INSECTICIDE MIXING STRATEGIES FOR MANAGING TARNISHED PLANT BUGS WITH AN EMPHASIS ON DIAMOND® Scott Stewart Sandy Steckel Kyle Pearson The University of Tennessee, West Tennessee Research and Education Center Jackson, TN Gus Lorenz Scott Akin University of Arkansas, Department of Entomology Fayetteville, AR Angus Catchot Mississippi State University, Department of Entomology and Plant Pathology Mississippi State, MS

Abstract

An identical protocol was performed at four locations to evaluate various insecticide treatments for the control of tarnished plant bug. Several insecticides including Acephate 90S, Bidrin[®], Centric[®] and Carbine[®] were sprayed individually and in combination with Diamond (novaluron). With the exception of Acephate, adding Diamond as a tank mix with other insecticides improved control of tarnished plant bugs. The efficacy of Diamond treatments improved following a second application relative to other treatments.

Introduction

The tarnished plant bug (TPB, *Lygus lineolaris* Palisot De Beauvois) has become the key pest of cotton in the Midsouth. Achieving adequate control of TPB with insecticides has become more difficult because of increasing pest pressure and resistance to several insecticide classes. Utilizing several modes of action is necessary to help manage resistance and maintain control of TPB populations. Diamond is a relatively new insecticide with a unique mode of action, acting as a chitin synthesis inhibitor. Because of this, Diamond does not kill adult tarnished plant bugs but is still being used extensively in the Midsouth. This study was designed to help evaluate how to best use Diamond as part of an insecticide management strategy to control tarnished plant bugs.

Materials and Methods

An identical insecticide efficacy trial was performed at four locations in Mississippi (Glendora), Tennessee (Dyer Co.) and Arkansas (Marianna and Rohwer). The initial insecticide application at each site was made between 7 and 29 July, 2010 using a small-plot, multiboom sprayer. A total of two or three (Rohwer) applications were made. There were 11 treatments replicated four times in a randomized complete block (Table 1). Individual plots were 4 to 8 rows wide and 40-60 ft long.

Table 1. Treatments of standardized insecticide protocol for tarmsned plant bug.		
Insecticide	Active ingredients	Product rate (oz/acre)
Untreated check (UTC)		
Diamond 0.83E	Novaluron	6
Diamond 0.83E	Novaluron	9
Centric 40WG	Thiamethoxam	2.5
Diamond 0.83E + Centric 40WG	Novaluron + Thiamethoxam	6 + 2.5
Orthene or Acephate 90S	Acephate	13.3 (0.75 lb ai)
Diamond 0.83E + Acephate 90	Novaluron	6 + 13.3
Bidrin 8E	Dicrotophos	6
Diamond 0.83E + Bidrin 8E	Novaluron + Dicrotophos	6 + 6
Carbine 50WG	Flonicamid	1.7
Diamond 0.83E + Carbine 50WG	Novaluron + Flonicamid	6 + 1.7

Table 1. Treatments of standardized insecticide protocol for tarnished plant bug.

At least one rating was taken following each application. On each rating date, TPB were counted by taking two samples (5 row feet each) with a black drop cloth in all plots. Within a location, the cumulative number of TPB found in each plot was calculated across all rating dates. The average cumulative number of TPB was then determined for each treatment. Statistical analyses (GLM) were done with these average numbers and using location as a block effect. Data were square-root transformed prior to analysis to account for unequal variances among treatments. Fisher's protected LSD (P < 0.05) was used for mean separation. The average percent control of each treatment relative to untreated plots was also calculated for each location, and the average percent control across locations was then determined to further standardizing the data.

Results

At the time of the first, post-treatment rating, populations in the check plots were approximately 16, 5, 7 and 3 fold the economic threshold of three TPB per five row feet for Marianna, Rohwer, Glendora and Dyer County, respectively. The maximum population density observed at each location was about 17, 14, 11 and 4 fold the economic threshold for Marianna, Rohwer, Glendora and Dyer County, also respectively. Approximately 90% of TPB found during these ratings were nymphs, regardless of location.

All insecticide treatments significantly reduced TPB numbers (F = 21.7; df = 13, 30; P < 0.0001). Based on cumulative TPB numbers found during the duration of these tests, adding Diamond to other insecticide treatments tended to improved overall control of TPB (Fig. 1). However, the control provided by Acephate was not improved by adding Diamond as a tank mix partner, and only the Carbine treatment was statistically improved by adding Diamond. Increasing the rate of Diamond from 6 to 9 oz/acre only increased its efficacy about 6% (Fig. 2). These data, unto themselves, would indicate that adding Diamond as a tank mix partner only had substantial value if the insecticide partner was by itself relatively ineffective (e.g., Carbine). However, Diamond is relatively slow acting but with comparatively long residual. Therefore, the numbers of TPB found 5-11 days following a second application were also evaluated across all locations. These data show that as a stand-alone treatment only Acephate provided better control than Diamond (Fig. 3). The addition of Diamond as a tank mix partner increased the efficacy of Centric, Bidrin and Carbine by 8, 11 and 20%, respectively, but increasing the Diamond rate from 6 to 9 oz/acre only increased percent control of TPB by 3% (Fig. 4).



Figure 1. Average cumulative number of tarnished plant bugs found following insecticide treatment across four locations. Bars not labeled with a common letter are significantly different (GLM, LSD, P < 0.05). An asterisk indicates a treatment in which control was statistically improved by adding Diamond.



Figure 2. Average percent control of cumulative tarnished plant bugs found following multiple insecticide treatments across four locations.



Figure 3. Average number of tarnished plant bugs per 10 row ft when across four locations at 5-11 days after a second application. Bars not labeled with a common letter are significantly different (GLM, LSD, P < 0.05). An asterisk indicates a treatment in which control was statistically improved by adding Diamond.



Figure 4. Average percent control of tarnished plant bugs across four locations at 5-11 days after a second application.

Discussion

Initial evaluations did not adequately assess the ultimate efficacy of Diamond treatments. Following a second application, Diamond was equal to or superior to all single-chemistry treatments except Acephate. Tank mixing Diamond with other products improved performance, again with the exception of Acephate. These data might suggest possible antagonism between Acephate and Diamond, although this seems unlikely. Regardless, our data show that tank mixes of Acephate and Diamond would not increase control of TPB. This may not be the case in areas where high levels of Acephate resistance are present in TPB populations or if adults composed much of the population. Nevertheless, it might be similarly effective and less expensive to use Acephate and Diamond in rotation rather than as tank mix partners. The same could be said for other potential tank mix partners that individually provide a high level of control. These tests were done during flowering when the vast majority of TPB were nymphs. Although Diamond does not cause adult mortality, it provided overall control comparable to other insecticides. This observation is consistent with the authors' previous experiences with tests done during flowering.

Diamond has excellent value as IRM tool because of its unique mode of action. If Diamond has slower activity with relatively long residual, it would appear to have more potential value when used early in an insecticide sequence (but primarily targeting immature stages of TPB). One potential drawback to using Diamond early is its potential to flare populations of aphids or spider mites. However, other insecticides used to control plant bugs may also cause secondary pest outbreaks. There may be less benefit to using Diamond in very late season, in areas where TPB resistance to other insecticide classes is minimal, or where TPB populations are typically low.

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