

BOLLWORM AND TOBACCO BUDWORM¹: EFFICACY OF INSECTICIDES
AND MIXTURES IN THE COMARCA LAGUNERA, MEXICOJorge Alvarez-M² and Javier Morgado-G³

ABSTRACT

Control of the tobacco budworm *Heliothis virescens* (F.) and the bollworm *Helicoverpa zea* (Boddie) with low (6.6%) and high (13.2%) cis isomers of cypermethrin mixed with profenophos was compared with that obtained from low cis-cypermethrin or profenophos applied individually, deltamethrin, and lambda-cyhalothrin at two locations in the Comarca Lagunera area of Mexico, 1987 - 1989. Although the mixtures gave good control of first and second instar larvae, they seldom were significantly more effective than cypermethrin or profenophos alone. The insecticidal mixtures were however, significantly more effective than deltamethrin and lambda-cyhalothrin.

INTRODUCTION

The major cotton growing area in Mexico, the Comarca Lagunera, is located in the states of Coahuila and Durango (Anonymous 1984). Cotton plantings in this area have decreased from 64,242 ha in 1983 to 40,000 ha in 1988, primarily because high populations of the bollworm, *Heliothis zea* (Boddie), and the tobacco budworm, *Heliothis virescens* (F.), have necessitated the increased use of chemical control.

In an effort to solve this problem, the pesticide industry, agricultural research agencies, and growers have sought safer and more effective methods for controlling these cotton pests. The possibility that mixtures of insecticides might enhance their efficacy enough to maintain infestations below the economic threshold has not been overlooked. Therefore, from 1987 to 1989, the efficacies of cypermethrin, profenophos, deltamethrin, lambda-cyhalothrin, and a mixture of profenophos and cypermethrin were evaluated against field populations of first- and second-stage larvae of the tobacco budworm and the bollworm.

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MATERIALS AND METHODS

Field Tests 1987-1989. At Tlahualilo, Dgo. and Matamoros, Coah., high cis-cypermethrin (13.2% cis isomer) and low cis-cypermethrin (6.6% cis isomer) + profenophos (40 + 400 g/l), cypermethrin (200 g/l), profenophos (500 g/l), lambda-cyhalothrin (35 g/l), and deltamethrin (25 g/l) were obtained as emulsifiable concentrates.

A Robin^R motorized knapsack mist sprayer was used to apply sprays at rates of 300-330 liters/ha. Test plots of cotton varied in size from 40 m² (5 8-m rows), 48 m² (6 8-m rows), 108 m² (9 12-m rows), 120 m² (10 20-m rows), to 200 m² (10 20-m rows), arranged in a randomized complete block design and replicated three to four times. Untreated check plots were included in each test.

In 1987, insecticides were applied weekly for 8 wk at Tlahualilo and 5 wk at Matamoros. The first application was made when one or more larval damaged squares was detected from a 25 square per plot sample. Three days after each spray application, 25 squares were again sampled in each plot.

At the same locations in 1988, insecticides were applied once when one or more squares from a 25 square sample were infested with first or second instar larvae. Additional larval counts were then made on the 3rd, 5th, and 14th posttreatment days at Tlahualilo and on the 3rd, 5th, and 12th days at Matamoros. Similar tests were conducted at the same location in 1989.

In all three years, the results of each sampling at each location were subjected to analysis of variance, and means were separated by Duncan's multiple range test, $P \leq 0.05$. (Duncan 1955).

RESULTS AND DISCUSSION

At Tlahualilo in 1987, mean reductions of bollworm and tobacco budworms achieved with cypermethrin plus profenophos over a 7 wk period (60 - 600 g (a.i.)/ha and 80 - 800 g (a.i.)/ha) were 88% and 94%, respectively. Reductions in the larval population resulting from treatments of cypermethrin and profenophos applied individually averaged 88% and 76% respectively (Table 1).

At Matamoros in 1987, cypermethrin plus profenophos applied at the lower rate resulted in an average reduction in the larval population of 79% over a 5 wk period. These materials applied at the higher rate produced a 95% reduction in the larval population during the same period. Cypermethrin and profenophos applied individually gave mean reductions of 82% and 79% respectively (Table 1).

Cypermethrin and its mixtures with profenophos significantly reduced populations of first and second instar larvae of the test insects compared to the untreated control in 6 of 7 wk at Tlahualilo and 5 of 5 wk at Matamoros. Profenophos gave significant reductions in 5 of 7 and 5 of 5 wk at the respective locations. However, significant differences in the activity of the two pesticides and their combinations at different rates occurred in the 3rd, 5th and 6th wk at Tlahualilo and once in the fifth week at Matamoros (Table 1).

TABLE 1. Efficacy of Low (6.6%) *Cis*-Cypermethrin and Profenophos, Alone and Combined Applied at Weekly Intervals Against First and Second Instar Larvae of the Tobacco Budworm and the Bollworm on Cotton, Mexico, 1987.^a

Treatment	Rate g(a.i.)/ha	Mean No. of Larvae/100 squares and Reduction (%) 3 da Posttreatment							
		1	2	3	WEEK 4	N O. 5	6	7	8
<u>Ilahualilo, Dgo.</u>									
cypermethrin + profenophos	60 600	0.6 AB 87%	0.6 A 85%	0.6 B 96%		3.0 AB 81%	2.0 A 88%	1.3 A 92%	3.0 A 86%
cypermethrin + profenophos	80 800	0.0 A 100%	0.3 A 92%	0.0 A 100%		1.0 AB 94%	0.6 A 96%	2.0 A 88%	2.0 A 90%
cypermethrin	100	0.3 A 95%	0.6 A 85%	1.0 B 93%		0.6 A 96%	1.6 A 91%	5.6 A 67%	3.0 A 86%
profenophos	750	0.6 AB 95%	1.0 A 85%	1.3 B 92%		4.0 B 75%	6.6 B 61%	5.0 A 71%	6.0 AB 71%
Untreated	---	4.5 B	4.0 B	15.3 C		16.0 C	17.0 C	17.0 B	21.0 B
<u>Matamoros, Coah.</u>									
cypermethrin + profenophos	60 600	5.0 A 59%	4.3 A 80%	2.3 A 87%		4.6 A 78%	1.6 A 92%		
cypermethrin + profenophos	80 800	1.6 A 87%	1.0 A 95%	0.3 A 98%		0.6 A 97%	0.3 A 98%		
cypermethrin	100	1.6 A 87%	5.0 A 77%	1.0 A 95%		4.6 A 78%	5.0 B 74%		
profenophos	750	3.3 A 73%	4.3 A 80%	4.0 A 78%		5.0 A 76%	2.3 A 88%		
Untreated	---	12.3 B	22.0 B	18.3 B		21.0 B	19.6 C		

^aNumbers in columns within sites followed by the same letters are not significantly different (Duncan's multiple range test, $P < 0.05$).

At both locations in 1988, the low and high *cis*-cypermethrin plus profenophos mixtures resulted in significant reductions in numbers of larvae compared to the untreated plots. The mixtures were significantly more effective than profenophos and deltamethrin on 4 of 6 sample days and 6 of 6 sample days, respectively, at the two locations. Profenophos treatment resulted in significant larval reductions on all sample dates, and deltamethrin on 4 of 6 sample dates (Table 2).

TABLE 2. Efficacy of Low (6.6%) Cis- and High (13.2%) Cis-Cypermethrin Plus Profenophos, Profenophos, and Deltamethrin Against First and Second Instar Larvae of the Tobacco Budworm and the Bollworm on Cotton, Mexico, 1988.^a

Treatment	Rate g(a.i.)/ha	Mean No. of Larvae/100 Squares and Reduction (%) on day Posttreatment					
		Tlahualilo, Dgo.			Matamoros, Coah.		
		3	5	14	3	5	12
Low <u>Cis</u> cypermethrin + profenophos	60 600	0.9 A 93%	6.2 A 73%	13.4 AB 63%	0.8 A 94%	0.3 A 58%	6.5 A 75%
High <u>Cis</u> cypermethrin + profenophos	37.5 600	0.4 A 97%	4.2 A 82%	11.0 A 69%	0.8 A 94%	0.8 A 95%	6.3 A 76%
profenophos	1000	1.1 A 92%	11.1 B 52%	15.0 B 58%	3.0 B 79%	5.6 B 66%	12.8 B 50%
deltamethrin	12.5	4.8 B 63%	19.2 B 18%	28.5 C 21%	13.8 C 5%	18.8 C 0	22.5 C 13%
Untreated	---	13.1 C	23.3 C	36.0 D	14.5 C	16.5 C	25.8 D

^aNumbers in columns within sites followed by the same letters are not significantly different (Duncan's multiple range test, $P \leq 0.05$).

Mean reduction in larval numbers for the 6 sampling dates was 83% for low cis-cypermethrin plus profenophos, 85% for high cis-cypermethrin plus profenophos, 66% for profenophos, and 20% for deltamethrin (Table 2). In topical tests with deltamethrin against the tobacco budworm in the Lower Rio Grande Valley of TX and Uvalde, TX, Wolfenbarger and Harding (1982) and Sparks et al. (1988) obtained LD₅₀ values 13-15 and 2-3 times, respectively, lower than those of Nava-C. et al. (1990) who obtained LD₅₀ values of 1.34 and 1.91 ug/g of larval weight.

At Matamoros and/or Tlahualilo in 1989, low and high cis-cypermethrin plus profenophos and cypermethrin alone were significantly more effective than lambda-cyhalothrin, with mean larval reductions of 94%, 93%, 86%, and 72%, respectively. All four treatments produced significant reductions in larval numbers compared to the untreated control (Table 3).

TABLE 3. Efficacy of Low (6.6%) *Cis*- and High (13.2%) *Cis*-Cypermethrin plus Profenophos, Low *Cis*-Cypermethrin Alone, and *Lambda*-cyhalothrin Against First and Second Instar Larvae of the Tobacco Budworm and the Bollworm on Cotton. Mexico, 1989.^a

Treatment	Rate g(a.i.)/ha	No. of Larvae/200 Squares and Reduction (%) on day Posttreatment				
		Tlahualilo, Dgo			Matamoros, Coah.	
		3	6	8	2	5
Low <i>Cis</i> cypermethrin + profenophos	60 600	1.8 A 91%	1.5 A 93%	2.3 A 91%	0.0 A 100%	0.5 A 97%
High <i>Cis</i> cypermethrin + profenophos	37.5 600	1.3 A 93%	1.5 A 93%	1.5 A 94%		
Low <i>Cis</i> cypermethrin	100	3.3 A 83%	2.5 A 89%	5.3 A 79%	1.3 A 89%	1.8 A 89%
<i>Lambda</i> cyhalothrin	30	5.8 B 70%	4.8 B 79%	8.0 B 68%		
Untreated	---	19.5 C	22.5 C	25.0 C	12.3 B	15.8 B

^aNumbers in columns within sites followed by the same letters are not significantly different (Duncan's multiple range test, $P \leq 0.05$).

Although we were unable to demonstrate a distinct enhancement in activity by combining organophosphorus and pyrethroid pesticides, we determined that there was not resistance, particularly to cypermethrin, in first and second instar larvae of the tobacco budworm and the bollworm. This finding may encourage growers to increase their cotton plantings in the Comarca Lagunera of Mexico in the future.

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