Insecticide Efficacy on Beet Armyworm Infestations In Open and Closed Cotton Flowers And Effects of Flower Infestation on Boll Abscission

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ABSTRACT

In 1988, severe beet armyworm (BAW) infestations resulted in damaged cotton flowers and foliage. Some insecticide applications failed to eliminate larvae in the flowers because applications were applied before the flowers opened. Applications made after flowers were open were more effective. In 1989, tests were conducted to define further these results. Karate[tm] applied when cotton flowers were open achieved 90% control compared to 9% when flowers were closed in one test, and 97% compared to 13%, respectively, in a second test (P\0.01). A higher percentage (18%) of cotton bolls was shed on day 7 following flower infestations than were shed (6%) when flowers were not infested.

INTRODUCTION

Beet armyworm (BAW) Spodoptera exigua (Hübner) infestations were prevalent in many Arizona cotton fields in 1988. In research plots, young larvae were observed to feed primarily on foliage but older (larger) larvae often fed in flowers. Cotton yield studies were jeopardized by infestations of fruiting structures. Insecticide treatments were effective against BAW larvae on foliage, but less effective when larvae were in flowers. Insecticide treatments were usually made before sunrise while the cotton flowers were closed. Examination of flowers revealed that larger larvae, usually no more than one per flower, were frequently present when the flowers opened. Infestations ranged from one larva per five to one larva per 10 flowers. There was a marked improvement of insecticide control efficacy by changing treatment timing to morning hours after the flowers opened. The objectives of the 1989 studies were to verify these observations and to determine if BAW flower infestations resulted in shedding of new bolls.

MATERIALS AND METHODS

Third or fourth instar BAW larvae from the Western Cotton Research Laboratory colony (USDA-ARS) were used in all tests. A series of three tests were conducted at weekly intervals in a plot of Deltapine 90 cotton, Gossypium hirsutum grown at the University of Arizona, Maricopa Agricultural Center (MAC), Maricopa, AZ. The plot was divided into eight subplots of 0.015 acres each. In tests 1 and 2, treatments were open or closed flowers with three replicates and one control for a total of four subplots for each treatment. Treatments were randomly distributed in a 4-block design (2 subplots per block). In both tests, Karate[tm] was applied at 3.5 oz/acre with a hand sprayer. Each subplot received an independent treatment to assure uniform application. Control plots were not treated. Closed flowers were artificially infested with BAW larvae by slitting the side of the flower with a dissecting needle and carefully inserting a BAW larva with very light touch forceps. In the first test, larvae were inserted into closed flowers about two hours before sunrise. The plots with closed flowers infested with BAW larvae were then treated with insecticide. Larvae were removed as the flowers opened and placed individually in small disposable petri dishes and then transferred to individual diet cups. Next, following sunrise and after the flowers opened, larvae were placed in open flowers in other subplots, insecticide was applied, and the larvae were retrieved as described for the closed flowers. Missing larvae were recorded for both

closed and open flowers and the larvae were observed at 12 hours and 24 hours posttreatment as being dead, moribund, or alive. Because a large number of larvae were missing from open flowers in the 1st test, in the second test, all larvae were inserted into closed flowers about 2-3 hr before sunrise. Then insecticide was applied to closed-flower subplots. Similarly, following sunrise and after the flowers had opened, insecticide was applied to open-flower subplots. Then, larvae were gathered and observed as in the first test. Insecticide efficacy was also evaluated in the second test. Data were analyzed by Chi Square tests after Abbott's formula correction for control mortality and missing larvae in both tests.

In the third test, the effect of BAW larval infestations in flowers on boll shed was examined in four infested and four uninfested (control) subplots in a random block design. Larvae were confined in the flowers for at least 24 hours, by fastening the flowers at the top with a small metal binder clip used by cotton plant breeders for pollination control. The possible effect of the binders was assessed by dividing the controls into two groups, (1) flowers tagged only and (2) flowers both tagged and fastened. The infested flowers were checked for presence of larvae 24 hours later. Bolls present, damaged, or missing from test flowers were recorded one week from infestation.

RESULTS AND DISCUSSION

Karate[tm] applied to cotton when cotton flowers were open resulted in 90% control, compared to 9% when applications were applied when flowers were closed in Test 1, and 97% to 13%, respectively in Test 2 (P\0.01) (Table 1). The experimental design in Test 2 was better, as it allowed BAW larvae a longer time to adjust to the flower environment before treatment. Consequently, there were fewer missing larvae in open flowers and insecticide efficacy determinations were more accurate. In Test 2, insecticide efficacy in open flowers averaged 95% compared to 1% for closed flowers (P\0.01). There was no significant difference between 12 versus 24 h mortality in either test. In the third test, to study effects of BAW flowers infestation on shedding or damage of new bolls, there was an 18% reduction in infested bolls but only a 6% reduction in uninfested bolls. The 12% difference was highly significant (P\0.01) (Table 2.) There was no effect from the binder clips.

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Table 1. Effects of insecticide application on beet army worm larvae in open versus closed cotton flowers.

	Closed Flowers			Open Flowers		
		Missing or dead larvae			Missing or dead larvae	
Replicate	No.	%	(No.)	No.	%	(No.)
			Test 1			
1	42	24	(10)	53	87	(47)
2	32	28	(9)	26	100	(26)
3	43	12	(5)	22	95	(21)
	117	20.5	(24)	101	93.1	(94)
Control	30	13	(4)	37	32	(12)
Percent adjusted by Abbott's correction		9%			90%	
			Test 2			
1	67	30	(20)	87	95	(83)
2	45	30	(14)	58	100	(58)
3	26	50	(13)	60	100	(60)
	138	34.1	(47)	205	98.1	(201)
Control	69	17	(12)	39	28	(11)
Percent adjusted by Abbott's correction		13%			97%	

Table 2. Effects on boll shedding by infestation of cotton flowers by beet army worm larvae.

Treatment -	Rep	Flowers	Flowers infested	Bolls shed or damaged	
			Total No.	%	No.
Control	1	Tagged and clipped	37	8.1	3
"	2	Tagged and clipped	105	3.8	4
"	3	Tagged only	76	1.3	1
"	4	Tagged only	74	9.5	7
Total			292	6.0%	15
Infested	1	Tagged and clipped	113	23.0	26
"	2	"	54	18.5	10
"	3	"	27	11.1	3
"	4	"	123	17.9	22
Total			371	18.0%	61