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BOLLGARD OVERSPRAY TRIALS

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Abstract

Lint yield improvements were observed but varied when Bollgard™ varieties received broad spectrum insecticide applications made according to: a.) thresholds being met for either primary or secondary pest infestations, and b.) when crop fruiting patterns were vulnerable to injury from a multi-pest complex which included plant bugs, stink bugs, and lepidopterous insects. Pyrethroids alone or in combination with imidacloprid were used as overspray treatments and were applied as single sprays or as sequential sprays during the months of June, July, and August. Results for 1999 and 2000 indicated that a single application made during early August preserved yield to a greater degree than all other treatment regimes including sequential treatments where an August application was included. This trend was not observed in 2001 with only a relatively modest yield difference detected among insecticide overspray treatments. During this three year study, average yields were increased in a range from 110 to 352 pounds per acre depending upon the insecticide treatment regime. These overspray trials have demonstrated that Bollgard cotton has even a greater yield potential when secondary pests (plant bugs, stink bugs and boll weevils) and to a lesser extent primary pests (Heliothine complex) are managed relative to their overall injury potential.

Introduction

There is an increased emphasis on genetically altered crops in West Tennessee as evidenced by roughly 85% of the cotton acreage being planted to Bollgard during the 2001 season. With such a high adoption rate of technology based varieties (Roundup Ready™ and BXN™ included), farmers have realized significant value in these novel products. However, with these new technologies come new challenges as these technologies have begun to reshape traditional management practices. These events have generated increased demand on the need for academic research and extension groups to provide timely crop production information in order for farmers to make both agronomically and economically sound decisions.

It's obvious to see that farmers have been facing economic strains and severe economic losses during the past several years. These losses are due to low market pricing, poor environmental conditions, and price discounts for grades. These factors in light of the rapidly changing agricultural industry have forced farmers at times to make less informed decisions and assume levels of risk that a decade ago were considered acceptable. The adoption of genetically enhanced crops has no doubt permitted many producers to remain in business despite the recent economic downturn; however farmers must continually modify management practices in order to maintain satisfactory margins as technological advancements become available.

New varieties are being released in a matter of one to two years. This combined with evolving crop management systems recommended to maximize profitability has caused confusion for some producers. The Plant and Pest Management teams at the University of Tennessee have incorporated field trails and demonstrations that will help fulfill the farmer's need for unbiased crop research yet incorporate novel technologies which are beneficial for their business. For this aspect, this research involves Bollgard varieties, broad spectrum insecticide oversprays and the boll weevil eradication program. Because of the complexity of the interactions among the before mentioned factors; crop scouting, application of insect pest thresholds (primary and secondary), crop fruiting patterns, and insecticide treatments must be evaluated further to develop and enhance new management systems. Practical research similar to these studies are necessary to keep farmers competitive by becoming better acquainted with the rapid changes facing them. The purpose of this education paper will be to investigate and update Bollgard management recommendations and thresholds in West Tennessee.

Materials and Methods

The study design information objectives were:

- Evaluate seasonal performance of Bollgard cotton.
- Evaluate efficacy of pyrethroid alternatives, e.g.Provado®, for early season plant bugs.
- Evaluate either pyrethroids alone or in combination with other insecticides at the outlined specified times.
- Evaluate temporal insecticide overspray benefit against a multi-pest complex in Bollgard cotton

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In 1999, 2000, and 2001, demonstration trials evaluated broad spectrum (pyrethroids) and more narrow spectrum insecticide use in Bollgard cotton in order to better understand seasonal crop-pest interactions which occur in West Tennessee. These evaluation studies were conducted in Fayette County, Tennessee, in a 26 acre field planted to Bollgard cotton and managed by Mark and Joseph McNabb, McNabb Farms, Somerville Tennessee. The growing conditions for this area average 2400 heat units (DD-60's), 36 to 42" tall cotton and a total of 9 to 14 fruiting nodes. These trials were conducted under dry land conditions and rainfall was below average,12.45" annually.

The initial trial, conducted in 1999, had four treatments set up as strip plots which ran the entire length of the field. Treatments corresponded to insecticide applications triggered by pest activity during the months of June, July, and August. Insecticide applications were made as follows:

- Treatment 1 - untreated check
- Treatments 2, 3, and 4 received a June 15th application primarily for plant bugs.
- Treatments 3 and 4 received a July 17th application for plant bugs, stink bugs, low bollworm infestations, and a decline in square retention.
- Treatment 4 received an August 16th application for plant bugs, stink bugs, small bollworms with eggs, and to maintain targeted boll retention levels.

It is important to note that the August 16th application was borderline as the crop had nearly achieved termination, i.e. nodes above white flower (NAWF) 5 + 380 heat units.

The 2000 and 2001 trials were expanded to 6 treatment strip trials in order to evaluate the efficacy of single insecticide applications in Bollgard cotton targeting early (June), middle (July), and late (August) season pest infestations. The insecticide treatments were as follows:

- A - June application only
- B- July application only
- C- August application only
- D- June and July applications
- E- June, July, and August applications
- F- No insecticide check

The strip treatments were 18 rows wide by 1000 feet long. The insecticide overspray treatments A, B, and C consisted of a single application in each month- June, July, and August, respectively. Two insecticide applications, one in June and one in July, corresponded to treatment D. Three insecticide applications, one in June, one in July and one in August, corresponded to treatment E. The check treatment, F, received no insecticide application. Though insecticide application timing corresponded to a specific month, the dates were selected according to thresholds being reached which was determined by weekly scouting. Treatment dates in 2000 were June 21, July 21, and August 17 and the termination of the crop on August 17 based upon the crop achieving NAWF + 360 heat units. Treatment dates in 2001 were June 14, July 27, and August 15 and the termination of the crop on August 15 based upon NAWF + 380 heat units.

Results and Discussion

At McNabb Farms in Somerville, Tn. in 1999, treatment timing, insects thresholds, and fruit retention results can be seen in Table 1. Results indicated that yields were greatest when three insecticide applications were made in June, July and August. However for this treatment, the greatest yield increase was considered to be due to the August application (+313 lbs/A) since the June only, and June and July insecticide treatments provided only modest increases in yield of +73 and + 94 lbs/A, respectively (Table 2).

Results from the 1999 study indicated that insect pest activities were relatively modest during the early and middle portion of the season, but the potential for insect pest injury late in the season was substantial. The broad spectrum insecticide application made during the month of August eliminated the growing plant bug, stink bug infestations as well as any potential bollworm escapes that can occur in late season Bollgard fields. This in conjunction with the crop rapidly reaching physiological maturity (“cutout”) limited boll injury by insects allowing the crop to achieve maximum yield potential.

2000 data revealed that the one single spray in August increased yield + 578 lbs over the untreated check. This biggest yield difference was considered to be due to control of late season stink bugs and possibly some escaped bollworm larvae (Table 3).

Additionally, beneficial insect populations were permitted to thrive during the early and middle portion of the season. The second largest yield increase (+ 386 lbs) in relation to the untreated check resulted from the three sequential spray treatment (June, July, and August sprays). The other treatments (June only, July only, and June and July applications) were not significantly different from one another and yielded roughly 100 lbs less than the three sequential spray treatment (Table 4). However, these treatments did provide a + 289 lbs average increase in yield in relation to the untreated check.

Though the treatment structure differed between the 1999 and 2000 trials, the treatments which contained a broad spectrum insecticide application in August tended to provide the greatest yields. Again beneficial insect populations were thought to provide a portion of the yield response observed in the August only application.

In 2001, scouting indicated that the insect pest complex was primarily composed of stink bugs and plant bugs (Table 5). Though low levels of bollworm eggs were detected, Bollgard prevented this below threshold infestation from developing and few, if any, escaped larvae were encountered to enact a spray decision.

Other than the June only insecticide spray treatment, no significant yield trends were observed among the remainder of the overspray treatments (Table 6). The June only overspray treatment provided a + 123 lb increase over the untreated check while the other treatments yielded within 31 lbs of one another. Though the pest complex was composed of primarily "bug" pests, the yield results indicated that the cost of an insecticide application made after June would have paid for itself. Additionally, the sporadic behavior and subsequent feeding injury to cotton from plant bugs and stink bugs may have been difficult to quantify within the scope of this trial. One possibility for this could have been caused by the repellency phenomenon that some insecticides have on the bug pests. This may have pushed these pests out of recently sprayed treatments into surrounding treatments which either had not been treated or had been treated many days prior. Though not a factor in this study, it could be possible that under heavy caterpillar infestations, insufficient feeding sites may be available for the bug pest to achieve high numbers.

Table 7 shows the results of the 3 year average treatment yields. These results suggest that well timed broad spectrum insecticide applications in Bollgard cotton permit the producer to aggressively manage insect pest populations in an effort to achieve maximum yield potential. Since Bollgard protects a greater proportion of early season fruit, the crop has the capacity to reach physiological maturity more rapidly which can reduce late season insect pest management complications.

Summary

Bollgard cotton has become a valuable insect management tool for many producers in West Tennessee. Though there have been relatively low bollworm and budworm infestations observed over the past couple of years, these pests even at low levels (possibly below thresholds) have the potential to reduce yields throughout the season and delay crop maturity. With the threat of bollworms and certainly budworms significantly diminished by Bollgard, producers are permitted to more aggressively manage other cotton pests. The results from the 1999 and 2000 seasons have indicated that broad spectrum insecticide applications in Bollgard cotton can improve yields. Furthermore, the most significant yield increases were observed from oversprays applications made in August when the crop has achieved a boll load which is still vulnerable to insect pest injury. These dynamic factors produce different results from one season to the next but place even greater emphasis on the need for more extensive research directed toward evaluating the interactions among novel technologies, insecticide use, pest scouting and crop development monitoring. A thorough understanding of these interactions will provide producers with valuable information they need when making on-farm management decisions.

Acknowledgments

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References

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Table 1. Insect pest scouting information for 1999.

INSECT POPULATION & DATES 1999

BAYTHROID	DATE	WORMS	EGGS	PLANT BUGS	STINK BUGS	SQUARE RET
1 TO 70	JUNE 15	2%	10%	4%	0%	85%
7 (DAT)		2%	2%	0%	0%	88%
1 TO 65	JULY 17	6%	2%	0%	0%	92%
7 (DAT)		2%	0%	0%	2%	94%
1 TO 80	AUG 16	4%	6%	6%	10%	60%
7 (DAT)		0%	0%	4%	2%	65%

NAWF 5 = 380 HU on Aug. 16th Insecticides were terminated

Table 2. Treatment yield for 1999.

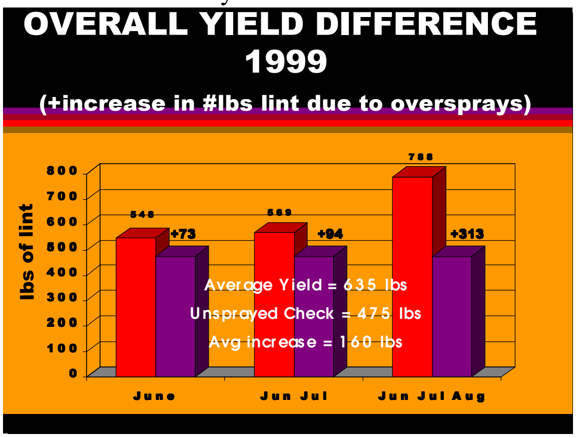

Table 3. Insect pest scouting for 2000.

INSECT POPULATION & DATES 2000

BAYTHROID	DATE	WORMS	EGGS	PLANT BUGS	STINK BUGS	SQUARE RET
1 TO 100	JUNE 21	0%	0%	8%	0%	95%
7 (DAT)	(1,3,5)	0%	0%	0%	0%	95%
1 TO 80	JULY 21	4%	0%	7%	5%	88%
7 (DAT)	(2,3,5)	0%	0%	0%	0%	85%
1 TO 80	AUG 17	6%	4%	4%	14%	75%
7 (DAT)	(4,5)	2%	2%	0%	6%	80%

NAWF 5 = 360 HU on Aug. 17th Insecticides were terminated

Table 4. Treatment yields for 2000.

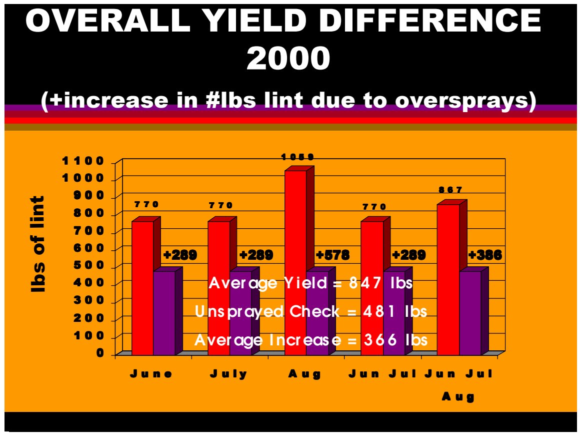

Table 5. Insect pest scouting for 2001.

INSECT POPULATION & DATES 2001

TREATMENTS	DATE	WORMS	EGGS	PLANT BUGS	STINK BUGS	SQUARE RET
All - 3	JUNE 14	0%	0%	8%	0%	98%
7 (DAT)	(1,3,5)	0%	0%	0%	0%	93%
All - 3	JULY 27	0%	4%	8%	14%	95%
7 (DAT)	(2,3,5)	2%	0%	3%	3%	94%
All - 3	AUG 15	2%	2%	8%	8%	84%
7 (DAT)	(4,5)	0%	0%	3%	2%	83%

NAWF 5 = 380 HU on Aug. 15th Insecticides were terminated

Table 6. Treatment yields for 2001

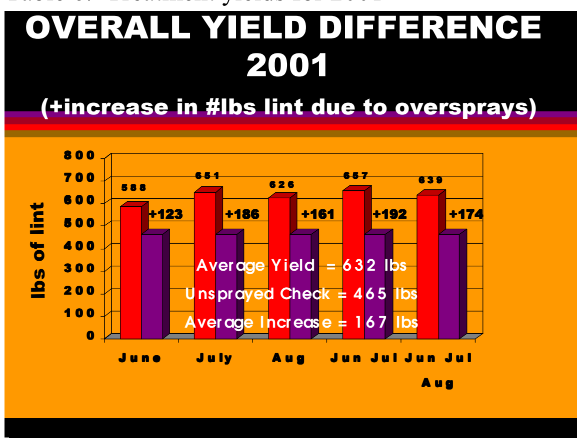

Table 7. Overall treatment yields for 1999-2001 trials.