SUMMARY OF TRACER PERFORMANCE FOR BOLLWORM (*Helicoverpa zea*) AND TOBACCO BUDWORM (*Heliothis virescens*) CONTROL IN ARKANSAS COTTON, 1998-1999

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RESEARCH PROBLEM

In an effort to control tobacco budworm and bollworm in cotton, repeated exposure to pyrethroid insecticides has resulted in the development of resistance to this class of chemistry. Resistance to the organophosphates and carbamates has also been observed. Research is needed to evaluate newly developed crop protection chemicals and determine their place in current pest management strategies.

BACKGROUND INFORMATION

In 1998, the bollworm and tobacco budworm caused an estimated 4.66% yield loss to cotton in Arkansas or an approximate loss of 29.0 million dollars (Williams, 1999a). Each pest alone is capable of causing considerable damage and in Arkansas, the population mix can vary from year to year and location to location. The statewide population mix in 1998 was approximately 44% bollworm / 56% tobacco budworm (Williams, 1999b). 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). Tracer is currently the only commercial example from a new class of insecticides called spinosyns and is a fermentation metabolite of the soil inhabiting microorganism *Saccharopolyspora spinosa*, an actinomycete. It has both stomach and contact activity against many caterpillar pests and was first registered for use on cotton in 1997. Tracer has a novel mode of action and acts by disrupting acetylcholine binding in nicotinic acetylcholine receptors at the postsynaptic nerve cell ending (Salgado, 1997). In these studies, Tracer was compared to traditional insecticides to determine its potential for use as a control tactic for the bollworm and tobacco budworm.

RESEARCH DESCRIPTION

Three trials were conducted in Jefferson County in 1998 (Test 1) and 1999 (Tests 2 and 3) to determine the efficacy of Tracer insecticide on the bollworm and tobacco budworm. Insecticide treatments were evaluated in small plots arranged in a random-

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ized complete-block design with four replications. The cotton varieties used were DP50 in 1998 and BXN47 in 1999. The seasonal population mix in the test locations, as determined by trap counts, was 90% bollworm and 10% tobacco budworm in 1998 and 89% bollworm and 11% tobacco budworm in 1999. Treatments were initiated when egg or small worm densities were at or approaching recommended treatment levels. Applications were made with a John Deere 6000 hi-cycle at 65 psi for every 10 gal/acre (1998) and 45 psi for every 8.56 gal/acre (1999) using Teejet TXVS-6 nozzles on 20-inch centers.

Test 1

Treatments (lb ai/acre) evaluated were an untreated control, Asana 0.66EC (0.036), Tracer 4EC (0.067), Tracer 4EC (0.05), Tracer 4EC (0.04), Asana 0.66EC + Tracer 4EC (0.036+0.067), Asana 0.66EC + Tracer 4EC (0.036 + 0.05), Asana 0.66EC + Tracer 4EC (0.036 + 0.04), Larvin 3.2SC + Tracer 4SC (0.5 + 0.05), Larvin 3.2SC (0.5), Tracer 4SC + Larvin 3.2SC (0.04 + 0.5), and Tracer 4EC + Curacron 8EC (0.04 + 0.75). Application dates in 1998 were 22 June, 10 July, 17 July, and 28 July. Evaluation dates in 1998 were 25 June 3DAT#1, 14 July 4DAT#2, 21 July 4DAT#3, 31 July 3DAT#4, and 23 October at harvest.

Test 2

Treatments (lb ai/acre) evaluated were Tracer 4EC (0.067), Tracer 4EC + Leverage (0.067 + 3 oz/acre), Tracer 4EC (0.04), Tracer 4EC + Leverage (0.04 + 3 oz/acre), Leverage (3 oz/acre), and an untreated control. 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.

Test 3

Treatments (lb ai/acre) evaluated were an untreated control, Baythroid 2EC (0.03), Tracer 4SC (0.067), Pirate 3SC (0.35), Baythroid 2EC + Pirate 3SC (0.03 + 0.25), Baythroid 2EC + Tracer 4SC (0.03 + 0.04), Baythroid 2EC + Orthene 90 SP (0.03 + 0.5), and Pirate 3SC (0.25). Application dates in 1998 were 22 June, 10 July, 17 July, and 28 July. Evaluation dates in 1998 were 25 June 3DAT#1, 15 July 5DAT#2, 22 July 5DAT#3, 31 July 3DAT#4, and 23 October at harvest.

Data were collected by examining 50 terminals and 50-100 fruit 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

All treatments in **Test 1** provided a significant level of Heliothine control when evaluating live larvae/terminals, live larvae/squares, and square damage. Tracer alone at rates ranging from 0.04 to 0.067 lb ai/acre was as effective as Asana, Larvin, and tankmix combinations of Tracer plus Asana, Larvin, and Curacron. All treatments pro-

vided a significant but statistically similar lint yield increase over the untreated control (Table 1).

In **Test 2**, Tracer alone at 0.04 to 0.067 lb ai/acre provided a statistically similar level of Heliothine control compared to Leverage and Tracer plus Leverage tankmix combinations. With respect to Heliothine control, the insecticide treatments significantly outperformed the check. While yields among treatments did not differ significantly, all insecticide treatments numerically out yielded the check (Table 2).

In **Test 3**, Tracer at 0.067 lb ai/acre and Pirate at 0.25-0.35 lb ai/acre provided a statistically similar level of Heliothine control compared to Baythroid alone, Baythroid plus Tracer, Baythroid plus Pirate, and Baythroid plus Orthene tankmix combinations. With respect to live worms/terminals, live worms/squares and square damage; the insecticide treatments significantly outperformed the check. All treatments provided a significant lint yield increase over the untreated control with Baythroid containing treatments which significantly out-yielded Pirate treatments (Table 3).

PRACTICAL APPLICATION

In these trials, the standard insecticides used alone or in combination for Heliothine complex control in cotton (various pyrethroids, Orthene, Curacron, and Larvin) were providing an acceptable level of control. These treatments also provided significant yield advantages over the untreated control. Tracer provided a level of control and yields similar to the standards. Evidence here indicates that Tracer can be used to effectively manage bollworms and tobacco budworms in cotton.

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Table 1: Evaluation of Tracer and Tracer combinations for control of Heliothine species.

Treatment	Rate	Live Heliothine spp.[z] Term.	Squares	Square Damage	Lint Yield
	lb ai/acre				lb/acre
UTC	–	3.4 a[y]	5.2 a	15.9 a	374.5 b
Asana 0.66EC	0.036	1.6 b	1.6 b	6.9 b	794.8 a
Tracer 4EC	0.067	1.1 b	1.0 b	6.8 b	782.8 a
Tracer 4EC	0.05	1.3 b	2.5 b	8.1 b	709.3 a
Tracer 4EC	0.04	1.3 b	1.3 b	7.6 b	703.3 a
Asana 0.66EC +	0.036 +				
Tracer 4EC	0.067	0.7 b	0.9 b	5.2 b	833.3 a
Asana 0.66EC +	0.036 +				
Tracer 4EC	0.05	0.8 b	0.9 b	5.1 b	694.8 a
Asana 0.66EC +	0.036 +				
Tracer 4EC	0.04	1.2 b	1.2 b	7.4 b	734.6 a
Larvin 3.2SC +	0.5 +				
Tracer 4SC	0.05	1.0 b	1.0 b	6.4 b	711.7 a
Larvin 3.2SC	0.5	0.9 b	1.3 b	9.3 b	728.6 a
Tracer 4SC +	0.04 +				
Larvin 3.2SC	0.5	1.4 b	1.4 b	7.1 b	688.8 a
Tracer 4EC +	0.04 +				
Curacron 8EC	0.75	0.5 b	0.8 b	4.1 b	805.7 a

[z] Worm count and damage are seasonal means of averages of 50-100 squares and 50 terminals.

[y] Means followed by same letter do not significantly differ (P=0.05,Duncan's New MRT).

Table 2: Evaluation of Tracer in combination with Leverage for control of Heliothine species

Treatment	Rate	Live Heliothine spp.[z] Term.	Squares	Square Damage	Lint Yield
	lb ai/acre				lb/acre
Tracer 4EC	0.067	1.0 a[y]	1.3 b	5.8 b	1018.0 a
Tracer 4EC +	0.067 +				
Leverage	3 oz/acre	0.6 ab	0.9 b	4.9 b	1141.0 a
Tracer 4EC	0.04	0.2 b	0.6 b	4.1 b	1032.5 a
Tracer 4EC +	0.04 +				
Leverage	3 oz/acre	0.4 b	0.9 b	4.3 b	1119.3 a
Leverage	3 oz/acre	0.9 a	1.1 b	3.7 b	1086.8 a
UTC	–	1.2 a	2.9 a	9.1 a	905.8 a

[z] Worm count and damage are seasonal means of averages of 50 squares and 50 terminals.

[y] Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls).

Table 3: Evaluation of Tracer, Pirate, and Baythroid in various combinations for control of Heliothine species.

Treatment	Rate	Live Heliothine spp.[z] Term.	Live Heliothine spp.[z] Squares	Square Damage	Lint Yield
	lb ai/acre				lb/acre
Untreated	–	3.8 a	5.8 a	18.2 a	262.5 c
Baythroid 2EC	0.03	0.9 b	1.0 b	6.8 b	808.1 a
Tracer 4SC	0.067	0.8 b	0.9 b	6.1 b	781.6 ab
Pirate 3SC	0.35	1.8 b	1.7 b	10.5 b	627.4 b
Baythroid 2EC + Pirate 3SC	0.03 + 0.25	0.7 b	1.0 b	6.0 b	851.4 a
Baythroid 2EC + Tracer 4SC	0.03 + 0.04	0.3 b	0.7 b	6.4 b	824.9 a
Baythroid 2EC + Orthene 90 SP	0.03 + 0.5	0.9 b	0.9 b	6.2 b	855.0 a
Pirate 3SC	0.25	1.8 b	1.9 b	7.3 b	634.7 b

[z] Worm count and damage are seasonal means of averages of 50-100 squares and 50 terminals.

[y] Means followed by same letter do not significantly differ (P=0.05,Duncan's New MRT).