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HELIOTHINES IN VIRGINIA COTTON: MANAGEMENT AND UPDATE

Linda Byrd-Masters and D. Ames Herbert, Jr.
Department of Entomology
Tidewater Agric. Res. & Ext. Ctr.
Virginia Tech
Suffolk, VA

Abstract

The Heliothine complex, *Helicoverpa zea* (Boddie) and *Helicoverpa virescens* (F.), is considered the second most important insect pest group in Virginia, thrips being the primary pest. It is estimated that Heliothines caused a total yield loss of 2,937 bales, or about 590 bales per year, in the years from 1997-2001. Each year, several field experiments are conducted at Virginia Tech research farms to evaluate efficiacy and efficiency of different products/rates and application strategies. Bollworm resistance has been monitored using adult vial testing procedures during the 2000 and 2001 seasons. Heliothine eggs collected from commercial cotton fields were tested with the Helid egg testing system to determine the species ratio of the bollworm:budworm complex. Results showed that all products did not result in the same lint yields, and that using the high rate at the second application generally resulted in more lint than applying two sequential lower-rate sprays. In vial testing studies, in 2000, over all sample dates and locations, 12 and 6% of bollworm adults survived the 5 and 10µg cypermethrin rates, respectively. In 2001, over all sample dates and locations, only 3.3 and 0% survived the 5 and 10µg cypermethrin rates, respectively. Only 2.2% survived the 15µg spinosad rate. The ratio of bollworm:budworm eggs varied over the five-sample date period with bollworm comprising 67-95% of the egg population, depending on sample date. Over all sample dates, the bollworm:budworm egg ratio was 78:22%.

Introduction

Approximately 103,000 to 110,000 acres of cotton are grown annually in Virginia. Average lint yields range from 700-900 lb lint per acre. An estimated 80 percent of the acreage is planted to cultivars with the Roundup Ready gene, and an estimated 50-60 percent to cultivars with the Bollgard gene. The Heliothine complex, *Helicoverpa zea* (Boddie) and *Helicoverpa virescens* (F.), is considered the second most important insect pest group in Virginia, thrips being the primary pest. It is estimated that Heliothines caused a total yield loss of 2,937 bales, or about 590 bales per year, in the years from 1997-2001 (Williams 1997-2001) (Table 1). Each year, several field experiments are conducted at Virginia Tech research farms to evaluate efficiacy and efficiency of different products/rates and application strategies. Pest intensity varies with years, which is reflected in the level of losses in untreated control plots of these experiments. Over all experiments and treatments in the 8-year period from 1994-2001, the average yield increase with treatments compared with the untreated controls equaled 165 lb lint per acre (Figure 1). Efficacy experiments are an ongoing effort with the ultimate objective of developing management recommendations for growers. Currently, almost all producers apply one or more pyrethroid insecticides for bollworm/budworm management. This raises concerns about resistance development. Resistance has been monitored using adult vial testing procedures during the 2000 and 2001 seasons. Also, Heliothine eggs from commercial cotton fields were tested with the Helid egg testing system to determine the species ratio of the bollworm:budworm complex. Results of selected efficacy experiments, adult vial test, and Helid egg test data are presented.

Materials and Methods

Efficacy and Yield Impact Experiments

Field experiments evaluated different products/rates and application strategies. Experiments were conducted at the Virginia Tech Tidewater Agricultural Research and Extension Center research farm located in southeastern-most Virginia. All fields are in a 3-year corn/peanut/cotton rotation. Tillage was rip-strip into a herbicide-killed winter wheat cover crop stubble. Plots were planted the first week in May, and harvested in mid-October. Cotton cultivars were DP 51 (1994-1999), SG 125RR (2000), and PM 1199 R (2001). A RCB experimental design was used with four replicates. Plots were four, 36-inch rows x 40 ft long. The center two rows of each plot were treated and evaluated. The different products and rates were applied two times, the first at bollworm egg threshold and the second, five days later. Percent boll damage was estimated by sampling 25 bolls in each plot, for 4-6 weeks after the second application. At crop maturity, the center two rows of each plot (80 row-ft/plot) were harvested with a 2-row John Deere combine. Sub-samples were ginned to determine percent lint. Means were compared using standard ANOVA procedures, P=0.05.

Adult Vial Tests to Monitor Bollworm Resistance

Adult vial testing procedures were done in cooperation with Dr. Greg Payne, State University of West Georgia. Adult bollworm moths were collected from pheromone-baited white plastic mesh Scentry Heliothis Traps from two locations (around cotton fields in the vicinity of the Tidewater Agric. Res. and Ext. Ctr., and around cotton fields in Southampton County, VA). Collections were made from June through September. Moths were placed into paper pint cartons with a sugar-water food source for 24-hour prior to being placed individually into insecticide pre-treated glass vials. Vials were pre-treated with either 5 or 10µg of cypermethrin, 15µg of spinosad, or untreated. After 24 hours in the vials, moths were inspected to determine percent dead, down (not dead but unable to fly) or alive.

Helid Egg Test to Determine Species Mix

Heliothine eggs were tested with the Helid egg testing system by Zackie Harrell, consultant, in cooperation with FMC Corporation. Eggs were collected at random from commercial cotton fields in southeast Virginia on Aug 9, 15, 16, 21 and 23. Eggs were collected by picking the plant material that they were attached to (e.g., leaf, petiole) and delivering that material to the analysis site within 12 hours. Mr. Harrell subjected each egg to the Helid procedure and documented percentage of each species.

Results

Efficacy and Yield Impact Experiments

The lb lint yield increase over untreated controls was averaged over years for selected insecticides and rates (Figure 2 – A and B). Results indicated several general findings. First, all products did not result in the same lint yields. In general, Scout X-tra, Asana XL, and Ammo 2.5EC at the rates tested did not result in as much lint as did other treatments. With most other products tested, using the high rate at the second application resulted in more lint than applying two sequential lower-rate sprays (Tracer 4SC at 2.8 vs. 2.0 oz/acre; Decis 1.5EC at 2.56 vs. 1.6; Fury 1.5EC at 3.2 vs. 2.8, Karate Z at 2.56 vs. 1.6, and Baythroid 2EC at 3.2 vs. 1.8).

Adult Vial Tests to Monitor Bollworm Resistance

In 2000, at total of 843 bollworm moths were tested (313 from the Tidewater Agric. Res. and Ext. Ctr. location, and 530 from the Southampton County location). A total of 560 were challenged with either 5 or 10µg or cypermethrin, and 283 were subjected to the untreated control. Over all sample dates and locations, 12 and 6% survived the 5 and 10µg cypermethrin rates, respectively (Table 2). In 2001, a total of 928 moths were tested (629 from the Tidewater Agric. Res. and Ext. Ctr. location, and 299 from the Southampton County location). Of those, 428 were subjected to cypermethrin, 244 to spinosad, and 256 to the untreated control. Over all sample dates and locations, only 3.3 and 0% survived the 5 and 10µg cypermethrin rates, respectively. Only 2.2% survived the 15µg spinosad rate.

Helid Egg Test to Determine Species Mix

The bollworm:budworm ratio varied over the five-sample date period with bollworm comprising 67-95% of the egg population, depending on sample date (Table 3). Over all sample dates, the bollworm:budworm egg ratio was 78:22%.

References

Williams, M. R. 1997-2001. Beltwide Cotton Insect Losses Report. Mississippi State University, Mississippi State, MS.

Table 1. Estimated cotton losses for Virginia, 1997-2001. From, "Cotton Insect Losses Report," M. R. Williams, Mississippi State University.

	Estimated bales lost			
	Thrips	**Bollworm/budworm**	**Lygus**	**Other**
1997	972	914	0	96
1998	9	12	0	2
1999	529	481	0	0
2000	2,060	1,530	77	0
2001	1,586	0	481	0
Total	5,156	2,937	558	98

Table 2. Cumulative percent (and range) survival of adult bollworms subjected to insecticide pre-treated vials. D. A. Herbert, Jr., Virginia Tech.

	Cypermethrin		Spinosad
Year	**5 µg**	**10 µg**	**15 µg**
2000	12%	6%	--
	(0 – 25%)	(0 – 25%)	--
2001	3.3%	0%	2.2%
	(0 – 33%)	(0%)	(0 – 17%)

Table 3. Percent of bollworm vs. budworm eggs collected from Virginia cotton as determined by the Helid Egg test. D. A. Herbert, Jr., Virginia Tech.

	August 2001					
	9th	**15th**	**16th**	**21st**	**23rd**	**Mean**
% TBW	27	13	5	33	30	21.6
% CEW	73	87	95	67	70	78.4

*Helid tests conducted by Z. Harrell, FMC Corp.

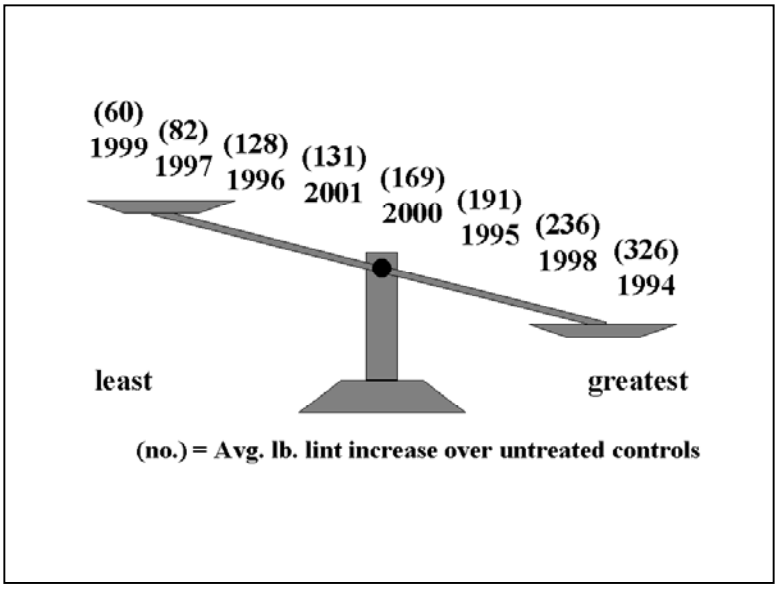

Figure 1. Bollworm infestation intensity as indicated by yield impact in field experiments from 1994 – 2001. D. A. Herbert, Jr., Virginia Tech.

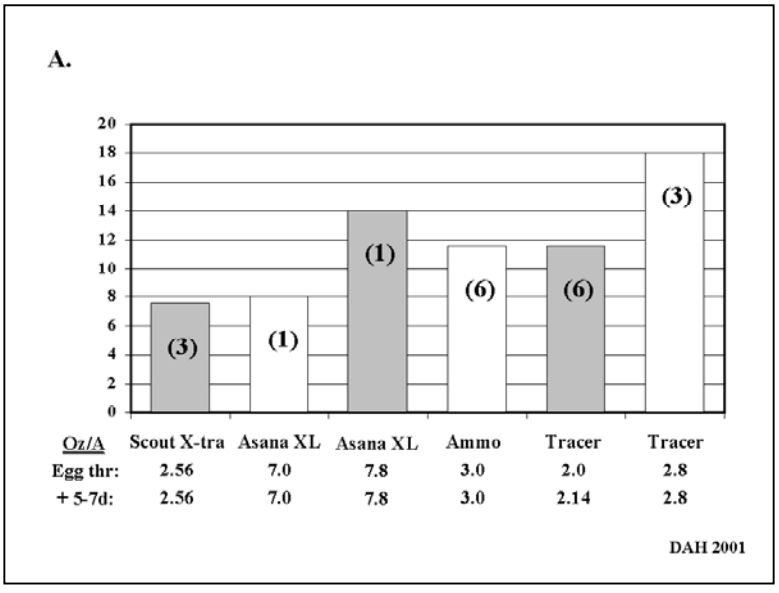

Figure 2A. Average percent lint yield increase over untreated controls for field experiments conducted from 1994 – 2001. Number in (-) represents the number of times that product/rate was tested during that period. Tidewater Agricultural Research and Extension Center, Suffolk, VA.

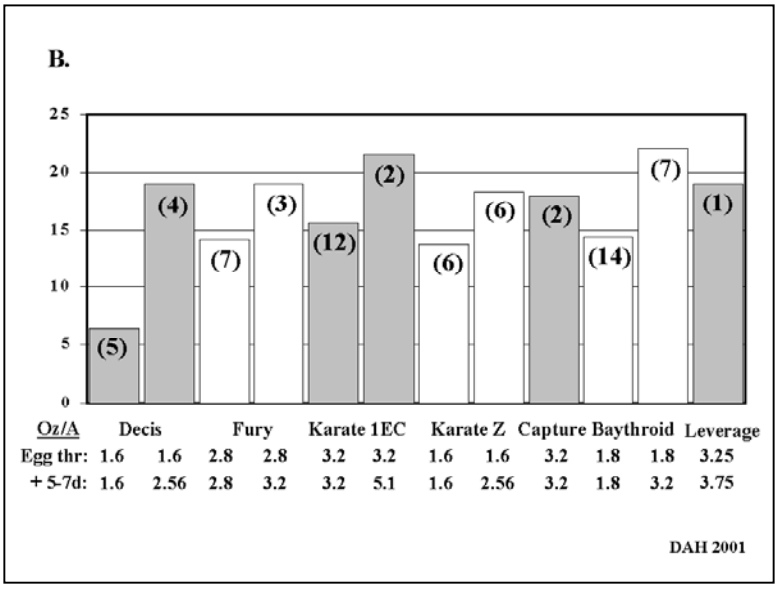

Figure 2B. Average percent lint yield increase over untreated controls for field experiments conducted from 1994 – 2001. Number in (-) represents the number of times that product/rate was tested during that period. Tidewater Agricultural Research and Extension Center, Suffolk, VA.