EFFICACY AND DURATION OF EARLY SEASON INSECTICIDE APPLICATIONS

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Abstract

Field studies were established in a cotton production system of the Mississippi Delta to examine the effects of various insecticides on cumulative insect feeding patterns and fruit initiation in cotton (Gossypium spp.). Cotton bollworm Helicoverpa zea (Boddie), tobacco budworm Heliothis virescens (Fabricus) and tarnished plant bug Lygus lineolaris (Palisot de Beauvois) damaged cotton plant terminals and subsequent primordial fruit with an increasing accumulation of feeding during early season. Effective insecticide control did decrease this duration of feeding and resulted in an acceptable fruit set.

Introduction

Timely insecticide applications are essential to prevent insect damage in cot-ton production. With IPM concepts steering cotton production to "earliness", early fruit retention is necessary to fulfill the requirements of this technique.

Cotton, Gossypium hirsutum L. is an economically important crop. Cotton bollworm, Heliothis virescens (Fabricus), and tobacco budworm Helicoverpa zea (Boddie), are two economic pests in cotton production operations (Jenkins et al. 1995). Tarnished plant bug Lygus lineolaris (Palisot de Beauvois), another primary economic pest, can destroy meristematic tissue in developing plant terminals (Leigh et al. 1988). An accumulation of these intensive feeding periods from these particular cotton pests can damage terminals and subsequently lead to aborted square positions or low square retention. The effects of cumulative feeding patterns has been described as an adequate indicator of pest infestation levels in crop production (Ruppel 1983, Morrill and Wrona 1987, Harris et al. 1992). This cumulative index describes the presence of insect pests in crop production systems as insect-days or the accumulation of an insect pest over time. This study reports the effects of early season insect control and duration of control by different insecticides during this early period.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:955-956 (1996)
National Cotton Council, Memphis TN

Materials and Methods

Five commercially available insecticides were evaluated for effectiveness in control and length of control against early season insects of cotton. A cotton production system with a history of tarnished plant bug populations was selected in Sunflower county, MS, adjacent to the Sunflower river. Cotton variety 'Suregrow 125' was planted on a Dundee silt loam soil. Plots contained 18 rows and were approximately 5,280 ft. in length and included four replications per treatment.

Sweep net and visual sampling procedures were initiated on 24 May 1995 and continued at 2 day intervals through 12 June 1995. Insect sampling consisted of 50 sweeps with a 15 inch sweep net and visual examination of 13 cotton plants per plot. Insects collected in the sweep net were anesthetized with ether and placed in a kill bucket containing a cotton wick soaked with ethyl acetate. These samples were transported to the laboratory where insects collected were identified and counted.

Terminals were examined for Heliothine eggs, larvae and insect damage. Insect days (ID), Lygus days and Heliothine days were calculated as: $ID = (X_{i+1} - X_i)\ [(Y_i + Y_{i+1}) / 2]$ where X is sample days and Y are sample numbers. Cumulative insect days were computed by summing the individual insect days.

Insecticide treatments were applied with a Melroe Spray Coupe delivering 5 gpa. Insecticides treatments were initiated on 25 May 1995 when the fourth leaf of the cotton plant had expanded to the size of a quarter. These insecticide treatments included Baythroid at 0.036 lb ai/A, Orthene at 0.33 lb ai/A, Vydate C-LV at 0.25 lb ai/A, Provado at 0.047 lb ai/A, and Karate at 0.033 lb ai/A. Subsequent applications were based on Mississippi Coopera-tive Extension Service insect control guide recommendations. Two applica-tions of each insecticide were made during the study. The second application of insecticide consisted of two different application dates. On 4 June 1995, Baythroid, Vydate C-LV, and Provado treatments were made and on 5 June 1995, Karate and Orthene treatments were made. Guthion at 0.25 lb ai/A was tank-mixed with Orthene and Provado at the second application timing to provide boll weevil control.

Results and Discussion

Sweep net sampling resulted in various plant feeding species being observed. Species observed were: tarnished plant bug, Heliothine larvae, spotted cucumber beetle, three cornered alfalfa hopper, cabbage looper, yellow stripped armyworm, stripped cucumber beetle, and multiple species of leafhoppers and fleabeetles.

Plant bugs comprised a larger percentage of the population in the Baythroid treatments than Karate treatments 4 days after the first application (Table 1). Karate maintained a lower percentage of plant bugs than did Vydate C-LV and Provado 2 days after the second application (Table 2). Baythroid controlled plant bug populations more than Vydate C-LV 2 days after treatment. Provado and Baythroid increased control of tarnished plant bug over Vydate C-LV 4 days after the second treatment. Provado demonstrated a slower, but longer control of plant bugs than did Vydate C-LV 6 days after treatment (Table 3).

Cumulative infestations of plant bug were similar during the first four sampling dates. Karate had significantly lower lygus days than Vydate C-LV on 2 June 1995. All insecticide treatments provided similar lygus day accumulations at the final sampling date (Table 4).

Terminal Heliothine larvae increased from 0% to 14% infested terminals 1 day after the second Orthene application (Table 5). This increase in population resulted in less control than Baythroid, Vydate C-LV, and Karate on 6 June 1995. Fewer terminal larvae were observed in the Vydate C-LV treated cotton than Orthene on 8 June 1995. This could be attributed to higher predator populations observed throughout the study period (Table 8). Vydate control provided less terminal damage to cotton than did Provado treatments (Table 6). On 12 June 1995 , cotton treated with Baythroid, Vydate C-LV, and Karate had accumulated less larval days than did cotton treated with Orthene (Table 7).

Acknowledgments

We thank Sammy Soignier, Field Consultant, Inverness, MS. for his assis-tance in the field study and also Robertson Planting Company for their cooperation.

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Table 1. Plant bug as a percent of the total population after first application.

Treatment	lbs ai/A	2 DAT	4 DAT	6 DAT
Baythroid	0.036	0.0 a	37.5 a	41.7 a
Orthene	0.33	18.8 a	7.1 ab	50.0 a
Vydate C-LV	0.25	11.7 a	14.3 ab	41.7 a
Provado	0.047	11.5 a	25.0 ab	12.5 a
Karate	0.033	0.0 a	0.0 b	12.5 a
LSD (0.10)	-	19.0	33.9	49.3

Table 2. Plant bug as a percent of the total population after second application.

Treatment	lbs ai/A	2 DAT	4 DAT	6 DAT
Baythroid	0.036	50.0 ab	33.3 a	22.5 a
Orthene	0.33	25.0 ab	37.5 a	33.3 a
Vydate C-LV	0.25	70.8 a	55.0 a	50.0 a
Provado	0.047	60.7 a	10.4 a	3.6 a
Karate	0.033	0.0 b	33.3 a	31.3 a
LSD (0.10)	-	51.9	50.0	46.6

Table 3. Tarnished plant bug control after second application.

Treatment	lbs ai/A	2 DAT	4 DAT	6 DAT
Baythroid	0.036	83.8 a	83.8 a	79.0 ab
Orthene	0.33	60.7 ab	64.8 ab	66.3 ab
Vydate C-LV	0.25	38.0 b	29.4 b	32.9 b
Provado	0.047	51.3 ab	85.6 a	94.3 a
Karate	0.033	75.0 ab	58.5 ab	58.5 ab
LSD (0.10)	-	45.8	38.9	46.8

Table 4. Lygus day cumulative infestations by insect-day calculations.

Treatment	lbs ai/A	29 May	31 May	2 June	4 June
Baythroid	0.036	1.5 a	4.3 a	17.0 ab	21.8 a
Orthene	0.33	5.8 a	8.8 a	17.0 ab	26.3 a
Vydate C-LV	0.25	9.0 a	12.3 a	22.0 a	28.0 a
Provado	0.047	4.0 a	6.0 a	18.9 ab	26.0 a
Karate	0.033	2.0 a	2.8 a	7.5 b	18.8 a
LSD (0.10)	-	9.1	11.2	13.2	16.6

Table 4. continued.

Treatment	lbs ai/A	6 June	8 June	10 June	12 June
Baythroid	0.036	22.8 a	23.8 a	26.3 a	27.0 a
Orthene	0.33	29.3 a	30.3 a	31.3 a	32.3 a
Vydate C-LV	0.25	32.0 a	36.0 a	39.3 a	42.3 a
Provado	0.047	28.5 a	29.0 a	29.8 a	31.5 a
Karate	0.033	22.0 a	22.0 a	23.5 a	24.0 a
LSD (0.10)	-	17.4	18.5	19.3	20.2

Table 5. Terminal Heliothine larvae.

Treatment	lbs ai/A	6 June	8 June	10 June	12 June
Baythroid	0.036	1.9 b	0.0 b	7.7 a	1.9 a
Orthene	0.33	13.5 a	5.8 a	3.9 a	9.6 a
Vydate C-LV	0.25	1.9 b	0.0 b	3.9 a	3.9 a
Provado	0.047	7.7 ab	1.9 ab	3.9 a	5.8 a
Karate	0.033	1.9 b	3.9 ab	3.9 a	5.8 a
LSD (0.10)	-	6.6	5.2	9.7	10.5

Table 6. Percent terminal damage.

Treatment	lbs ai/A	terminal damage
		-------%-------
Baythroid	0.036	28.9 ab
Orthene	0.33	30.8 ab
Vydate C-LV	0.25	26.9 b
Provado	0.047	38.5 a
Karate	0.033	36.5 ab
LSD (0.10)	-	11.4

Table 7. Heliothine larval day cumulative infestations by insect-day calculations.

Treatment	lbs ai/A	6 June	8 June	10 June	12 June
Baythroid	0.036	2.9 b	6.7 bc	16.3 ab	27.9 b
Orthene	0.33	24.0 a	39.4 a	48.1 a	61.5 a
Vydate C-LV	0.25	2.9 b	3.9 c	6.7 b	13.5 b
Provado	0.047	19.2 a	26.0 ab	32.7 ab	43.3 ab
Karate	0.033	2.9 b	6.7 bc	10.6 b	14.4 b
LSD (0.10)	-	12.7	21.0	32.0	30.0

Table 8. Beneficial arthropod population per 100 sweeps at final observation.

Treatment	lbs ai/A	Population
		no./100 sweeps
Baythroid	0.036	12.0 b
Orthene	0.33	10.0 b
Vydate C-LV	0.25	21.0 a
Provado	0.047	7.6 b
Karate	0.033	5.0 b
LSD (0.10)	-	8.2