 2002. The trials were conducted in both dryland and irrigated conditions and included both Bt and non-Bt varieties except in 1996 and 2000. A Bt cotton variety was not planted in the dryland trial in 1996 and drought conditions in 2000 were so severe that the dryland trials were never established.

The varieties were managed for insects based on weekly field scouting. All the varieties were treated the same once thresholds were reached. Bt cotton was treated the same as non-Bt cotton. Two applications of spinosad (Tracer[®]) were made on the dryland trial in 1997 and two applications of bifenthrin (Capture[®]) were made on one of the irrigated trials in 2001.

For the analysis, the top yielding Bt variety was compared to the top yielding non-Bt variety. We also compared an average of the top three yielding varieties of Bt and non-Bt varieties to try and eliminate some of the variability associated with the trials.

Yields were analyzed by ANOVA and differences in means compared using Tukey's. Cotton prices were calculated using CCC loan values with appropriate premiums and discounts added.

Results and Discussion

The top varieties for each year are listed in Table 1. The advantage to having irrigation is huge. When considering the top three yielding varieties for each trial (including Bt and non-Bt), irrigated trials significantly yielded more (1150 lbs. lint/ac) than dryland trials (293 lbs. lint/ac, $F=296.3$, $df=1$, $P<0.001$). Very few varieties repeat from year to year. Also note that many of the varieties tested from 1996 to 2000 have been removed from the market place.

The average change in gross income favors varieties with the Bt gene (Table 1). However a closer look shows that the advantage occurs primarily in the irrigated trials. Using only the top yielding varieties, a variety containing the Bt gene returned an average of \$41.66 in irrigated trials from 1996-2002. But, the dryland trials show an average loss of \$11.73.

To reduce some of the variability, we looked at the top three yielding varieties for both Bt and non-Bt. This provided a larger data set and removed some of the problems with trials that has one variety that performs above all the others. Using that criteria, the yields are virtually identical-836 lbs of lint for Bt cotton compared to 833 lbs. of lint for non-Bt cotton across all trials. Breaking those numbers down into irrigated trials and dryland trials does not change the outcome. Using only irrigated trials, average yield for the top three yielding Bt cottons is 1161 lbs. lint/ac compared to 1140 lbs. lint/acre or only a 21 lb. lint/acre advantage for the Bt cotton. Dryland trials actually show a 24 lbs. lint/acre advantage for the non-Bt cotton (305 lbs. lint/acre for non-Bt and 281 lbs. lint/acre for Bt).

Conclusions

The Bt gene has been available for testing for seven years in these trials. In dryland trials, a variety containing the Bt gene has topped the test three out of six years it has been tested, including one year (2000) when drought prevented the field from being harvested. Results in irrigated cotton trials have been similar with a variety containing the Bt gene topping the trials four out of seven years.

Producers in low input areas must consider their inputs carefully. These results indicate that in the absence of insect pressure, yield and quality should be the main criteria when selecting cotton varieties. For irrigated producers in the SRP, varieties containing the Bt gene should be considered insurance. With favorable differential pricing of seed, varieties containing the Bt gene have a low risk for the irrigated producer with a relatively high reward if conditions favor an insect outbreak.

The situation is not a clear for the dryland producer. The risk of buying the seed is higher because drought can prevent harvesting later in the season. Even in good growing conditions, the lack of bollworm pressure and competitive non-Bt cotton varieties limit the reward for dryland producers growing varieties containing the Bt gene.

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Table 1. Highest yielding varieties in both dryland and irrigated cotton variety trials in Runnels and Tom Green counties. 1996-2002.

Year	Irrigated	Best Variety	Yield	Change in Gross Income¹	Comment
1996	Yes	D&PL 90	1158	(\$36.86)	
	No	Ranger Whitegold	375	-	No Bt in trial
1997	Yes	D&PL NuCOTN 32 B	1068	\$64.85	
	No	Tamcot Sphinx	786	\$13.35	Sprayed bollworm
	No	Paymaster HS-26	375	(\$125.32)	
1998	Yes	D&PL 5557	1197	(\$23.33)	Above Avg. Temp.
	Yes	Paymaster 1220 BG/RR	672	\$85.80	
	No	D&PL 90 B	162	\$15.66	
	No	Concho 297	252	(\$25.79)	
1999	Yes	Stoneville BXN-47	1657	(\$36.89)	Drought
	Yes	FiberMax 819	871	(\$6.37)	
	No	AgriPro 7115	378	(\$28.42)	
	No	Concho 297	256	(\$7.59)	
2000	Yes	Paymaster 1560 BG/RR	1363	\$297.12	Drought
	Yes	Suregrow 747	1109	(\$26.83)	
2001	Yes	FiberMax 832	1508	(\$13.60)	Sprayed bollworm
	Yes	D&PL 458 B/RR	1663	\$195.99	
	No	D&PL 448 B	463	\$8.57	
2002	Yes	FiberMax 989 BG/RR	1558	-	No advantage ²
	Yes	D&PL 555 B/RR	1637	-	No advantage ²
	No	FiberMax 989 BG/RR	564	\$43.91	
Average				\$18.77	

1. Change in gross income the difference between the highest yielding Bt variety and the highest yielding non-Bt. Numbers in parenthesis indicate an advantage for the non-Bt

2. No advantage indicates that the Bt cotton yielded higher but fiber qualities affected the price such that no advantage was seen for the higher yields.