BT VS. NON-BT UNR COTTON IN N.E. MISSISSIPPI

J. T. Reed, D. Bao, C. S. Jackson and A. Cachot
Mississippi State University
Mississippi State, MS

Abstract

An evaluation to help ascertain the fit of transgenic cotton containing the Bollgard gene in ultra-narrow row (UNR) cotton production was located at the Campbell Farm in N. E. Mississippi in 1998 and 1999. No-till plantings of Bt (Bollgard, Monsanto Agricultural Company, 800 N. Lindbergh Boulevard, St. Louis, MO 63167) and non-Bt cotton were scouted and treated based on average insect counts of all plots of the same variety. Insect population densities were light both years, and only heliothines received treatment. Non-Bt plots received an average of 2.5 applications of insecticide, and Bt plots averaged 1.0 application. Non-Bt plots maintained in the same field by the cooperator and scouted by a consultant in 2000 received 3 insecticide applications for heliothine management compared to no application on the Bollgard plots. Because of light heliothine population density, income after cost of insect control favored non-Bt cotton.

Introduction

Ultra narrow row (UNR) cotton is gaining popularity in areas of the mid-south. Currently there is very little data on managing insect pests in UNR, and possible benefit of transgenic, Bollgard (Monsanto Agricultural Company, 800 N. Lindbergh Boulevard, St. Louis, MO 63167) cotton in UNR plantings has only recently been investigated. As row spacing is decreased in cotton, there is an effect on growth and fruiting patterns of the cotton plant. It is not known if the transgenic varieties will react the same way to decreased row spacing as conventional varieties, and insect management in Bt cotton may require different thresholds or other management options. Plant densities of up to 170,000 plants per acre may be obtained in UNR plantings. Plantings of such density result in shorter plants with short laterally growing branches, fewer branches, and fewer fruit than in wide-row plantings with 35-40,000 plants per acre. This study was initiated to evaluate transgenic, Bollgard cottons in large plot, replicated experiments in UNR plantings. Superimposed on the study was the use of pyrethroids and/or Spinosad for control of heliothine larvae.

Materials and Methods

The statistical design was randomized complete block and compared Bollgard and conventional (non-Bt) cotton planted in 7.5 inch rows in 6-acre blocks. There were three replications, repeated in 1998 and 1999. Plots were planted no-till, following burn-down with Roundup herbicide. The stand was approximately 140,000 plants per acre. Thrips control was foliar in 1998, and Gaucho (imidacloprid, Gustophson Inc., P.O. Box 660065, Dallas, TX 75266-0065) treated seed was used in 1999. All plots received the same agronomic care including PIX growth regulator used according to label recommendations. Boll weevil (*Anthonomus grandis grandis* Boheman) eradication sprays were applied to the entire field, but all other insect control procedures were based on sample averages of the three replicates of each treatment. Conventional and Bt varieties were chosen that were genetically closely related, however, the same varieties were not available in consecutive years.

Insects were sampled twice a week following square set by sampling 25 terminals, squares and bolls in two locations in each plot for insects and heliothine damage. Twenty-five sweeps with a standard sweep net were also made in two locations within each plot twice a week for beneficial insect counts.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1131-1133 (2001)
National Cotton Council, Memphis TN

Yield was determined by stripping 1-2 stripper baskets full in each plot, measuring the area picked, and weighing the cotton in a boll buggy via electronic truck scales placed under the tires. An Allis Chalmers 880W stripper with a continental burr extractor was used to harvest the plots. Values used to calculate per acre costs for insecticide application at the rates used were: Highboy, $2.09; KarateZ (lambda-cyhalothrin, Syngenta Crop Protection, P.O. Box 18300, Greensboro, NC 27419-8300), $8.09; Ammo (Cypermethrin, FMC Corp., Agricultural Chemicals Group, 100 Niagra Street, Middleport, NY 14105) $6.35; Bollgard technical fee, $32.00. Price of cotton was estimated at the price of $0.533 (November price). These values were obtained from the Mississippi 2000 Cotton Planning Budget (Anonymous 1999).

An additional study was planted in the Mississippi delta near Stoneville at the Monsanto research center in 1999 and 2000 that compared UNR and wide-row Bt and non-Bt cotton and four heliothine control thresholds. Yield results four the UNR portion of that study are briefly discussed.

Discussion

The 1998 growing season had adequate moisture and generally good growing conditions and produced an excellent UNR crop. Yield as indicated in Table 1 was nearly two bales, a better yield on average than the non-Bt, wide-row cotton in the region near the UNR plots. There were no differences in yield between the Bt and conventional cotton, and the non-Bt cotton received two sprays for heliothine larvae while the Bt cotton received one (Table 1). Heliothine densities in the plots were light, and no applications were made for insects other than thrips on seedling cotton. The crop matured approximately 10 days prior to neighboring wide-row cotton that was planted before the UNR cotton.

The 1999 growing season was influenced heavily by lack of rainfall, causing the crop to open slowly as a result of flaccid, drought affected bolls. Because of the flaccid bolls, the earliness expected from the UNR planting did not appear. Yield in 1999 was less than half of that for 1998. Statistically, there was a slight advantage in the yield of the non-Bt cotton compared with Bollgard cotton. Non-Bt cotton in 1999 received three insecticide applications for heliothines and the Bt cotton received one (Table 2).

Comparisons of insect sample results for the 1998 and 1999 trials are given in Table 4. During 1998, a season of very low insect pressure, there were no differences in sample numbers of any insect pest or insect related damage. Thus the two insecticide applications adequately prevented damage in the non-Bt cotton. The 1999 season resulted in a dominance of bollworm (*Helicoverpa zea* (Boddie)) numbers as determined from moth trap catches and results of egg bioassays with the AGDIA (AGDIA, Inc., 30380 County Road 6, Elkhart, IN 46514) Heli-ID kits. There were more terminals with worms and insect damaged squares on non-Bt cotton than on the Bollgard variety. However, because of timely application of insecticide on the non-Bt cotton and the hesitance to spray Bollgard cotton until there was evidence of larval survival, there were more worms in bolls and more damaged bolls on the Bollgard cotton than on the non-Bt cotton. The numbers of damaged bolls and worms in bolls were extremely low in both varieties.

Yield-associated income (after deduction of insecticide costs including the Bollgard technical fee) is presented in Table 3, and indicates a trend for an economic benefit of non-Bt cotton. Yield from the research plots is indicated as pounds of lint cotton per acre in tables 1 and 2.

During 2000, the trial in N.E. Mississippi was voluntarily continued by the Campbells, however the DP451 (Bt) which had been planted 2 days after the DP425 (non-Bt), had to be replanted because of poor stand, making a valid comparison between the Bollgard and the conventional varieties

questionable. Yield in the non-Bt plots was 644 lb of lint, and yield in the Bt plots was 466 lb. Three insecticide applications for heliothine management were made in 2000 on the non-Bt cotton, and no sprays were made on the Bt cotton.

Yield from the Delta UNR research plots did not differ statistically between the Bt and non-Bt over the two year study. The yields were: 1999: Bt, 503 lb; non-Bt 535 lb. 2000: Bt, 515 lb; non-Bt, 535 lb.

Summary

Insect population densities were light both years, and only heliothines received treatment Non-Bt plots received an average of 2.5 applications of insecticide and Bt plots averaged 1.0. Non-Bt plots maintained in the same field by the cooperator and scouted by a consultant in 2000 received three insecticide applications for heliothines compared to none on the Bollgard plots. Because of low insect densities during the years of the study, income after cost of insect control favored non-Bt cotton.

References

Anonymous. 1999. Cotton 2000 planning budgets. Mississippi State University Extension Service, Mississippi State, MS. Agricultural Economics Report 106, 95 pgs.

Table 1. Insecticide history and heliothine related results of Roundup Ready and Bollgard/Roundup ready comparisons in Ultra Narrow Row cotton in 1998.

Variety	PM1220 RR	PM1220 BGRR
Insecticide history	18 Jul – KarateZ 0.04	
	25 Jul – KarateZ 0.04	25 Jul – KarateZ 0.04
Lb Lint/acre (SD)	956 (60) a	950 (27) a

Means within a row not sharing common letters differ significantly (LSD; P=0.05).

Table 2. Insecticide history and heliothine related results of Roundup Ready and Bollgard/Roundup ready comparisons in Ultra Narrow Row cotton in 1999.

Variety	DP425 RR	DP451 BGRR
Insecticide history	23 Jul – Tracer 0.067	
	3 Aug – KarateZ 0.04	
	13 Aug – Ammo 0.06	13 Aug – Ammo 0.06
Lb Lint/acre (SD)	469 (13.3) a	429 (22) b

Means within a row not sharing common letters differ significantly (LSD; P=0.05).

Table 3. Per acre income comparison after subtraction of insecticide application costs and Bollgard technical fee[2], 1998 and 1999.

	(Lb lint * $0.533[1])-insecticide cost		Difference
Year	Roundup ready	Bollgard / Roundup Ready	Roundup ready - Bollgard / RR
1998	$486.01	$463.93	$22.08
1999	$216.31	$188.22	$28.09

[1] Estimated 2000 cotton price from the 1999 Cotton 2000 Planning Budgets. Agricultural Economics Report 106, Mississippi State University.
[2] Technical fee set at $32.00 per acre.

Table 4. Mean heliothine damage and insect counts per 25 terminals, squares and bolls.

	1998		1999	
Variable	PM1220 RR	PM1220 BG/RR	DP425 RR	DP451 BG/RR
Terminals with eggs	0.59 a	0.32 a	0.47 a	0.54 a
Terminals with worms	0.07 a	0.02 a	0.28 a	0.00 b
Worms in squares	0.32 a	0.22 a	0.05 a	0.18 a
Worm damaged Squares	0.64 a	0.51 a	0.93 a	0.19 b
Worms in Bolls	0.00 a	0.00 a	0.03 a	0.47 b
Worm damaged bolls	0.21 a	0.14 a	0.10 a	0.37 b

Means within a year and row not sharing a common letter differ significantly (LSD; P=0.05).