

## OVICIDAL PROPERTIES OF LEVERAGE® FOR BOLLWORM IN COTTON

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### Abstract

Two greenhouse and two field experiments were conducted near the University of Georgia, Athens, to evaluate the heliothine ovicidal activity of three products produced by Bayer Corporation; Provado® 1.6 SC (1.6 lb ai imidacloprid/gallon), Baythroid® 2.0 EC (2.0 lb ai cyfluthrin/gallon) and Leverage® 2.7 SC (1.6 lb ai imidacloprid and 1.1 lb ai cyfluthrin/gallon). All three products were ovicidal for 24 to 48 hours and retained activity following 1.36 inches of rain during one of the field tests. Results indicated that toxicity of the products to heliothine eggs may decrease after 48 hours in field environments.

### Introduction

Compounds that possess ovicidal properties have advantages for cotton pest management programs because they may act preemptively, or they may be toxic at lower dosages as ovicides than as larvicides, and sometimes they may have less impact on natural enemies of pests as compared to other types of insecticides. Carbamates thiodicarb and methomyl, the formamidin amitraz, and certain pyrethroids such as lambda-cyhalothrin have been known to possess ovicidal activity versus heliothine species (Leonard et al. 1990; Allen et al. 1997). Peterson et al. (1998) found that spinosad provided both ovicidal and ova-larvicidal activity to both *Helicoverpa zea* (Boddie) and *Heliothis virescens* (F.); whereas Elzen (1997) reported that imidacloprid, cyfluthrin, and a mixture of the two insecticides was ovicidal on eggs of *H. virescens*. Leverage® is a product developed by Bayer Corporation containing imidacloprid and cyfluthrin. Greenhouse and field experiments were conducted to evaluate the ovicidal properties of Leverage® for bollworm in cotton.

### Methods

Two greenhouse and two field experiments were conducted near the University of Georgia, Athens, to evaluate the ovicidal activity of three products produced by Bayer Corporation; Provado® 1.6 SC (1.6 lb ai imidacloprid/gallon), Baythroid® 2.0 EC (2.0 lb ai cyfluthrin/gallon) and Leverage® 2.7 SC (1.6 lb ai imidacloprid and 1.1 lb ai cyfluthrin/gallon).

### Greenhouse Tests

Two experiments were conducted on flowering cotton in the greenhouse. Cotton (DP 5415) was planted in one gallon containers containing Craven's commercial potting medium. Plants were irrigated overhead as needed until the tests were initiated, at which time they were placed in stainless steel trays containing one inch of water. Provado®, Baythroid®, and Leverage® were applied to the top of plants 70 days after planting with an air sprayer using an aqueous mixture equivalent to 10 gallons/acre. The rates that were sprayed on the plants were equivalent to 0.0375 lbs ai/acre for Provado®, 0.025 lbs ai/acre for Baythroid®, and 0.0634 lbs ai/acre for Leverage®.

Leaves were collected off the upper third of the treated plants one hour and 48 hours after spraying and placed into one ounce plastic cups containing two pieces of moistened filter paper. Once the leaves were collected, two corn earworm, *H. zea*, eggs (source: laboratory colony, USDA-ARS, Tifton, GA) were placed on each leaf. Each treatment was replicated 10 times. The cups were placed in a walk-in incubator at 80° F for 72 hours and then the eggs were examined for hatching under a dissecting microscope.

Aspects such as the presence of live or dead larvae and partial or complete eclosion prior to death were also noted.

### Field Tests

Two tests were conducted in a field planted in DP 90 cotton. Six-row plots were established in a randomized complete block design with four replications. The plots measured 50 ft long x 38 in row width with 10 ft alleys separating blocks. The first test was initiated on August 29 when plants were well into flowering. The treatments were sprayed using a high cycle sprayer modified with a CO<sub>2</sub> spray system calibrated to apply at a volume of 10 gallons/acre. The spray boom had three TX3 hollow cone nozzles per row with one nozzle over the top of the row and two six-inch drop nozzles angled 45° into each side of the row. The middle four rows of each plot were sprayed with either Provado® (0.0375 lbs ai/acre, Baythroid® (0.025 lbs ai/acre), or Leverage® (0.0634 lbs ai/acre). The second test was sprayed on September 12 using the same treatments and plots as in the first test.

Assessments of ovicidal toxicity of the treatments to heliothine eggs were made 24, 48 and 72 hours after application in both tests and at six days in the second test. All leaves on the upper half of all of the plants in each plot were searched for eggs. Leaves bearing eggs were put in Ziploc® plastic bags and placed in an insulated container until returning to the laboratory. The eggs were examined for hatching, etc. three days later in the manner as described for the greenhouse experiments. Analysis of variance and Tukey's multiple comparison procedure was conducted on the data using a computer-based statistics program at a P < 0.05 level of significance (SAS Institute 2000).

### Results and Discussion

#### Greenhouse Tests

The results in both greenhouse tests showed that all three insecticides had a significantly high number of unhatched eggs of *H. zea* that had been placed on sprayed leaves one hour after treatment (Table 1). In the first test all of the larvae that emerged from eggs in the Baythroid® treatment died quickly on treated leaves, as indicated by the fact that cadavers were usually adjacent to the eggs or within a few millimeters. The two live larvae observed on two of the Provado® treated leaves and the single larvae that was observed on a Leverage® sprayed leaf appeared similar in size and vigor as the larvae seen on leaves of the untreated check plants. At 48 hours a significant number (50% or more) of the eggs did not hatch on the leaves sprayed with all three insecticides, indicating that the chemicals had residual toxicity to *H. zea* eggs. Elzen (1997) reported that laboratory assays demonstrated that imidacloprid, cyfluthrin, and imidacloprid + cyfluthrin were ovicidal to field and lab strains of *H. virescens*.

#### Field Tests

The data in the first field test reflected the greenhouse results (Table 2). On the second day after applying the insecticides, 1.36 inches of rain was deposited in the field throughout the day, preventing collecting of eggs. The ovicidal activity of the three treatments was reduced in the 72 hour collection, but over 40% of the eggs did not hatch in treatments sprayed with Leverage® and Provado®, as compared to 9.1% of the eggs collected in unsprayed plots. In the second test, the data showed that Leverage® and Baythroid® sprayed leaves had significantly higher numbers of unhatched eggs at 24 hours, but only Baythroid® treatments were significantly different from the checks in the 48 hour sample. Data from the samples collected 72 hours and six days after spraying did not show any positive results for the insecticides for ovicidal effects on heliothine populations.

These results from one year of tests are preliminary, but do show that products containing imidacloprid, cyfluthrin and the two combined have ovicidal activity to heliothine spp. in cotton. Further tests with different rates and application scenarios in different cotton environments should be

conducted to bring into clearer focus the potential usefulness of these products in cotton insect management programs.

### References

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Table 1. Greenhouse test results of bollworm ovicidal activity of selected insecticides sprayed on flowering cotton plants.

Chemical	% unhatched eggs	
	1 h	48 h
<b>Test 1</b>		
Leverage	80.0 a	50.0 a
Provado	90.0 a	60.0 a
Baythroid	70.0 a	60.0 a
Check	0.0 b	0.0 b
<b>Test 2</b>		
Leverage	50.0 a	45.0 a
Provado	55.0 a	20.0 ab
Baythroid	25.0 ab	10.0 b
Check	0.0 b	0.0 b

Means followed by the same letter are not significantly different in Tukey's multiple comparison procedure.

Table 2. Ovicidal activity of three insecticide products for heliothine infestations in cotton near Athens, GA.

Chemical	% unhatched eggs		
	24 h	48 h*	72 h
<b>Test 1</b>			
Leverage	76.4 a	--	50.8 a
Provado	67.6 a	--	45.0 a
Baythroid	57.6 a	--	38.5 a
Check	23.3 b	--	9.1 b
<b>Test 2</b>			
Leverage	72.5 a	27.5 ab	11.2 b
Provado	35.8 bc	35.0 ab	41.7 ab
Baythroid	53.5 ab	91.6 a	25.0 a
Check	15.9 c	21.7 b	17.5 ab

Means followed by the same letter are not significantly different in Tukey's multiple comparison procedure.

\*1.36 inches of rain occurred throughout the day, preventing collection of eggs.