CHANGES IN PLANT BUG EFFICACY OVER 14 YEARS IN ARKANSAS

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Abstract

Data from a total of 121 tarnished plant bug efficacy trials conducted in Arkansas from 2005 – 2018 were combined to evaluate the performance of insecticides classes over time. Based on this analysis, there were no changes in organophosphate, neonicotinoid, sulfoxamine, or benzoylurea efficacy. However, pyrethroid efficacy declined substantially over the same time period. Even with the decline in pyrethroid efficacy the addition of bifenthrin to acephate continued to increase control of plant bugs over acephate alone. Data from the past five years indicates acephate, dicrotophos, novaluron, and sulfoxaflor provide the greatest control of tarnished plant bug in cotton at 2-4 and 5-8 days after treatment.

Introduction

Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), is the most damaging insect pest of cotton in Arkansas totaling near $74 million in losses plus cost in 2018 (Cook, 2019). Plant bugs are a difficult pest to manage in cotton with growers averaging 4.7 insecticide applications per acre treated. Few currently labeled insecticides provide effective control of plant bugs meaning growers must tank mix products with multiple modes of action to obtain an acceptable level of control. With few effective modes of action, insecticide resistance is an issue growers continue to face. Comparing insecticide performance in past trials to current ones can provide insight on how efficacy has changed over time.

Methods

Efficacy trials were conducted from 2005 – 2018 in Arkansas. Of the total 121 trials used in the analysis 116 were conducted on Lon Mann Cotton Research Station in Lee County, AR, while the remaining were conducted on grower fields across the state. Plots were sprayed using a Mud-Master sprayer fitted with either 80-02 dual flat fan nozzles or TXVS-6 hollow cone nozzles with 19.5 inch spacing. Spray volume was 10 gal/a at 40 psi. Plot sizes were 12.5 ft (4 rows) by 40 ft. Insecticide classes, active ingredients, and the rates included in this study can be found in table 1. All products, formulations, and rates were standardized to lbs ai/a. Insecticide rates within 10% of the most commonly used rate were combined with the more common rate. Plant bug densities were determined by using a 2.5 ft drop cloth and taking 2 samples per plot (10 row ft). Plant bug densities were standardized within each sample date as percent control relative to the untreated check. Only samples collected 2-4 days after treatment (DAT)are reported unless otherwise indicated. Analysis was conducted in JMP 14 using analysis of variance and regression analysis. Means were separated using Tukey's HSD ($P<0.05$). Sample dates where plant bug densities were lower than threshold (6 per 10 row ft) in the untreated check were eliminated from analysis.

Results

Analysis of selected insecticides from 2014-2018 at 2-4 days after treatment indicated that sulfoxaflor provided the greatest overall control of plant bugs but was not different than acephate, dicrotophos, flonicamid, or novaluron (Figure 1). Control at 5-8 DAT was similar to that at 2-4 DAT, with the exception of flonicamid, which dropped substantially in the amount of control provided. Regression analysis found there were no changes in organophosphate, neonicotinoid, sulfoxamine, or benzoylurea efficacy over the evaluated time period (organophosphate, $P = 0.11$; neonicotinoid, $P = 0.15$; sulfoxamine, $P = 0.21$; benzoylurea, $P = 0.72$) (Figures 3 – 6). However, pyrethroid efficacy declined substantially over the same period of time (P = 0.02) (Figure 7). Although pyrethroid efficacy has declined in recent years, mixtures of bifenthrin + dicrotophos continued to provide an increase level of control over dicrotophos alone (Figure 8).

Table 1. Insecticide classes, active ingredients, and rates included in analysis.

Insecticide class	Active Ingredient	Rate (lbs ai/a)
Organophosphate	Acephate	0.75
	Dicrotophos	0.5
Pyrethroid	Bifenthrin	0.1
	Gamma-cyhalothrin	0.015
	Lambda-cyhalothrin	0.03
	Zeta-cypermethrin	0.025
Sulfoxamine	Sulfoxaflor	0.047
Neonicotinoid	Acetamiprid	0.013
	Imidacloprid	0.0625
	Thiamethoxam	0.05
Benzoylurea	Novaluron	0.039

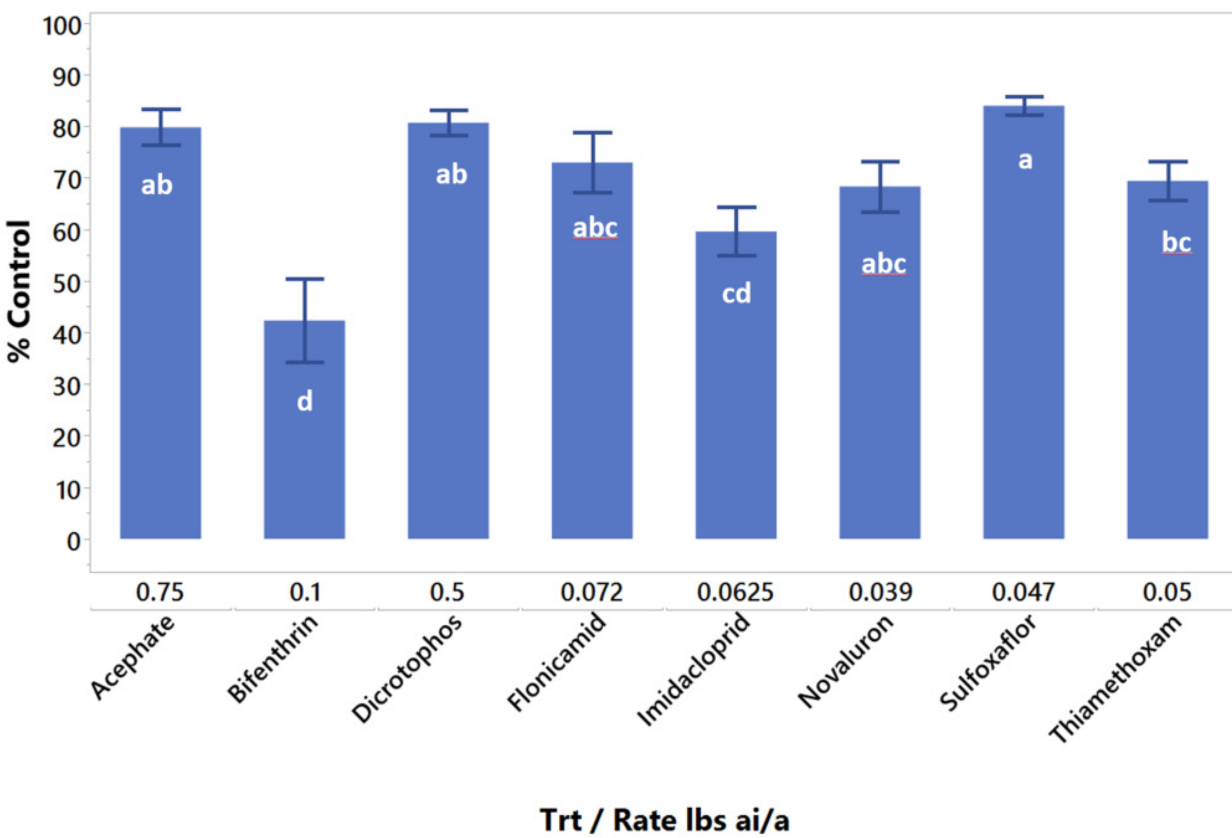

Figure 1. Mean efficacy of selected insecticides for control of tarnished plant bug 2-4 DAT in 2014 – 2018.

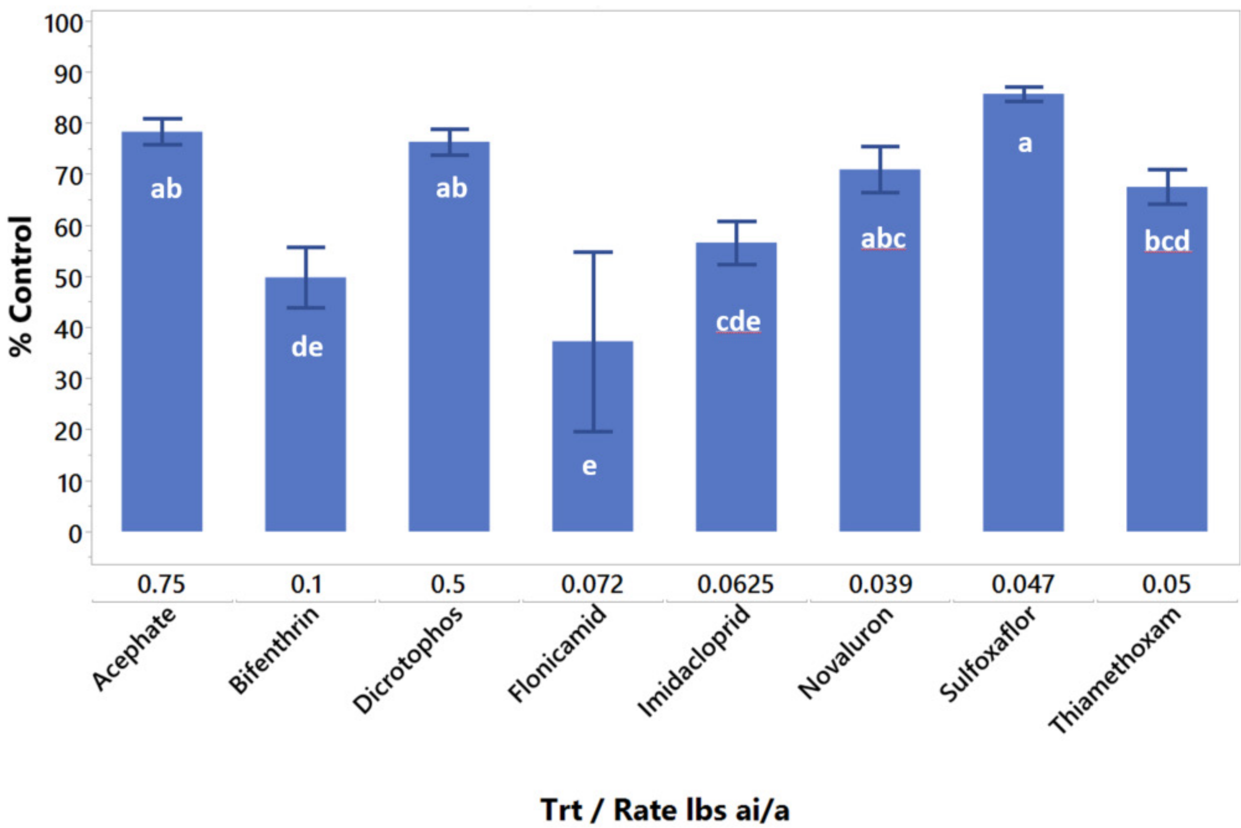

Figure 2. Mean efficacy of selected insecticides for control of tarnished plant bug 5-8 DAT in 2014 – 2018.

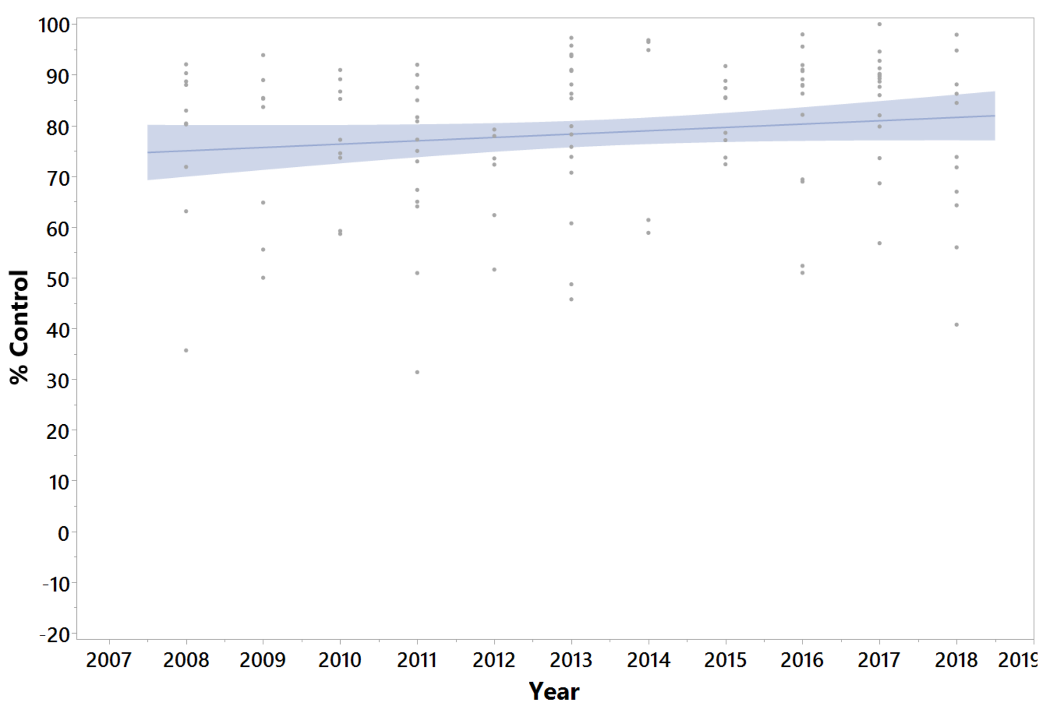

Figure 3. Organophosphate (acephate 0.75 lbs ai/a, dicrotophos 0.5 lbs ai/a) efficacy over time P = 0.11

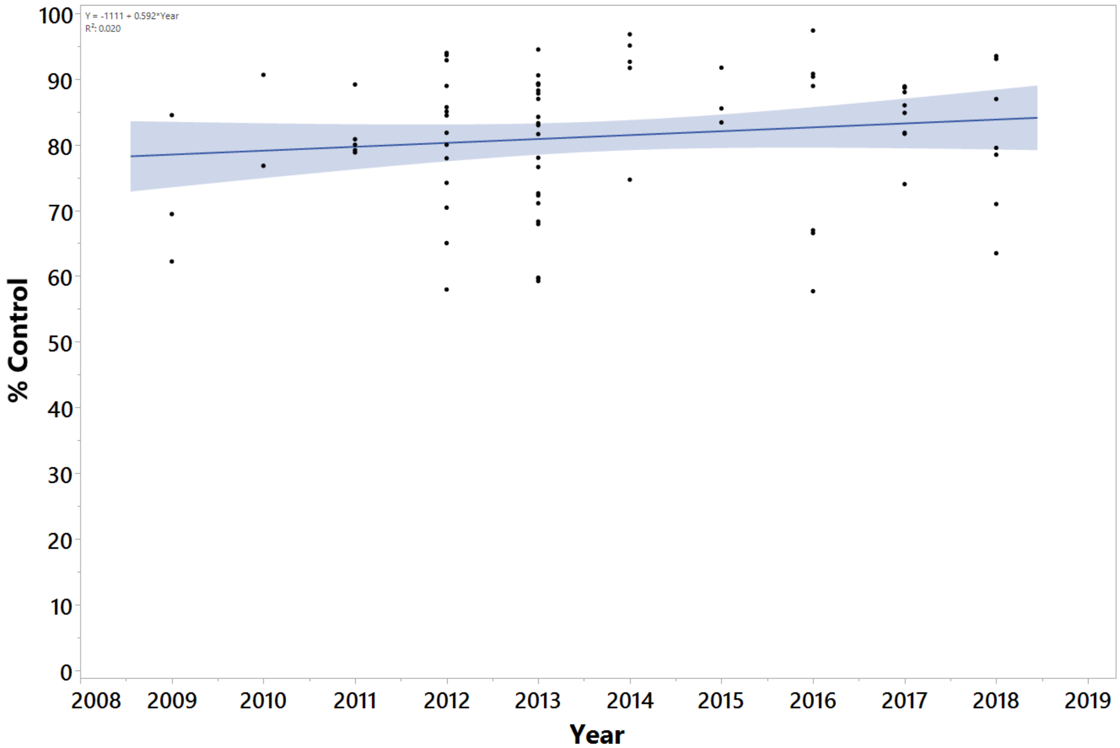

Figure 4. Sulfoxamine (sulfoxaflor 0.047 lbs ai/a) efficacy over time P = 0.21

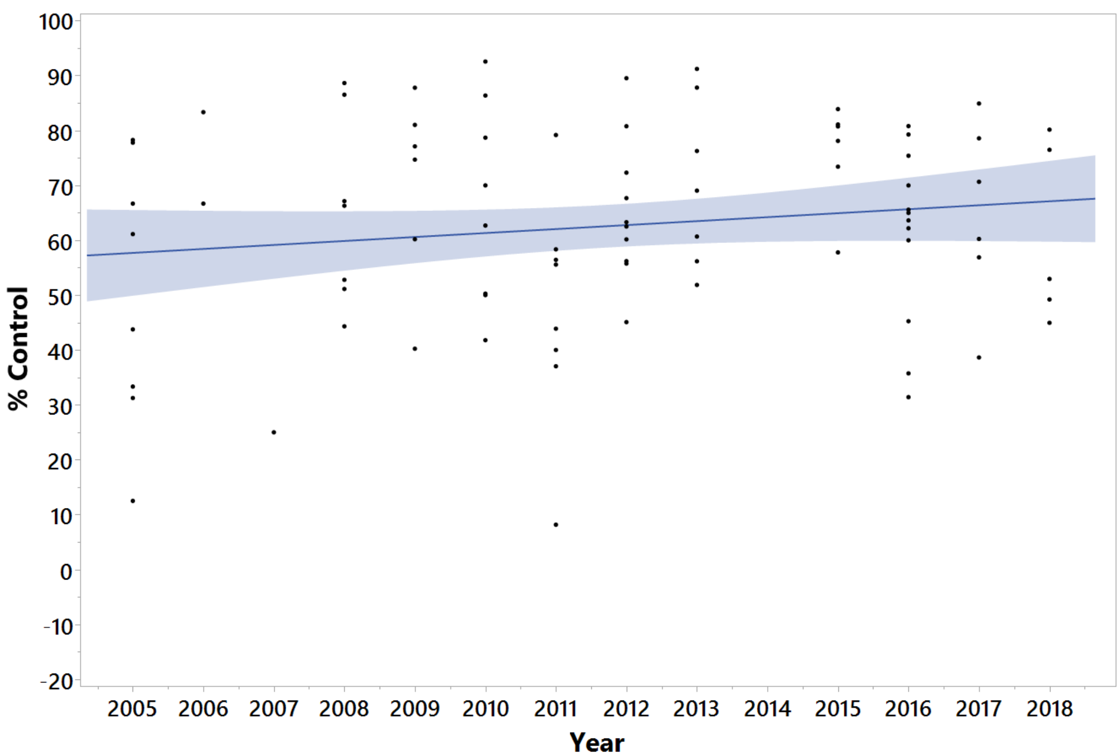

Figure 5. Neonicotinoid (acetamiprid 0.013 lbs ai/a, imidacloprid 0.0625 lbs ai/a, thiamethoxam 0.05 lbs ai/a) efficacy over time P = 0.15

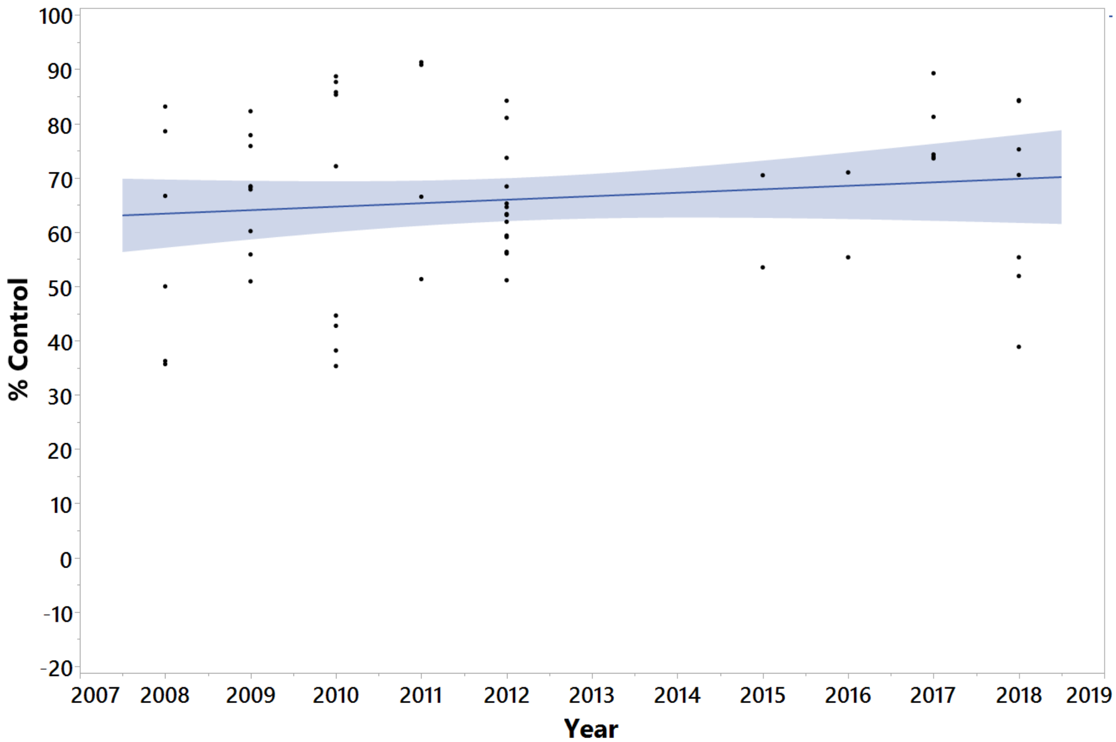

Figure 6. Benzoylurea (novaluron 0.039 lbs ai/a) efficacy over time P = 0.72

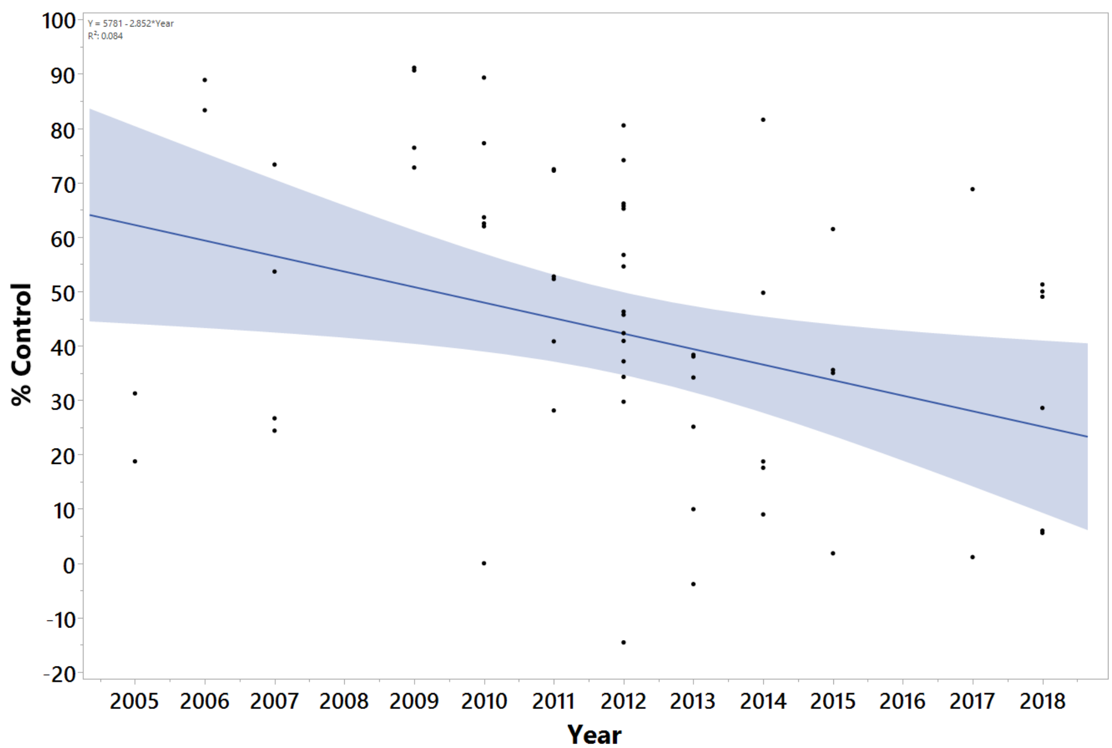

Figure 7. Pyrethroid (bifenthrin 0.1 lbs ai/a, gamma-cyhalothrin 0.015 lbs ai/a, lambda-cyhalothrin 0.03 lbs ai/a, zeta-cypermethrin 0.025) efficacy over time P = 0.02

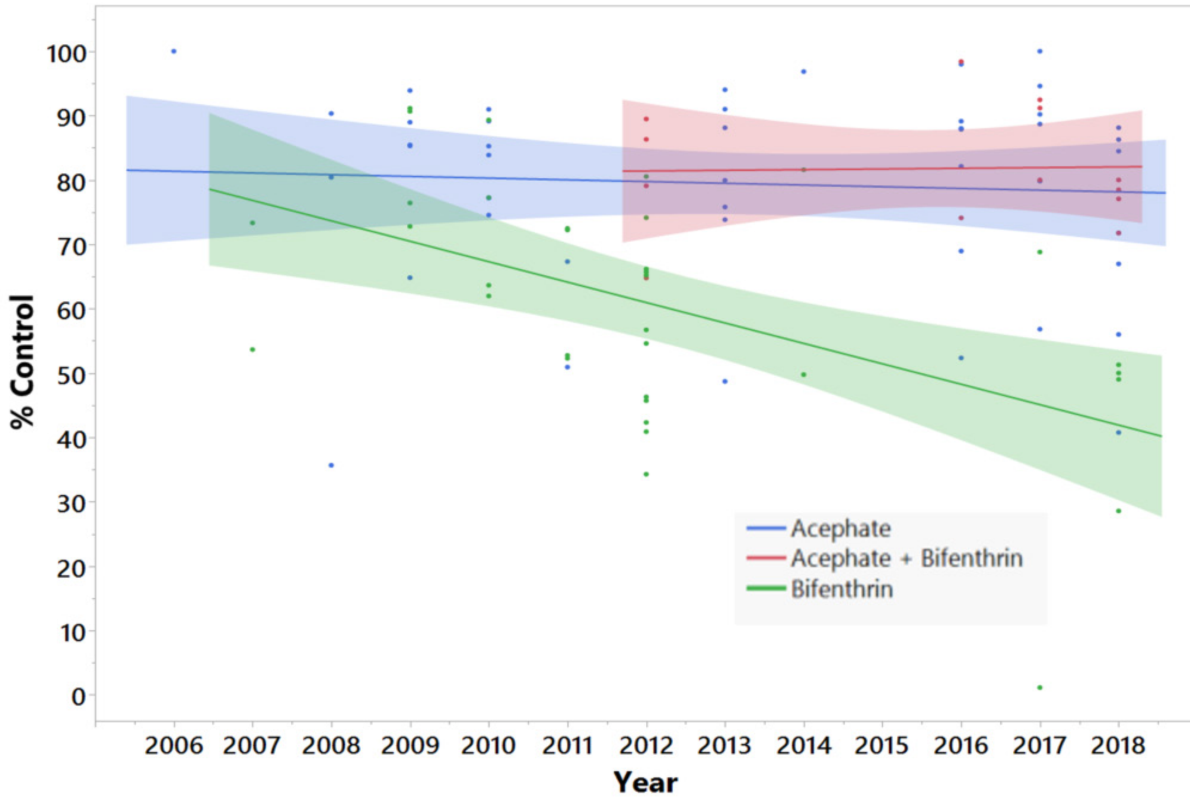

Figure 8. Efficacy of acephate (0.75 lbs ai/a), bifenthrin (0.1 lbs ai/a), and acephate (0.75 lbs ai/a) + bifenthrin (0.1 lbs ai/a) over time.

Summary

Over the past five years acephate, dicrotophos, novaluron, and sulfoxaflor provided the greatest mean control of tarnished plant bug in cotton at 2-4 DAT and 5-8 DAT. Analysis indicated that pyrethroids were the only insecticide class of the tested to have reduced efficacy across the analyzed time period. Even though there was a reduction in pyrethroid efficacy over that time, a mixture of bifenthrin (a pyrethroid) + acephate continued to provide increased control over acephate alone. Several studies including Snodgrass 2009 and Parys 2018 found great variation in the susceptibility of tarnished plant bugs to multiple insecticide classes across locations. Because the majority of the data included in this analysis was from one location, including data from other locations across the mid-South would help provide a better idea of how insecticides have performed over time.

Acknowledgements

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References

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