THE EFFECTS OF OVER SPRAYS ON BT COTTON

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Abstract

With the introduction of the Boll Weevil Eradication Program (BWEP) in Georgia and the adoption of the use of transgenic Bt cotton, cotton insect control has taken on a new dimension. Growers are seeing a new spectrum of insect pests beginning to emerge as a major economic factor in cotton production. With fewer insecticide sprays being applied to Bt cotton, questions have been raised regarding insect thresholds, and economic impact. Should over sprays be used on Bt cotton? Will yield be increased with the use of over sprays? Is one type of insecticide superior to another for late season, non-traditional insect populations?

This study was designed to determine the effects of over sprays on Bt cotton. The field study was conducted in Dodge and Worth Counties, Georgia in 1997 and 1998 and in Dooly County, Georgia in 1998. Single replicate large strip plots were planted with transgenic Bt cotton. Four treatments were used in the trial: Untreated, methyl parathion (Penncap M), Tracer, and pyrethroid (Karate and Baythroid). Two treatments were made in each plot ten to twenty-one days apart beginning in late July and ending in mid-August. This time frame coincides with traditional dry down of corn in Georgia. Three insect pest were targeted for this study: bollworm, fall armyworm, and stink bug. Plots were scouted weekly for four to six weeks after the initial treatment. Insect populations were noted and bolls were collected to determine the percent damaged bolls due to stink bugs. Lint yield was determined at harvest.

Insect populations generally increased in the absence of insecticide sprays. Bt cotton worked well to control tobacco budworm and performed well against bollworm. However, low levels of bollworm and fall armyworm were present. The pyrethroid treatment significantly reduced the bollworm population when compared to the untreated plot. In addition, Tracer and the pyrethroid treatments numerically reduced the fall armyworm populations when compared to the untreated plots. Though the stink bug populations did not exceed the one per six feet of row treatment level, the use of methyl parathion and pyrethroid treatments significantly reduced the stink bug level when compared to the Tracer and the untreated plots. In addition, the percent damaged bolls was reduced where stink bug control insecticides were used. Even though the threshold of one per six feet of row was not reached, greater than twenty percent damage was experienced where control was not effected. Yield increases were observed in the three treated plots, with the pyrethroid showing a significant yield increase over the other three treaments.

The use of pyrethroid sprays on BT cotton decreased bollworm, fall armyworm and stink bug populations and would be the preferred treatment for late season insect control. Cotton yields increased when insecticide treatments were used on Bt cotton with pyrethroid sprays providing a significantly higher yield when compared to the other treatments. The use of scouting to determine the necessity for insecticide sprays remains the number one method of determining environmentally safe and effective insecticide scheduling. More study is needed relating to stink bug thresholds and treatment triggers.

Introduction

The Boll Weevil Eradication Program (BWEP) created for Georgia cotton growers a different set of entomological factors with which to contend. Since the successful elimination of the boll weevil as an economic pest, bollworm and tobacco budworm have become the primary cotton insect pests in Georgia. The introduction of transgenic Bt cottons has again redefined the cotton insect control picture. The use of transgenic Bt cottons has greatly diminished the demands on the cotton producers relating to bollworm and tobacco budworm control by further reducing the need for repeated insect sprays to decrease losses from these two insect pests.

Beginning in 1996, Georgia farmers began to use the Bt varieties for cotton on a wide spread basis. In 1996, 23 percent of Georgia's cotton carried the Bt gene. This figure grew to 37 percent in 1997 and further expanded to 55 percent in 1998. The excellent tobacco budworm control that Georgia farmers have experienced lends itself to further expansion of this acceptance. Experiences in Georgia as well as other cotton producing areas have demonstrated the need for additional insect control measures for bollworm as well as other pests such as boll weevil, fall armyworm, plant bug, and stink bugs on Bt cotton. In Georgia, bollworm, fall armyworm, and stink bugs are the primary insect pests of Bt cotton. The dry down of corn in mid to late July encourages the increased bollworm and fall armyworm infestations, while stink bugs are historically a mid to late season pest.

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Objective

The objective of this study was to evaluate the impact of three insecticide treatments on insect pest populations and yield of Bt cotton. Selected treatments included methyl parathion (Penncap-M), Tracer, and a pyrethroid (Karate or Baythroid). Methyl parathion was selected because of its activity on stink bug, Tracer for its activity on caterpillar pests, and a pyrethroid for its activity on both stink bugs and caterpillar pests. Two applications of each insecticide were made at approximately ten day intervals with the first application applied to coincide with the historical movement of bollworm to cotton, i.e. corn dry down.

Methods and Materials

Single replicate large plot (5 - 15 acres) strip trials of transgenic Bt cotton were established in Dodge and Worth Counties, GA in 1997 and 1998. Similar trials were added in Dooly County, GA in 1998. The treatments in 1997 included an untreated check, Penncap-M at 1 qt./A, Tracer at 2 oz./A and Karate at 4 oz./A in both locations. In 1998, the treatments included an untreated check, Penncap-M at 1 qt./A, Tracer at 2 oz./A, and Karate Z at 2 oz./A. The pyrethroid treatment in the Dooly County trial was Baythroid at 2.3 oz./A. Table 1 indicates the application dates for both years.

All plots were scouted weekly until the threat of insect injury was deemed negligible. Scouting procedures included examination of the top 1/3 of ten to twenty plants. One bloom, one boll with a stuck bloom tag, and another boll lower in the canopy were also examined for bollworm and fall armyworm (Roberts, 1997). A drop cloth was used at five to ten locations per plot to monitor plant bug and stink bug populations. Twenty-five or fifty bolls approximately 15-20 days after white bloom were also collected from each plot and examined for internal stink bug damage. Bolls were considered damaged if discoloration was present on the lint or if warty growths or puncture wounds were observed on the inner surface of the boll wall. Plots were machine harvested at all locations and weighed to determine seed cotton yield. The cotton was ginned to determine lint percentage or estimated based on farmer trends.

Results and Discussion

The seasonal means for insect counts and internal boll damage are shown in Table 2. During 1997, stink bug counts were made weekly for six weeks beginning five to six days after the initial treatment. Boll worm and fall armyworm counts were made once per week for four weeks following the initial treatment. During 1998, stink bug, boll worm and fall armyworm counts were begun three days after the initial treatments and continued for four weeks in the Worth and Dooly trials. The counts were begun ten days after the initial treatment was made in the Dodge trial and continued for four weeks.

Insect pest populations generally increased in the absence of insecticide treatment. Bt cotton provided excellent control of tobacco budworm and performed well on bollworm. However, Bt cotton failed to prevent low levels of bollworm and fall armyworm from occurring. Only the pyrethroid treatment significantly reduced bollworms greater than 1/4 inch in length from the untreated check. Fall armyworm numbers were numerically less in the Tracer and pyrethroid treatments.

The seasonal mean for stink bug counts were below the one per six feet of row threshold that is used in Georgia (Roberts and Herzog, 1998). The use of methyl parathion and pyrethroids significantly lowered stink bug populations when compared to the untreated and Tracer plots. In addition, the percent internal damaged bolls were significantly reduced where insecticides that have activity on stink bugs were used.

Preliminary studies in South Carolina suggested that 20 percent internal boll injury may be expected when stink bugs number one per six row feet (Greene et al., 1997). The internal boll damage in this study exceeded 20 percent in the untreated check and Tracer plots even though the stink bug numbers did not reach this threshold.

The yields for 1997 and 1998 and the average yields for all locations are shown in Table 3. Numerical yield increases were observed in all three treated plots. However, only the methyl parathion and pyrethroid treatments were significantly greater than the untreated. The pyrethroid treatment showed the greatest yield increase and was significantly greater than other treatments.

Conclusions

Insect pest populations increased in the absence of pyrethroid sprays. The use of the pyrethroid sprays decreased bollworm and fall populations as well as stink bug numbers. The use of a pyrethroid insecticide would be the treatment of choice for late season, broad spectrum insect control when compared with the use of methyl parathion or Tracer.

Lint cotton per acre yields were increased by the use of over sprays on transgenic Bt cotton. Yields for both the Tracer and methyl parathion plots tended to be higher, but only the methyl parathion plots were significantly higher. Significant increases were experienced through the use of pyrethroids when compared to all other treatments. Though indiscriminate use of insecticides is discouraged, late season over sprays of transgenic Bt cotton should be encouraged where insect scouting indicates a treatable level.

Though transgenic Bt cottons have improved the control of tobacco budworm in Georgia cotton, the use of proper insect scouting techniques and procedures remains as important as ever in the determination of effective, economical insecticide use. Properly trained insect scouts still remain the first line defense against economic lose due to insect pests.

More study is needed relating to stink bug threshold and treatment levels. Transgenic Bt cotton has increased the importance of this insect pest because control is no longer accomplished through the use of insecticides against other target insects. Scouting procedures, lose estimates and treatment triggers need to be determined to insure environmentally safe and economically sound use of over sprays on transgenic Bt cotton.

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Table 1. 1997 and 1998 application dates

Location/year	1st App.	2nd App.
Dodge/1997	July 24	August 6
Dodge/1998	July 30	August 11
Worth/1997	July 23	August 6
Worth/1998[1]	August 3	August 17[2]
Dooly/1998[3]	August 5	August 26

[1] All plots were treated with Asana XL (7.2 oz./A) on July 21.
[2] Dimilin (4 oz./A) was added to all treatments.
Check plot was treated with Fury (3.2 oz./A) and Dimilin (4 oz/A).
[3] All plots treated with Decis (2 oz./A) and Lannate (8 oz./A) on Aug. 18.

Table 2. Bollworm, fall armyworm, stinkbug, and percent internal boll damage seasonal means in cotton treated with selected insecticides.

Treatment	No. Per 100 Plants		Stink Bugs per 6 row ft.	%Internal Damage
	Bollworm (>1/4 inch)	Fall Armyworm		
Check	3.04a	6.94a	0.35a	34.6a
Tracer	2.28ab	3.78a	0.33a	31.4a
Methyl parathion	2.34ab	6.80a	0.18b	19.2b
Pyrethroid	0.52b	3.34a	0.14b	12.2c

Means in the same column are not significantly different (DMRT p=0.10).

Table 3. Yields for 1997 and 1998 locations and average yields for all locations in lbs. lint per acre.

Treatment	1997	1998	Average
Check	948	1036	1001c
Tracer	1026	1021	1023bc
Methyl Parathion	1007	1101	1063b
Pyrethroid	1134	1132	1133a

Means in the same column are not significantly different (DMRT p=0.10).