COMPARISON OF NEW INSECTICIDES FOR CONTROL OF HELIOTHINE SPECIES IN COTTON

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RESEARCH PROBLEM

The tobacco budworm, *Heliothis virescens,* and the cotton bollworm, *Helicoverpa zea,* make up the Heliothine complex, a major pest of cotton grown in Arkansas. Insecticides are needed every year to maintain control of this pest complex. Resistance to the pyrethroid, organophosphate, and carbamate classes of insecticides, which have been used extensively to control the Heliothine complex, has become a problem. Research is needed to evaluate newly developed crop protection chemicals to determine their place in current pest management strategies.

BACKGROUND INFORMATION

In 1998, the Heliothine complex resulted in the most acres treated, the greatest number of insecticide applications, the greatest cost of control per acre, and the greatest reduction in yield of any Arkansas cotton pest (Williams, 1999). Continued reliance on pyrethroid insecticides as the major control measure for the Heliothine complex has resulted in increased levels of resistance for both species (Bagwell, 1999; Brown *et al.,* 1998; Sparks *et al.*, 1993). Continued discovery of new pest control technology is essential to maintain a viable cotton production industry in Arkansas. The new insecticides, Steward (Mitchell, 1999), Tracer (Salgado, 1997), Intrepid (Dhadialla and Jansson, 2000), Denim and Pirate (Micinski *et al.*, 1998) have all shown some activity against the Heliothine complex. In these trials, the novel chemistry mentioned above was evaluated to determine their potential as control tactics for the Heliothine complex in cotton.

RESEARCH DESCRIPTION

Two field trials were conducted in Jefferson Co., Arkansas in 1999 to evaluate Steward, Tracer, Intrepid, Denim, and Pirate, against various standard pyrethroid and organophosphate insecticides for the control of the bollworm and tobacco budworm. Insecticide treatments were evaluated in small plots arranged in a randomized complete-block design with four replications. The cotton variety utilized was Stoneville BXN47. The seasonal population mix in the test location, as determined by trap counts, was 89% bollworm and 11% tobacco budworm. Treatments were initiated when egg or

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small worm densities were at or approaching recommended treatment levels. Applications were made with a John Deere 6000 hi-cycle at 45 psi for every 8.56 gal/acre using Teejet TXVS-6 nozzles on 20-inch centers.

Treatments (lb ai/acre) evaluated in **Test 1** were an untreated control, Steward 1.25SC + Dyne Amic (0.09 + 0.5%v/v), Steward 1.25SC + Dyne Amic (0.11 + 0.5%v/v), Tracer 4EC (0.08), Intrepid 80WP + Karate 2.08Z + Dyne Amic (0.10 + 0.025 + 0.5%v/v), Intrepid 80WP + Karate 2.08Z + Dyne Amic (0.15 + 0.025 + 0.5%v/v), Karate 2.08Z + Dyne Amic (0.025 + 0.5%v/v), Denim 0.16EC (0.01), Denim 0.16EC + Karate 2.08Z (0.01 + 0.025), Steward 1.25SC + Karate 2.08Z + Dyne Amic (0.06 + 0.025 + 0.5%v/v), and Steward 1.25SC (0.06). Application dates in 1999 were 8 July, 15 July, 3 August, and 9 August. Evaluation dates in 1999 were 12 July 4DAT#1, 19 July 4DAT#2, 6 August 3DAT#3, 12 August 3DAT#4, and 1 October at harvest.

Treatments (lb ai/acre) evaluated in **Test 2** were an untreated control, Decis 1EC (0.025), Baythroid 2EC (0.03), Leverage 2.7SE (3.75 floz/acre), Leverage 2.7SE (3 floz/acre), Tracer 4EC (0.067), Steward 1.25SC (0.11), Pirate 3SC (0.35), Baythroid 2EC + Tracer 4EC (0.03 + 0.04), Curacron 8EC (0.75), and Baythroid 2EC + Curacron 8EC (0.03 + 0.5). Appliction dates in 1999 were 9 July, 2 August, and 9 August. Evaluation dates in 1999 were 13 July (4DAT#1), 5 August (3DAT#2), 13 August (4DAT#3), and 12 October (at harvest).

Data were collected by examining 50 terminals and 50 squares at random from the center of each plot. Yields were determined by harvesting the middle rows of each plot with a commercial two-row John Deere cotton picker. Data were processed using Agriculture Research Manager Ver. 6.0.1. Analysis of variance was run and the least significant difference was used to separate means.

RESULTS AND DISCUSSION

In **Test 1**, none of the treatments reduced the seasonal average for boll weevil damage or live heliothine larvae per 50 terminals. All treatments significantly reduced the seasonal average for Heliothine square damage and live Heliothine larvae per 50 squares but did not differ significantly among themselves. All treatments except Denim 0.16EC (0.01 lb ai/acre) significantly increased yield over the untreated control. Steward 1.25SC + Karate 2.08Z + Dyne Amic (0.06 + 0.025 + 0.5%v/v) was the only treatment to significantly out-yield the above Denim treatment; however, all other insecticide treatments numerically out-yielded Denim alone (Table 1).

In **Test 2**, Baythroid 2EC + Curacron 8EC (0.03 + 0.5) was the only treatment that significantly reduced the seasonal average for boll weevil square damage. As in **Test 1,** no treatment resulted in a reduction for the seasonal average of live Heliothine larvae per 50 terminals. All treatments provided a similar significant reduction in the seasonal averages for Heliothine square damage and live Heliothine larvae per 50 squares. Significant yield differences were not observed in this trial, but all treatments did numerically out-yield the untreated control (Table 2).

PRACTICAL APPLICATION

Steward and Tracer, applied alone, appear to have great promise as effective control measures for Heliothine cotton pests. Activity with these new chemistries was similar to the pyrethroids and organophosphate tested. The pyrethroid comparisons included, Karate Z, Decis, Baythroid, and Leverage (Baythroid + Provado premix), while the organophosphate comparison was Curacron. Tankmixes of the new chemistries with pyrethroids or Curacron did not offer any benefits over the materials used alone.

Intrepid has shown promise as a beet armyworm material but when tankmixed with Karate Z, does not increase Heliothine efficacy over Karate Z alone. Denim alone, does not stand out as a Heliothine control material.

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Table 1. (Test 1) Comparison of Steward, Tracer, Denim, and Intrepid/Karate combs for control of heliothine species in cotton.

Treatment	Rate	% Square damage[z]		Live Heliothine larvae[z]		Lint yield
		Boll weevil	Heliothine	50 terminals	50 squares	
	lb ai/acre	-------- % --------		-------- No. --------		lb/acre
Steward 1.25SC +	0.09 +					
Dyne Amic	0.5%v/v	1.9 a[y]	5.9 b	0.6 a	1.1 b	1016.8 ab
Steward 1.25SC +	0.11 +					
Dyne Amic	0.5%v/v	2.4 a	4.4 b	0.5 a	0.7 b	1014.4 ab
Tracer 4EC	0.08	2.0 a	5.6 b	0.5 a	1.0 b	1057.8 ab
Intrepid 80WP +	0.10 +					
Karate 2.08Z +	0.025 +					
Dyne Amic	0.5%v/v	2.8 a	5.6 b	0.7 a	1.4 b	1009.6 ab
Intrepid 80WP +	0.15 +					
Karate 2.08Z +	0.025 +					
Dyne Amic	0.5%v/v	1.6 a	4.7 b	0.6 a	1.0 b	1007.2 ab
Karate 2.08Z +	0.025 +					
Dyne Amic	0.5%v/v	1.8 a	6.4 b	0.7 a	1.2 b	1012.0 ab
Denim 0.16EC	0.01	2.3 a	6.3 b	1.1 a	1.3 b	896.2 bc
Denim 0.16EC +	0.01 +					
Karate 2.08Z	0.025	2.1 a	4.9 b	0.4 a	1.5 b	1040.9 ab
Steward 1.25SC +	0.06 +					
Karate 2.08Z +	0.025 +					
Dyne Amic	0.5%v/v	2.3 a	5.7 b	0.6 a	1.0 b	1092.8 a
Steward 1.25SC	0.06	2.3 a	6.2 b	0.6 a	1.6 b	1034.9 ab
Untreated control	–	3.2 a	10.0 a	1.3 a	3.8 a	825.0 c
LSD (P=0.05)	–	0.98	2.02	0.72	0.64	111.41

[z] Weevil and worm damage and live worm counts are seasonal means of averages of 50 squares and 50 terminals.
[y] Means followed by same letter do not significantly differ (P=0.05, Student-Newman-Keuls).

Table 2. (Test 2) Comparison of Steward, Tracer, Pirate, Leverage, Decis, Baythroid, and Curacron for control of heliothine species in cotton.

		% Square damage[z]		Live Heliothine larvae[z]		
Treatment	Rate	Boll weevil	Heliothine	50 terminals	50 squares	Lint yield
	lb ai/acre	-------------------- % ------------------		------------------ No. ----------------		lb/acre
Decis 1EC	0.025	1.3 ab[y]	3.4 b	0.6 a	0.8 b	863.0 a
Baythroid 2EC	0.03	1.0 ab	4.8 b	0.7 a	1.5 b	896.6 a
Leverage 2.7SE	3.75 fl oz/acre	1.3 ab	4.9 b	1.1 a	1.1 b	941.7 a
Leverage 2.7SE	3 fl oz/acre	1.9 ab	3.5 b	0.1 a	1.4 b	860.4 a
Tracer 4EC	0.067	1.2 ab	2.1 b	0.3 a	0.6 b	894.6 a
Steward 1.25SC	0.11	1.3 ab	4.1 b	0.8 a	1.7 b	844.9 a
Pirate 3SC	0.35	1.3 ab	4.5 b	0.4 a	1.5 b	838.9 a
Baythroid 2EC +	0.03 +					
Tracer 4EC	0.04	1.0 ab	3.8 b	0.3 a	0.8 b	889.1 a
Curacron 8EC	0.75	1.2 ab	3.7 b	0.3 a	1.1 b	880.2 a
Baythroid 2EC +	0.03 +					
Curacron 8EC	0.5	0.8 b	4.3 b	0.5 a	1.5 b	913.2 a
Untreated control	–	2.4 a	8.4 a	0.6 a	3.9 a	810.7 a
LSD (P=0.05)	–	0.85	2.33	0.97	1.54	79.06

[z] Weevil and worm damage and live worm counts are seasonal means of averages of 50 squares and 50 terminals.

[y] Means followed by same letter do not significantly differ (P=0.05, Student-Newman-Keuls).