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EVALUATION OF INSECTICIDES FOR TARNISHED PLANT BUG MANAGEMENT IN LOUISIANA COTTON

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Abstract

Studies were conducted during 2005 to evaluate the efficacy of selected insecticides for control of tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), in cotton. In Test 1, there were no significant differences among treatments for densities of TPB adults across sample dates. Centric 40WG (0.05 lb AI/acre), Vydate 3.77L (0.33 lb AI/acre), Orthene 90S (0.33 lb AI/acre), Bidrin 8E (0.33 lb AI/acre), and Diamond 0.83EC (0.058 lb AI/acre) significantly reduced TPB nymphs compared to Trimax 4F (0.047 lb AI/acre) and the non-treated control across sample dates. In Test 2, all insecticide treatments significantly reduced TPB adults and nymphs compared to the non-treated control across sample dates. All of the insecticide treatments resulted in significantly greater seedcotton yields compared to the non-treated control. In Test 3, plots treated with Orthene 90S (0.25 lb AI/acre) + Diamond 0.83EC (0.045 lb AI/acre), Trimax 4F (0.31 lb AI/acre) + Diamond 0.83EC (0.045 lb AI/acre), Bidrin 8E (0.25 lb AI/acre) + Diamond (0.045 lb AI/acre), or Centric 40WG (0.031 lb AI/acre) + Diamond 0.83EC (0.045 lb AI/acre) had significantly lower densities of TPB adults compared to plots treated with Orthene 90S (0.5 lb AI/acre) and the non-treated plots across sample dates. All of the insecticide treatments significantly reduced densities of TPB nymphs compared to the non-treated control across sample dates. All of the insecticide treatments, except Orthene 90S (0.5lb AI/acre), resulted in significantly greater seedcotton yield compared to the non-treated control. In Test 4, TPB (adults + nymphs) densities exceeded treatment levels on 11, 7, and 2 of the 15 sample dates in the 5%, 10%, and 20% treatment threshold plots, respectively. The 5%, 10%, and 20% treatment threshold plots received 8, 6, and 2 insecticide applications, respectively. The 5% and 10% treatment threshold plots produced significantly higher seedcotton yields compared to the 20% treatment threshold plots.

Introduction

The importance of tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), as an insect pest of cotton has increased dramatically. The wide spread adoption of transgenic *Bacillus thuringiensis* Berliner var. *kurstaki* (Bollgard®) cotton (Hardee and Bryan 1997, James 2003), boll weevil, *Anthonomus grandis grandis* (Boheman) eradication (Snodgrass and Scott 2003), the reduction in applications of broad spectrum insecticides for boll weevil and bollworm/tobacco budworm control, and the development of target-specific insecticides primarily for lepidopteran pests, have resulted in increased insecticide treatments specifically for tarnished plant bug control. During 2004, *Lygus* (including tarnished plant bug) was the second most important insect pest of cotton in the United States with respect to yield loss. In Louisiana, tarnished plant bug was the most important insect pest of cotton and the target of 58% of the insecticide applications during 2004 (Williams 2005).

There are several insecticides recommended for tarnished plant bug control on cotton in Louisiana including acephate (Orthene 90S, 97S and generics), Bidrin 8E, Centric 40WG, Trimax 4F, and Vydate 3.77L (Bagwell et al. 2005). During 2001 to 2003, acephate, Bidrin, Centric, Trimax, and Vydate generally provided satisfactory control of tarnished plant bug in Arkansas, Louisiana, and Mississippi (Leonard 2002a, 2002b, Greene and Capps 2003, Layton et al. 2003, Walsh et al. 2003, Capps et al. 2004, Gable et al. 2004, Lorenz et al. 2004, Studebaker et al. 2004, Cook et al. 2005). Diamond 0.83EC (novaluron) received registration for use on cotton during 2004. Diamond is an insect growth regulator that has activity against lepidopteran larvae and heteropteran nymphs (Anonymous 2004). Results from trials conducted in Arkansas and Louisiana indicate that Diamond provides satisfactory control of tarnished plant bug nymphs (Greene and Capps 2003, Gable et al. 2004, Cook et al. 2005).

During the 2004 and 2005 growing season, there were numerous reports of large and extended tarnished plant bug infestations on cotton in the mid-south. Numerous insecticide applications were required to control these infestations (B. R. Leonard, G. M. Lorenz III personal communication). Also during 2004, a population of

tarnished plant bug exhibiting a high level of resistance (10-fold) to acephate was discovered in Mississippi (G. Snodgrass, unpublished data, USDA-ARS Stoneville, MS). Populations of tarnished plant bug exhibiting varying levels of tolerance/resistance to some organophosphates, pyrethroids, cyclodienes, and carbamates including methyl parathion (Cleveland and Furr 1979, Snodgrass and Elzen 1995), dicrotophos and monocrotophos (McCaa and Schuster 1986, Snodgrass and Elzen 1995), dimethoate (Snodgrass and Scott 1988), cypermerthrin, bifenthrin, and permethrin (Snodgrass 1994, Snodgrass and Elzen 1995, Holloway et al. 1998), lambda-cyhalothrin, dimethoate, endosulfan, and oxamyl (Hollingsworth et al. 1997) have been reported. With the increase in status of tarnished plant bug as a cotton pest, the limited number of insecticides available for control, and with the potential for insecticide resistance, it is important that insecticides be evaluated regularly to determine if their performance has remained satisfactory.

Materials and Methods

Trials were conducted during 2005 at the LSU AgCenter Northeast Research Station near St. Joseph, LA to evaluate the efficacy of selected insecticides against tarnished plant bug on cotton. A study was also conducted to evaluate the impact of tarnished plant bug treatment threshold levels on seedcotton yield (Test 4). Cottonseed, Delta and Pine Land Delta Pearl (Tests 1, 2, and 3) and Delta and Pine Land 555 BR (Test 4) were planted on a Commerce silt loam on 8 Jun (Test 1), 20 Jun (Tests 2 and 3), and 11 May (Test 4). Plot size was four rows (centered on 40 inches) by 50 feet and treatments were replicated four times in a randomized complete block design in Tests 1, 2 and 3. Plot size in Test 4 was 16 rows (centered on 40 inches) by 100 feet and treatments were replicated four times in a randomized complete block design. Treatments were applied with a high clearance sprayer and CO_2 charged spray system calibrated to deliver 6 gpa through Teejet TX-8 hollow cone nozzles (2/row) on 17 Aug (Test 1) and on 18 Aug (Tests 2 and 3). In Test 4, insecticides were applied with a high clearance sprayer using the factory hydraulic spray system calibrated to deliver 10 gpa through Teejet TX-12 hollow cone nozzles (2/row). Treatment efficacy was determined by sampling the center two rows of each plot with a sweep net (25 sweeps/row) at 2 and 5 DAT (Test 1) and at 5 and 7 DAT (Tests 2 and 3). In Test 4, tarnished plant bug densities were estimated by sampling four of the interior rows (25 sweeps/row) of each plot. For Test 4, sample dates and insecticide applications are detailed in Table 1. In Tests 2 and 3, the two center rows of each plot were mechanically harvested using a John Deere spindle type picker on 26 Oct. In Test 4, four of the interior rows of each plot were mechanically harvested with a John Deere spindle type picker on 3 Oct. Yields were converted to lb seedcotton/acre. Data were subjected to ANOVA and means separated according to Fisher's Protected Least Significant Difference. A total of 0.3 (Tests 1, 2, and 3) and 3.11 (Test 4) inches of rainfall occurred from the first application until the end of sampling.

Results and Discussion

In Test 1, there were no significant differences among treatments for numbers of tarnished plant bug (TPB) adults at 2 or 5 DAT or across sample dates (Table 2). At 2 and 5 DAT and across sample dates, all of the insecticide treated plots, except those treated with Trimax, had significantly fewer TPB nymphs compared to the non-treated plots. Vydate and Bidrin significantly reduced TPB nymphs compared to Trimax at 2 DAT and across sample dates.

In Test 2, there were no significant differences among treatments for densities of tarnished plant bug (TPB) adults at 5 DAT (Table 3). All of the insecticide treatments significantly reduced densities of TPB adults at 7 DAT and across sample dates and TPB nymphs at 5 and 7 DAT and across sample dates compared to the non-treated control. Across sample dates, Vydate plus Diamond significantly reduced densities of TPB adults compared Dimethoate plus Diamond. All of the insecticide treatments, except Vydate plus Diamond, resulted in significantly higher seedcotton yields compared to the non-treated control.

Table 1. List of sample dates, application dates, and insecticide treatments.

Treatment Threshold Level	Sample Dates	Application Date	Insecticide/Rate (lb AI/acre)
≥5 Tarnished Plant Bugs (adults + nymphs) per 100 sweeps	20 Jun, 23 Jun, 29 Jun, 1 Jul, 5 Jul, 11 Jul, 19 Jul, 22 Jul, 25 Jul, 29 Jul, 3 Aug, 5 Aug, 8 Aug, and 11Aug	20 Jun	Bidrin 8E 0.33
		26 Jun	Bidrin 8E 0.33
		2 Jul	Centric 40WG 0.05
		14 Jul	Monitor 4L 0.33
		19 Jul	Orthene 90S 0.5
		23 Jul	Trimax 4F 0.047 + Karate 2.08CS 0.028
		26 Jul	Trimax 4F 0.047 + Capture 2EC 0.05
		9 Aug	Orthene 90S 0.75
≥10 Tarnished Plant Bugs (adults + nymphs) per 100 sweeps	20 Jun, 23 Jun, 29 Jun, 1 Jul, 5 Jul, 11 Jul, 19 Jul, 22 Jul, 25 Jul, 29 Jul, 3 Aug, 5 Aug, 8 Aug, and 11Aug	20 Jun	Bidrin 8E 0.33
		14 Jul	Monitor 4L 0.33
		19 Jul	Orthene 90S 0.5
		23 Jul	Trimax 4F 0.047 + Karate 2.08CS 0.028
		26 Jul	Trimax 4F 0.047 + Capture 2EC 0.05
		9 Aug	Orthene 90S 0.75
≥20 Tarnished Plant Bugs (adults + nymphs) per 100 sweeps	20 Jun, 23 Jun, 29 Jun, 1 Jul, 5 Jul, 11 Jul, 19 Jul, 22 Jul, 25 Jul, 29 Jul, 3 Aug, 5 Aug, 8 Aug, and 11Aug	19 Jul	Orthene 90S 0.5
		9 Aug	Orthene 90S 0.75

Table 2. Efficacy of selected insecticide treatments against tarnished plant bug adults and nymphs at 2 and 5 DAT and across sample dates.

		TPB/25 sweeps					
	Rate/acre	2 DAT		5 DAT		Mean	
Treatment/Form.	lb/AI	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs
Centric 40WG	0.05	3.6	6.6bc	4.5	3.6b	4.1	5.1bc
Trimax 4F	0.047	5.6	9.0ab	4.5	5.9ab	5.1	7.4ab
Vydate 3.77L	0.33	3.3	5.0c	5.9	3.3b	4.6	4.1c
Orthene 90S	0.33	5.0	7.1bc	5.8	4.1b	5.4	5.6bc
Bidrin 8E	0.33	6.3	4.8c	3.9	3.5b	5.1	4.1c
Diamond 0.83E	0.058	7.9	7.0bc	5.0	2.5b	6.4	4.8bc
Non-treated	-	6.3	11.3a	6.5	9.6a	6.4	10.4a
P>F		0.16	0.02	0.62	0.02	0.37	<0.01

Means within columns followed by a common letter are not significantly different (FPLSD, $P \leq 0.05$).

Table 3. Evaluation of Diamond tank mixes against tarnished plant bug adults and nymphs at 5 and 7 DAT, across sample dates, and impact on seedcotton yield.

		TPB/25 sweeps						
	Rate/acre	5 DAT		7 DAT		Mean		Seedcotton Yield
Treatment/Form.	lb/AI	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs	lb/acre
Orthene 90S	0.5	4.8	5.7b	4.4b	2.9b	4.6bc	4.3b	595ab
Orthene 90S +	0.25	5.4	4.8b	4.9b	1.8b	5.1bc	3.3b	617ab
Diamond 0.83EC	0.039							
Trimax 4F +	0.031	5.0	3.1b	3.8b	1.1b	4.4bc	2.1b	678a
Diamond 0.83EC	0.039							
Bidrin 8E +	0.25	6.0	3.1b	5.3b	1.4b	5.6bc	2.3b	713a
Diamond 0.83EC	0.039							
Centric 40WG +	0.031	5.9	3.1b	5.3b	2.3b	5.6bc	2.7b	708a
Diamond 0.83EC	0.039							
Dimethoate 4EC +	0.25	7.3	5.6b	3.7b	1.4b	5.8b	3.5b	658ab
Diamond 0.83EC	0.039							
Vydate 3.77L +	0.33	3.8	3.6b	4.9b	1.8b	4.3c	2.7b	530ba
Diamond 0.83EC	0.039							
Non-treated	-	7.3	19.5a	8.6a	10.9a	7.9a	15.2a	410c
P>F		0.08	<0.01	0.03	<0.01	<0.01	<0.01	<0.01

Means within columns followed by a common letter are not significantly different (FPLSD, $P \leq 0.05$).

In Test 3, there were no significant differences among treatments for densities of TPB adults at 5 DAT (Table 4). All of the insecticide treatments significantly reduced densities of TPB adults at 7 DAT and TPB nymphs at 5 and 7 DAT and across sample dates compared to the non-treated control. At 7 DAT, Bidrin plus Diamond resulted in significantly fewer TPB adults compared to Orthene, Dimethoate plus Diamond, Vydate plus Diamond, and the non-treated plots. Across sample dates, plots treated with Orthene plus Diamond, Trimax plus Diamond, Bidrin plus Diamond, or Centric plus Diamond had significantly fewer TPB adults compared to plots treated with Orthene, Dimethoate plus Diamond, or the non-treated plots. All of the insecticide treatments significantly reduced densities of TPB nymphs at 5 and 7 DAT and across sample dates compared to the non-treated control. All of the insecticide treated plots, except those treated with Orthene, yielded significantly more seedcotton yields compared to the non-treated plots.

Table 4. Efficacy of Diamond combinations against tarnished plant bug adults and nymphs at 5 and 7 DAT, across sample dates, and impact on seedcotton yield.

		TPB/25 sweeps						
	Rate/acre	5 DAT		7 DAT		Mean		Seedcotton Yield
Treatment/Form.	lb/AI	Adults	Nymphs	Adults	Nymphs	Adults	Nymphs	lb/acre
Orthene 90S	0.5	6.1	6.1b	7.1b	6.9b	6.6ab	6.5b	659bc
Orthene 90S +	0.25	3.5	2.1b	4.9cd	2.0b	4.2c	2.1b	794ab
Diamond 0.83EC	0.045							
Trimax 4F +	0.031	2.9	4.9b	5.4bcd	4.1b	4.1c	4.5b	858a
Diamond 0.83EC	0.045							
Bidrin 8E +	0.25	4.1	2.8b	3.5d	3.8b	3.8c	3.3b	816ab
Diamond 0.83EC	0.045							
Centric 40WG +	0.031	3.1	3.3b	5.4bcd	3.0b	4.3c	3.1b	886a
Diamond 0.83EC	0.045							
Dimethoate 4EC +	0.25	5.9	3.5b	6.3bc	4.4b	6.1ab	3.9b	740ab
Diamond 0.83EC	0.045							
Vydate 3.77L +	0.33	4.9	2.9b	5.8bc	3.0b	5.3bc	2.9b	729ab
Diamond 0.83EC	0.045							
Non-treated	-	6.3	16.5a	9.1a	14.0a	7.7a	15.3a	504c
P>F		0.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Means within columns followed by a common letter are not significantly different (FPLSD, $P \leq 0.05$).

In Test 4, TPB (adults plus nymphs) densities in the 5% treatment level plots exceeded threshold on eleven of the fifteen sample dates and received eight insecticide applications (Figure 1). Tarnished plant bug densities in the 10% treatment level plots exceeded threshold on seven of the fifteen sample dates and received six insecticide applications. In the 20% treatment level plots, TPB densities exceeded threshold on two of the fifteen sample dates

and received two insecticide applications. Plots treated when TPB infestations exceed 5% or 10% produced significantly more seedcotton compared to plots treated when TPB infestations exceeded 20% (Figure 2).

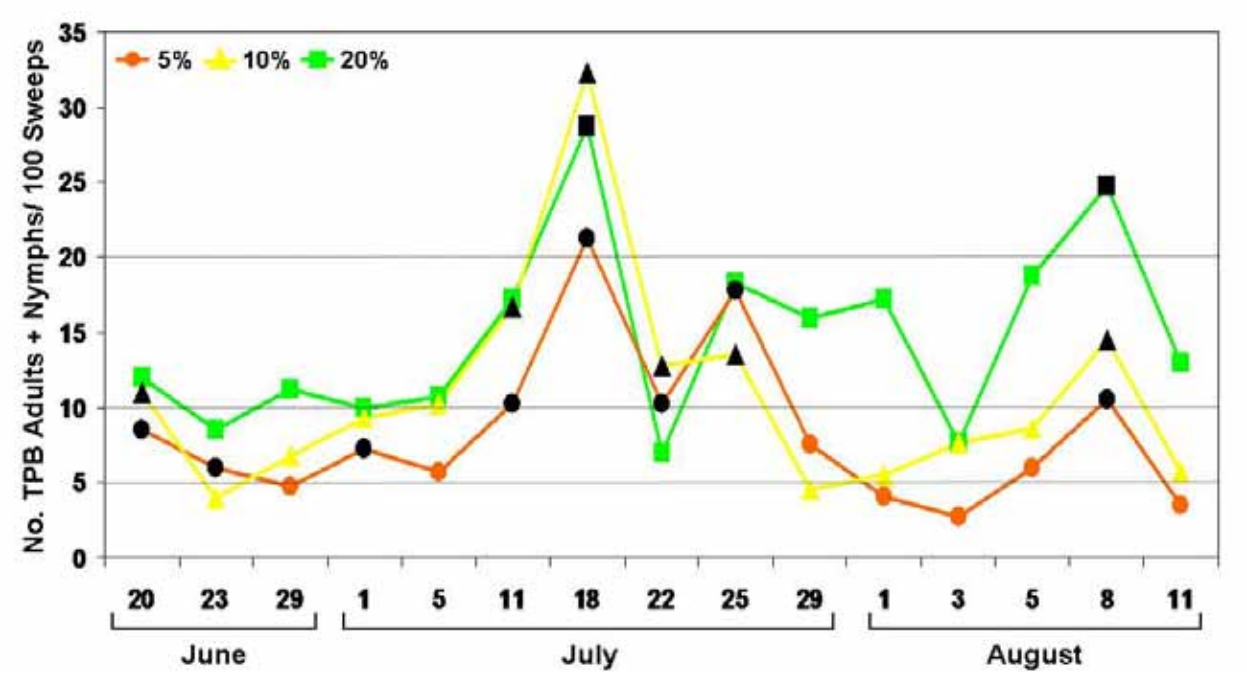

Figure 1. Mean tarnished plant bug (adults + nymphs) densities during 20 Jun until 11 Aug. Black point markers indicate insecticide applications to plots for the respective treatments.

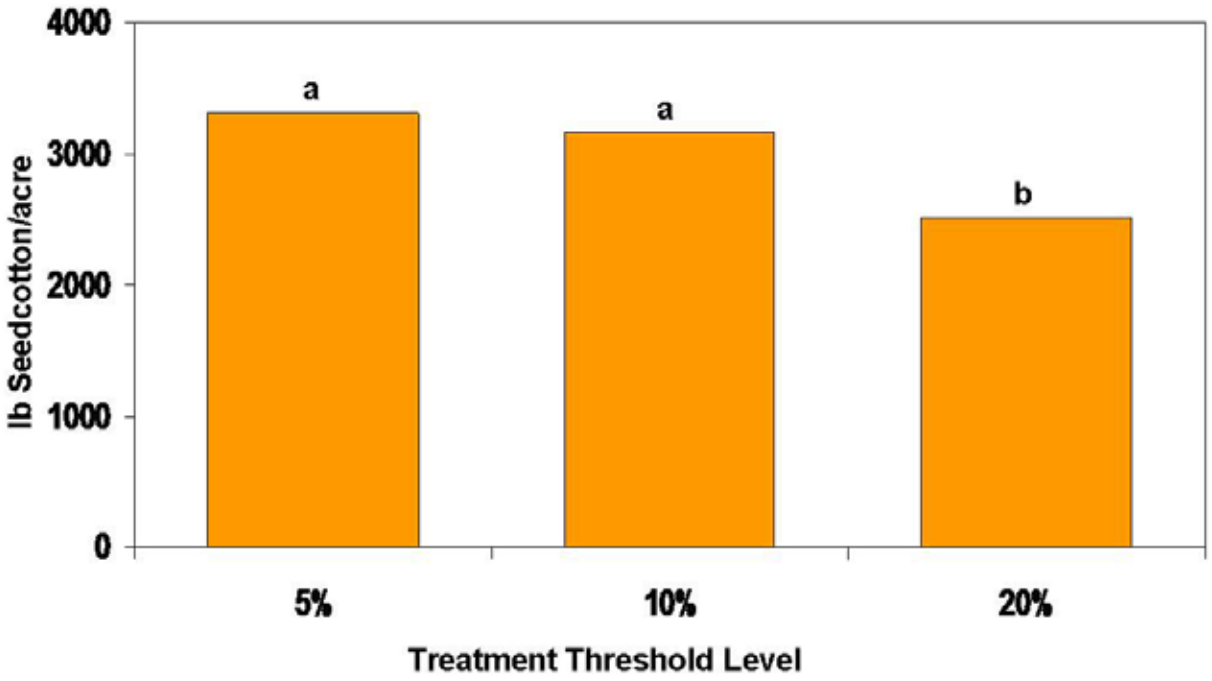

Figure 2. Impact of tarnished plant bug treatment thresholds on seedcotton yield.

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