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CONTROL OF TARNISHED PLANT BUGS IN MISSISSIPPI DELTA COTTON

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Abstract

During the 2001 and 2002 growing seasons four small plot efficacy trials were conducted to evaluate control of heavy, mid to late-season infestations of tarnished plant bugs (TPB). Orthene (acephate), Bidrin (dicrotophos) and Centric (thiamethoxam) were the most consistently effective treatments. However, products such as Vydate (oxamyl), Trimax (imidacloprid), Intruder (acetamiprid), and some of the pyrethroids also provided significant control. Results of these trials indicate that two successive treatments are often required to obtain effective control of heavy, mid to late-season infestations of TPB nymphs.

Introduction

Tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), is an important pest of Mississippi cotton, often ranking among the three most damaging insect pests of the season. Although TPB occurs on cotton throughout the state, it is relatively more common in the Delta area than in the Hills, and Delta producers normally apply several more TPB treatments than Hill producers each growing season (Layton, 2000). For example, in 2001 Delta producers applied an estimated 3.5 sprays to control TPB, while Hill producers applied only 0.7 TPB sprays (Williams, 2002). In 2002 the estimated number of TPB sprays applied in the Delta and in the Hills was 3.5 and 1.1, respectively (Williams, 2003).

During recent years the relative importance of TPB has increased significantly, especially in the Delta area. This is due to the success of the boll weevil eradication effort and heavy utilization of transgenic Bt cotton. Collectively these two factors have resulted in large reductions in the total number of foliar insecticide treatments applied each season, and this overall reduction in insecticide use to control boll weevils and caterpillar pests has resulted in less coincidental control of tarnished plant bugs. Hence, TPB has become more important because of the decline in the relative importance of boll weevils and caterpillar pests, and because the reduced spray environment has resulted in a need for more insecticide treatments specifically targeted against TPB. For the past two growing seasons approximately 80% of Mississippi's cotton acreage has been planted to transgenic Bt cotton varieties, and results of surveys conducted during these years have shown that Delta Bt cotton fields receive significantly more TPB treatments than non-Bt fields (Layton, et. al., 2002, 2003).

Historically, most TPB sprays are applied during June, or the first four weeks of squaring, and there has been relatively little increase in the number of TPB sprays applied during this time period. Instead, the increased need for TPB sprays most commonly occurs during mid to late season, when heavy populations of nymphs often become established. These mid and late season infestations are often difficult to control because nymphs are often located inside square bracts, relatively deep in the canopy, where they are difficult to reach with insecticides.

TPB control is further complicated in the Delta by high levels of insecticide resistance, especially to synthetic pyrethroids, but also to certain organophosphates and carbamates (Snodgrass, 1996). This increase in the relative importance of TPB, combined with the associated resistance problems, has intensified the need for current information on the efficacy of TPB insecticides.

Materials and Methods

During the 2001 and 2002 growing seasons a total of four replicated trials were conducted to evaluate efficacy of various insecticides for control of mid and late season plant bugs. All of these trials were conducted in the Delta portion of the state. The two 2001 trials were conducted in a commercially planted cotton field in Quitman County, while the 2002 trials were conducted in Sunflower County. Both of these fields were planted to transgenic Bt-cotton varieties. All trials were conducted in late July to early August, when cotton was in the late bloom stage. In 2001 the plants were unusually tall and rank, but in 2002 the plants were short with an open canopy that was conducive to good spray penetration.

All trials were replicated four times in a randomized complete block design, and plot size ranged from eight to twelve rows wide by forty to fifty feet in length. With the exception of the second 2001 trial, all treatments were applied with a CO_2-powered backpack sprayer calibrated to deliver 9.5 or 10 gallons of finished spray per acre through 8001E spray tips at 40 psi. The second 2001 trial was applied using a high-clearance small plot spray tractor calibrated to deliver 7.5 gallons of finished spray per acre through Tx4 hollow cone nozzles at 40 psi. In this trial all treatments were re-applied 7 days after the initial treatments, but only a single application was made in the other three trials.

Plots were rated by visually examining 20 (2001) or 25 (2002) randomly chosen plants per plot and counting the number of plant bug adults or nymphs present in the terminal, inside the bracts of large squares and bolls, or in blooms. A minimum of five squares and one bloom were searched on each plant examined. Results are reported as average numbers of plant bug adults or nymphs found per 100 plants in order to allow easy comparison to Mississippi's recommended treatment threshold for mid and late season TPB infestations, which is 15 TPB (adults + nymphs) per 100 plants (Layton, 2002). Initial ratings were made at two or three days after treatment and repeated at five to seven days after treatment.

Because of their highly mobile nature, it is difficult to effectively evaluate the efficacy of foliar insecticides against adult TPB in small plot trials. This is because even plots that receive highly effective treatments are quickly re-infested by adult TPB moving from nearby check plots or untreated areas. However, the high populations of TPB nymphs that were present in these four trials provided an excellent opportunity to evaluate TPB treatments.

Results

Trial 1 of 2001

Results of Trial 1 of 2001 are presented in Table 1. Note that populations in the untreated plots were several-fold higher than the economic threshold of 15 TPB per 100 plants. All treatments provided significant reductions in numbers of TPB nymphs. The highest level of control was provided by the 0.5 lbs. Ai/acre rate of Bidrin (dicrotophos), which was the only treatment to provide over 80% control of nymphs on all three sample dates. Both rates of Orthene (acephate) also performed well, but there was relatively little difference between the control provided by the 0.5 lb ai/acre rate and the 1.0 lb rate. The newly labeled Centric (thiamethoxam) also provided good control of TPB nymphs when used at the 0.047 lbs. Ai/acre rate. Although it is primarily a caterpillar insecticide, Steward (indoxacarb) provided approximately 60% control of nymphs at 5 and 7 DAT. Note however, that no treatment was successful in reducing this unusually heavy TPB infestation below the economic threshold of 15 TPB/100 plants with only a single application.

Trial 2 of 2001

The second 2001 trial is summarized in Table 2 (nymphs) and Table 3 (adults). In this trial, all treatments were re-applied seven days after the initial treatment. Note that the average number of nymphs in untreated plots exceeded 100 bugs/100 plants at 2DAT1. With the exception of Asana (esfenvalerate), all treatments provided significant reductions in the number of nymphs at both 2DAT1 and 5DAT1, but no treatment reduced nymph numbers below15 bugs/100 plants. However, it must be noted that, although these plots received no significant rainfall within 12 hours of the initial application, 1.77 inches of rainfall occurred between 12 and 48 hours after the first treatment.

At 2DAT2 all treatments except Asana reduced nymph numbers below 15 bugs/100 plants, and Orthene (acephate) and all three rates of Centric (thiamethoxam) continued to provide effective control at 5DAT2. It is noteworthy that both Steward (indoxacarb) and Denim (emamectin benzoate) provided significant levels of TPB control, even though they are primarily caterpillar products. Although the rainfall that occurred following the initial treatment undoubtedly affected efficacy, these results illustrate the need for multiple, successive treatments when attempting to control heavy infestations of TPB nymphs. The increase in numbers of adult TPB from 2DAT1 to 5DAT1 (Table 3) is due to the presence of large numbers of newly emerged adults, which tend to be less 'flighty' and more easily sampled than older adults.

Trial 1 of 2002

Table 4 presents the results of the first 2002 trial. Note that the total number of TPB (nymphs + adults) exceeded 100 bugs/100 plants at both 3 and 7DAT. All treatments provided significant levels of control, relative to untreated plots. Orthene (acepthate), Centric (thiamethoxam), and Bidrin (dicrotophos), along with the tank mix of Bidrin and Trimax (imidacloprid) provided best control of TPB nymphs at 7DAT. However, no treatment succeeded in reducing the total number of TPB (nymphs + adults) below the economic threshold of 15 bugs/100 plants. Again, these results illustrate that a single application is often not sufficient to provide effective control of heavy, late-season plant bug infestations.

Trial 2 of 2002

In the second trial of 2002 (Table 5) average numbers of nymphs in the untreated plots exceeded 50/100 plants at 3DAT. All treatments, except Trimax, provided significant reductions in numbers of nymphs at both 3DAT and 7DAT. At 7DAT the two pyrethroids, Danitol (fenpropathrin) and Capture (bifenthrin), provided control of nymphs that was equivalent to that of Orthene (acephtate) or Centric (thiamethoxam). This was noteworthy because pyrethroid insecticides often do not provide good control of late-season plant bug infestations in the Delta because of resistance (Snodgrass, 1996). Note also that there was relatively little improvement in the level of control provided by the 1.0 lb. Ai/acre rate of Orthene (acephate), compared to the 0.5 lb rate.

Summary

When considered collectively the results of these four trials illustrate several key points relative to control of heavy mid and late-season plant bug infestations in the Mississippi Delta. 1} Orthene (acepthate), Bidrin (dicrotophos) and Centric (thia-

methoxam) are the most consistently effective treatments for TPB. 2} All three of the neonicotinoid products tested, Centric (thiamethoxam), Trimax (imidacloprid), and Intruder (acetamiprid) are active against TPB, but Centric is the most effective of the neonicotinoids. 3} Regardless of the product used, single applications are often not sufficient to effectively control heavy mid to late-season infestations of TPB nymphs, and multiple, successive treatments are often necessary. 4}Increasing the rate of Orthene from 0.5 lbs ai/acre to 1.0 lb provides relatively little improvement in control. 5}The two caterpillar products, Steward (indoxacarb) and Denim (emamectin benzoate), both exhibit significant efficacy against TPB, but this efficacy is not sufficient to warrant the use of these products as a primary treatment for TPB.

References

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Table 1. Trial 1 of 2001: Results of Tarnished Plant Bug Efficacy Trial, Quitman Co., MS, August 1, 2001.

Treatment/ Formulation	Lbs ai Per acre	Avg. No. TPB per 100 Plants					
		2 DAT		5 DAT		7 DAT	
		Nymphs	Adults	Nymphs	Adults	Nymphs	Adults
Untreated	--	81.5 a	16.5 a	125.0 a	27.5 a	129.0 a	16.5 a
Centric 25 WG	0.047	42.5 bc	9.0 bc	22.5 c	14.0 bc	26.5 c	15.0 a
Orthene 97	0.5	46.5 bc	10.0 ab	17.5 c	10.0 c	29.0 bc	10.0 a
Orthene 97	1.0	20.0 de	9.0 bc	14.0 c	10.0 c	39.0 bc	12.5 a
Steward 1.25 SC	0.11	55.0 b	5.0 bc	45.0 b	20.0 ab	54.0 b	19.0 a
Vydate C-LV 3.77	0.33	34.0 cd	9.0 bc	46.5 b	19.0 abc	41.5 bc	5.0 a
Karate-Z 2.08	0.04	32.5 cd	2.5 c	45.0 b	10.0 c	37.5 bc	11.5 a
Bidrin 8E	0.5	10.0 e	6.5 bc	6.5 c	11.5 bc	16.5 c	10.0 a

Means within a column that are not followed by a common letter differ significantly (Fishers Protected LSD, P =0.1).

Table 2. Trial 2 of 2001: Results of Tarnished Plant Bug Efficacy Trial, Quitman Co., MS, August 8, 2001, nymphs.

Treatment/ Formulation	Lbs ai Per acre	Avg. No. TPB Nymphs per 100 Plants			
		2 DAT1	5 DAT1	2 DAT2*	5DAT2*
Untreated	--	114.0 a	91.5 a	79.0 a	65.0 a
Centric 25 WG	0.031	34.0 d	49.0 bc	11.5 bcd	11.5 bcd
Centric 25 WG	0.047	37.5 d	40.0 bc	2.5 d	13.5 bcd
Centric 25 WG	0.062	45.0 cd	30.0 c	11.5 bcd	5.0 d
Steward 1.25 SC	0.11	71.5 bc	51.5 bc	8.0 cd	23.5 bc
Denim 0.16 E	0.01	75.0 bc	67.5 ab	14.0 bc	23.5 bc
Asana 0.66 EC	0.05	96.5 ab	95.0 a	33.0 ab	61.5 a
Orthene 97	0.5	46.5 cd	55.0 bc	6.5 cd	8.5 cd
Capture 2 EC	0.05	32.5 d	53.0 bc	10.5 bcd	26.5 b

Treatment 2 was applied 7 days after the initial treatment.
Means within a column that are not followed by a common letter differ significantly (Fishers Protected LSD, P = 0.1).

Table 3. Trial 2 of 2001: Results of Tarnished Plant Bug Efficacy Trial, Quitman Co., MS,August 8, 2001, adults.

Treatment/ Formulation	Lbs ai Per acre	Avg. No. TPB Adults per 100 Plants			
		2 DAT1	5 DAT1	2 DAT2*	5DAT2*
Untreated	--	16.5 ab	50.0 a	43.0 a	55.0 ab
Centric 25 WG	0.031	19.0 ab	32.5 a	7.5 cde	30.0 c
Centric 25 WG	0.047	4.0 c	34.0 a	19.5 abc	30.0 c
Centric 25 WG	0.062	21.5 a	37.5 a	5.5 de	8.5 d
Steward 1.25 SC	0.11	19.0 ab	40.0 a	16.5 bcd	35.0 bc
Denim 0.16 E	0.01	25.0 a	59.0 a	33.0 ab	28.5 cd
Asana 0.66 EC	0.05	10.0 bc	49.0 a	13.0 bcde	61.5 a
Orthene 97	0.5	22.5 a	47.5 a	19.0 abc	15.0 cd
Capture 2 EC	0.05	4.5 c	29.0 a	4.0 e	21.5 cd

*Treatment 2 was applied 7 days after the initial treatment.
Means within a column that are not followed by a common letter differ significantly (Fishers Protected LSD, $P = 0.1$).

Table 4 Trial 1 of 2002 -Tarnished Plant Bug Efficacy Trial Results, Sunflower County, July 26, 2002.

Treatment	Lbs. ai. Per acre	Avg. No. TPB per 100 plants			
		3 DAT		7 DAT	
		Adults	Nymphs	Adults	Nymphs
Untreated	--	44 a	72 a	61 a	59 a
Bidrin 8E	0.4	20 b	9 c	15 b	18 cd
Bidrin 8E + Trimax 4SC	0.25 + 0.01	17 b	16 bc	18 b	11 d
Trimax 4SC	0.047	16 b	27 b	21 b	30 bc
Centric 40WG	0.05	17 b	15 bc	18 b	12 d
Intruder 70WP	0.05	12 b	23 bc	25 b	32 b
Orthene 97SP	0.5	18 b	7 c	14 b	9 d
Vydate 3.77	0.33	19 b	11 bc	14 b	27 bc

Means within a column that are not followed by a common letter differ significantly (Fisher's Protected LSD, P = 0.1.).

Table 5. Trial 2 of 2002 - Tarnished Plant Bug Efficacy Trial Results, Sunflower County, MS, August 5, 2002.

Treatment	Lbs. ai. Per acre	Avg. No. TPB per 100 plants			
		3 DAT		7 DAT	
		Adults	Nymphs	Adults	Nymphs
Untreated	--	19 a	52 a	30 a	27 a
Orthene 97SP	0.5	5 bc	14 cd	8 bc	11 b
Orthene 97SP	1.0	13 ab	9 cd	5 c	7 b
Trimax 4SC	0.047	7 bc	37 ab	14 b	18 ab
Centric 40WG	0.05	7 bc	5 d	9 bc	5 b
Danitol 2.4EC	0.2	4 c	26 bc	10 bc	5 b
Capture 2EC	0.06	4 c	19 cd	8 bc	8 b
(CS-AU-44-JO) *	1 quart*	8 bc	24 bc	8 bc	10 b

* 1 quart of CS-AU-44-70 contains 0.5 lbs acephate and 0.05 lbs cypermethrin.
Means within a column that are not followed by a common letter differ significantly (Fisher's Protected LSD, P = 0.1.).