EGG VS. ESCAPED WORM THRESHOLDS FOR CONTROL OF BOLLWORM IN B.T. COTTON IN SOUTH CAROLINA

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Abstract

Use of escaped worm (less than 0.25 inch) thresholds for bollworm (*Helicoverpa zea*) in transgenic B.t. cotton in South Carolina during 1996 led to unacceptable levels of boll damage and subsequent yield loss. Larvae developed from eggs deposited within the plant canopy, particularly blooms and squares, and damaged small bolls by feeding underneath bloom tags. These larvae were difficult to control because of their location and size. Because of these problems, a treatment threshold based on eggs was established for 1997; treat at 75 eggs OR 30 small larvae(less than 0.25 inch) OR 3 large larvae(greater than 0.25 inch) OR 5% boll damage per 100 plants. Four geographic locations in the southern half of the state were selected to test this threshold. Two sets of studies were established in all locations; in one set, a broad spectrum insecticide was applied in early July to disrupt beneficial species and the other set was left undisturbed. Hand picked yield data, from both disrupted and undisrupted sets, indicated that the egg threshold increased lint yields by 58 and 83 lbs. respectively, when compared to the escaped worm threshold. Machine picked yields indicated similar differences. Undisrupted sets required an average of 0.25 fewer pyrethroid treatments for bollworm, treatment dates were delayed, and these plots matured earlier. We will continue to use this same egg threshold in South Carolina in 1998.

Introduction

In South Carolina, there are two distinct moth flights within our cotton production regions (Sullivan, et.al. 1993). The July cotton bollworm (*Helicoverpa zea*) flight is of major concern; growers must protect fruit for the duration of this flight to be economically successful. Early season (June) applications of insecticides are not needed because of a.) the absence of boll weevil (*Anthonomous grandis grandis*), b.) <5% of acreage is treated for tobacco budworm (*Heliothis virescens*), and c.) insignificant plant bug problems (primarily *Lygus lineoloris*). This combination of events allow growers to enter the July/bollworm period with maximum populations of beneficial species.

Transgenic B.t. varieties were made available to growers in 1996 and South Carolina utilized escaped larval thresholds to make treatment decisions for cotton bollworm. Personal field observations by consultants and research/extension personnel during the 1996 growing season indicated that moderate/heavy bollworm pressure in July led to larger numbers of escaped larvae than expected. Most of these escapes were through bloom tags. Several non-replicated grower field trials indicated that one or two pyrethroid applications at the initiation of the July bollworm flight increased lint yields 100-150 lbs. in two bale cotton when compared to no pyrethroid applications (unpublished data).

Therefore, we modified the 1996 escaped worm threshold for bollworm on B.t. cotton and utilized one based on egg numbers. This threshold was: 75 eggs OR 30 small larvae (less than 0.25 inch) OR 3 large larvae (greater than 0.25 inch) OR 5% boll damage/100 plants. Ours was the only egg threshold to be recommended. We reasoned that this threshold would result in more timely insecticide applications that would control small larvae and prevent escapes through bloom tags. Studies were designed to verify this egg threshold during the 1997 growing season with two objectives: 1.) compare egg thresholds with an escaped worm threshold and 2.) test thresholds with and without early July disruption of beneficial arthropods.

Materials & Methods

Four thresholds were compared: 1.) 75 eggs OR 30 small larvae (<0.25 inch) OR 3 large larvae (>0.25 inch) OR 5% boll damage/100 plants, 2.) double this threshold (150 egg, etc.), 3.) cadillac treatment (treat the B.t. each time adjoining conventional ('DPL 5415') needed treatment), 4.) escaped worm threshold (8 large larvae >0.25 inch/100 plants) and 5.) untreated control. These plots were established in four locations in growers' fields in the southern half of the state. There were two sets of plots, one that was treated in early July (1 - 2 X) with 0.75 lb.AI/ac of acephate to disrupt beneficial populations and the other left undisrupted. 'NuCOTN 33b' was used in all locations.

Plot size was 12 rows (38 inch) X 50 feet with 4 replications in a RCBD. Standard cotton production practices were followed as outlined in Clemson University Extension Cotton Production Guides. Once individual thresholds were reached, a standard pyrethroid treatment was made as a foliar spray using either a tractor mounted sprayer or John Deere 6000 Hi-Cycle system. All plots were oversprayed for stink bugs with methyl parathion (0.5 lb. AI/ac) as needed in Aug.-Sept.

Yields were obtained by hand harvest (10 ft. row/plot) and machine harvest (two rows/plot). For purposes of reporting data from this study, only hand picked yields will be used.

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Results

Location 1

Yields from the Ashley Bush location near Estill, SC indicated no significant differences among the thresholds in either the early treated with acephate (July 1) or untreated early regime (Table 1). Threshold 1 (75 eggs) was treated with a pyrethroid 3 X in both disrupted and nondisrupted plots; the last treatment in the undisrupted being 9 days later than the disrupted. Threshold 2 (150 egg) was treated 2 X on the same dates for both sets of plots. Treatment 3 (cadillac) was treated 4 X in both sets as determined by scouting adjoining conventional cotton. Treatment 4 (escaped worm) was treated 1 X in both sets; the undisrupted plots reached threshold 9 days later than disrupted.

Comparing the 75 egg to the escaped worm threshold (1 vs. 4), the egg threshold produced 69 lbs. more lint in the disrupted set and 134 lbs. more lint in the undisrupted.

Location 2

Data from the Youngblood field indicated significant yield differences (Table 2). Comparison of egg threshold vs. escaped worm threshold (1 vs. 4) shows an increase of 193 lbs. lint in the disrupted set and 57 lbs. lint in the undisrupted set. The disrupted side was treated July 1 and 12 with acephate.

Threshold 1 (75 egg) was treated 2 X on the same dates for both sets of plots; threshold 2 (150 egg) was treated 2 X in the disrupted set vs. 1 X in the undisrupted. Threshold 3 (cadillac) was treated 3 X. Threshold 4 (escaped worm) was treated 1 X in the disrupted set and was not reached where beneficials were left intact.

Summary of Locations

Average yields for all four locations are shown in Table 3. Threshold 1 (75 egg) resulted in a 58 lb. lint increase over threshold 4 (escaped worm) in the disrupted set and and 83 lb. lint increase in the undisrupted set. Machine harvested yields indicated similar differences. For thresholds 1, 2, and 4, there was .25 fewer insecticide applications in the undisrupted plots.

These data support our use of an egg threshold for cotton bollworm in Bollgard cotton in South Carolina. Yield increases shown in these studies were obtained during a year in which bollworm pressure was considered "moderate". Larger increases would be expected in years when "heavy" pressure is encountered.

References

Sullivan, M. J., T. W. Smith, Jr., and S. G. Turnipseed. 1993. Pyrethroid efficacy on bollworm in South Carolina. In Proceedings Beltwide Cotton Conf., National Cotton Council of America, Memphis, TN. pp. 830-831.

Table 1. Number pyrethroid applications, application dates, and lint yields - Ashley Bush field, Estill, SC. 1997.

	Disrupted July 1-acephate		Undisrupted	
Threshold[1]	# appli.(Dates)	Yield[2]	# appli. (Dates)	Yield[2]
1	3(7/10,17,24)	1461a	3(7/10,17,8/2)	1565a
2	2(7/17,8/2)	1510a	2(7/17,8/2)	1535a
3	4(7/10,17,24,8/2)	1538a	4(7/10,17,24,8/2)	1623a
4	1(7/24)	1329a	1/(8/2)	1431a
5	0	1279a	0	1513a

[1]Thresholds were 1 - 75 egg, 2 - 150 egg, 3 - cadillac, 4 - escaped worm, 5 - control - - fully explained in text.
[2] Means in each column followed by same letter are not significantly different (Alpha = .05).

Table 2. Number pyrethroid applications, application dates, and lint yields - Youngblood field, Blackville, SC . 1997.

	Disrupted July 1, 12 -acephate		Undisrupted	
Threshold[1]	# appli.(Dates)	Yield[2]	# appli. (Dates)	Yield[2]
1	2(7/25,8/12)	1161b	2(7/25,8/12)	1064ab
2	2(7/25,8/12)	1175b	1(7/25)	1111ab
3	(7/21,25,8/1)	1392a	4(7/21,25,8/1)	1233 a
4	1(8/12)	968c	0	1007ab
5	0	1037bc	0	946 b

[1]Thresholds were 1 - 75 egg, 2 - 150 egg, 3 - cadillac, 4 - escaped worm, 5 - control - - fully explained in text.
[2] Means in each column followed by same letter are not significantly different (Alpha = .05).

Table 3. Average number pyrethroid applications and average lint yield in four locations, 1997.

	Disrupted in July		Undisrupted in July	
Threshold[1]	# appli.	Yield	#appli.	Yield
1	2.5	1064	2.25	1093
2	1.5	1050	1.25	1025
3	3.5	1102	3.50	1117
4	1.0	1006	0.75	1010
5	0.0	871	0.0	977

[1]Thresholds were 1 - 75 egg, 2 - 150 egg, 3 - cadillac, 4 - escaped worm, 5 - control - - fully explained in text.