INSECT CONTROL IN MISSISSIPPI WITH TRANSFORM

Andrew Adams
Jeff Gore
Don Cook
Mississippi State University
Stoneville, MS
Angus Catchot
Mississippi State University
Starkville, MS

Abstract

A series of experiments were conducted from 2008-2011 to determine the optimum use strategy of Transform for cotton aphid, *Aphis gossypii* (Glover), and tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), control in Mississippi. Plots were 4 rows on 40 inch centers X 50ft.They were sampled at multiple intervals with a 2.5 ft. drop cloth. Transform rates of 0.71 and 1.1 oz/A reduced tarnished plant bug numbers below that in the untreated check. Rates of Transform ranging from 1.44 to 2.14 oz/A provided better control of tarnished plant bug than the lower rates. Bioassay and field experiments were conducted to determine the susceptibility of cotton aphids to Transform. Centric (thiamethoxam) was used as a representative of the neonicotinoid class in the bioassays and compared to Transform. The mean LC 50 for Centric increased from less than 5 ppm in 2008 to 25 ppm in 2011. The Mean LC 50 for Transform ranged from 1.28 to 2.67 ppm during the same time period. Cotton aphid control with Transform was compared to Centric (thiamethoxam), Intruder (acetamiprid), Carbine (flonicamid), and Trimax Pro (imidacloprid) in field studies. In that study, Transform performed as good or better than the insecticides currently labeled for cotton aphid control in cotton. Transform will be an important insecticide to manage both tarnished plant bug and cotton aphid in cotton.

Introduction

Tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), is a primary pest of cotton in Mississippi and is almost exclusively controlled with insecticides (Snodgrass and Gore 2007). Cotton is the main crop damaged by plant bugs (Snodgrass et al. 1983). Boll weevil *Anthonomus grandis* (Boheman), eradication and the use of transgenic cotton expressing endotoxin proteins of *Bacillus thuringiensis* (Bt) has resulted in a reduction of broad-spectrum insecticide applications (Roberts 1999).

Populations of plant bugs in the Mississippi delta are highly resistant to pyrethroid, organophosphate, and cyclodiene insecticides (Snodgrass 1996, Snodgrass and Gore 2007). Recommended insecticides for plant bug control in the mid-south include the organophosphates acephate, dicrotophos, malathion, methamidophos, and profenofos; the carbamate oxamyl; the neonicotinoids imidacloprid and thiamethoxam; and the insect growth regulator novaluron (Snodgrass and Gore 2007). Application numbers targeting plant bugs have steadily increased from approximately 1 application in 1986 to approximately 8 applications in 2011 on average. Also insecticide use rates have increased from 0.25 ib/ai per acre with acephate and Bidrin in 1993 to a full pound of acephate and half a pound of Bidrin in 2008. A regional trial conducted throughout the Mid-South showed that the average level of control with currently labeled insecticides ranged from 35% with Intruder (1.1 oz/A) to 64% with acephate (1 Ib ai/A). Other currently labeled insecticides fell within this range.

The cotton aphid, *Aphis gossypii* (Glover), is a secondary pest of cotton. They have a history of rapidly developing resistance to insecticides (Gore et al 2010). Currently, cotton aphids are primarily controlled with the neonicotinoid class of chemistry. This class includes imidacloprid (Trimax Pro, Bayer CropScience), thiamethoxam (Centric, Syngenta Crop Protection), acetamiprid (Intruder, Nisso America), and clothianidin (Belay, Valent USA). Additionally, imidacloprid (Gaucho Grande and Aeris) and thiamethoxam (Cruiser and Avicta) are labeled as seed treatments. Studies by Gore et al. (2010), showed that susceptibility of cotton aphids to the neonicotinoid class of insecticides is declining. Where field control failures are observed, the pyridine carboxamide, flonicamid (Carbine, FMC Corp.), has shown good control of cotton aphid.

Sulfoxaflor (Transform, Dow AgroSciences) is the first insecticide from the sulfoximine chemical class. It has been tested for the past three years as GF-2032 2SC and GF-2372 50WG against cotton aphids and tarnished plant bugs in

the mid-South. The results suggest that this insecticide will be an important rotational component for the management of cotton aphids and tarnished plant bug. This paper will summarize recent testing of this insecticide and suggest the optimum use strategies for Transform in an overall IPM program.

Methods

Foliar Control with Sulfoxaflor

A series of experiments were conducted to compare Transform to other currently labeled insecticides. Plots were sprayed with a John Deere high clearance sprayer with a compressed air system calibrated to deliver 10 GPA through TX – 8 hollow cone nozzles at 47 psi and 5 mph. Plots were 4 rows centered on 40 inch centers X 50ft. Applications were made when tarnished plant bug or cotton aphid populations reached >3x threshold. For tarnished plant bug, samples were taken using a 2.5 ft black drop cloth at multiple intervals. The number of plant bug nymphs and adults were counted. Summaries of plant bug control with currently registered insecticides and sulfoxaflor were obtained after collecting data from multiple experiments. For cotton aphid, samples were taken by counting the number of aphids on 5 leaves. Data were analyzed with analysis of variance.

Aphid Collections

Aphid populations were collected from cotton fields at multiple locations in Arkansas, Louisiana, Tennessee, and Mississippi from 2008 – 2011. Heavily infested leaves were removed from plants in each field, placed in paper bags, and transported to the laboratory within 24h after collection.

Leaf Dip Procedures

Cotton leaves were removed from non-treated plants at the Delta Research and Extension Center in Stoneville, MS. Leaves were then washed in a mild solution of soap and water in order to remove any naturally occurring aphid populations. After rinsing the leaves and allowing them to air dry a no. 18 cork borer was used to cut a 23 mm disc from each leaf. Serial dilution of sulfoxaflor (GF-2032 2SC, 2 ib ai/Gal) and thiamethoxam (Centric 40WG, 40% w/w) were prepared in 500 ml beakers. Each leaf disc was dipped in one of the dilutions swirled for 5 seconds and then placed on a wire rack with the bottom side facing up and allowed to dry.

A 1% agar solution was prepared and an approximate 2mm deep layer was dispensed into 55mm diameter Petri dishes. Once the agar was completely dry, the treated leaf discs were placed bottom side up in the Petri dishes. The discs were lightly pressed into the agar with a pair of forceps in order to seal the edges of the leaf disc. Ten discs were used for each dose (one per dish) and a minimum of 6 doses (plus non-treated) were used for each bioassay. Five aphids were placed onto the underside of each leaf disc with a very fine camel hair brush. Each dish was covered with a small piece of cotton cloth and the lid was attached and secured using a rubber band. Mortality was rated at 48 and 72 hours after treatment. Aphids were considered dead if they could not take a coordinated step after being gently stroked several times with a fine paint brush. Data were subjected to Probit analysis in SAS.

Results

Transform provided good control of tarnished plant bugs. In a trial comparing multiple rates of Transform compared to acephate and Centric, rates ranging from 1.45 to 2.14 oz/A provided good control (Figure 1). Rates of 0.71 and 1.1 oz/A reduced tarnished plant bug numbers below that in the untreated check. A summary of data collected from multiple trials showed that there were no differences between 1.45 and 2.14 oz when compared at 1-4 days after treatment (Figure 2). In contrast, there was a significant difference between these rates when compared at 5-8 days after treatment. Additionally, research has shown that Transform co-applied with a pyrethroid in a tank-mix resulted in increased control of tarnished plant bugs (Figure 3). Based on these results, it appears that rates ranging from 1.44 to 2.14 oz/a will provide the levels of control that are needed to manage tarnished plant bugs. Added benefits in terms of increased residual control may be observed with 2.14 oz/A compared to 1.44 oz/A. Also, the addition of a pyrethroid for bollworm control will likely improve control of tarnished plant bugs compared to Transform alone.

From 2008 – 2011 a total of 24 populations were tested in a leaf dip bioassay to determine the susceptibility of cotton aphids to thiamethoxam and sulfoxaflor. Of these locations, all but 7 were previously exposed to an overspray with a neonicotinoid, and each location was planted using a neonicotinoid seed treatment. Data suggest that the Mean LC 50 increased from less than 5 ppm in 2008 to 25 ppm in 2011. The Mean LC 50 of sulfoxaflor ranged from 1.28 to 2.67 during the same time period. Data from a field experiment showed a reduction of cotton aphids

from 474 per 5 leaves in the untreated check to 281 per 5 leaves using Centric at 2 oz/acre compared to11.5 per 5 leaves using Transform at 1.45 oz/acre (Figure 4). In early season studies, Transform targeting cotton aphids at 0.75 oz/acre combined with other plant bug materials provided acceptable control of plant bugs to 7 DAT (Figure 5).

Discussion

Transform will provide an important rotational partner to alternate with current plant bug and aphid insecticides. The optimum use strategy for Transform in the current IPM program will include 1-2 applications during the late squaring to early flowering period. These applications will target both tarnished plant bugs and cotton aphids. Additional applications may be needed during the peak flowering stage to control tarnished plant bugs. At peak flowering, 2.14 oz/A may be needed to get the maximum level of control. Addition of a pyrethroid with 1.45 oz/A will also provide good control of tarnished plant bug. Transform will not be a "silver bullet" for tarnished plant bug control, but will be a valuable tool in the overall insecticide use program to manage tarnished plant bug and cotton aphid in Mississippi cotton. Continued IPM approaches including insecticide rotation, 4-5 day spray intervals, early season host management, crop earliness, and tank mixes will be necessary to prolong the use of this product.

Reference

Gore. J., D. Cook, A. Catchot, R. Leonard, G. Lorenz, and S. Stewart. 2010. Bioassays and management of cotton aphids with neonicotinoids and sulfoxaflor. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council of America, Memphis, TN. New Orleans, LA., 4-7 Jan. 2010. pp. 1207-1210.

Roberts, P. 1999. Post eradication insect control: was it worth it? Proceedings Beltwide Cotton Conference, National Cotton Council of America, Memphis, Tn., pp. 832-834

Snodgrass, G. L. 1996. Glass-vial bioassay to estimate insecticide resistance in adult tarnished plant bugs (Heteroptera: Miridae). J. Econ. Entomol. 89: 1053-1059.

Snodgrass, G.L., and J. Gore. 2007. A laboratory bioassay for monitoring resistance in tarnished plant bug populations to neonicotinoid insecticides. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council of America, Memphis, TN. New Orleans, LA., 9-12 Jan 2007. pp. 297-301.

Snodgrass, G. L., W. P. Scott, and J. W. Smith. 1983. An annotated list of the host plants of *Lygus lineolaris* (Hemiptera: Miridae) in the Arkansas, Louisiana, and Mississippi delta.

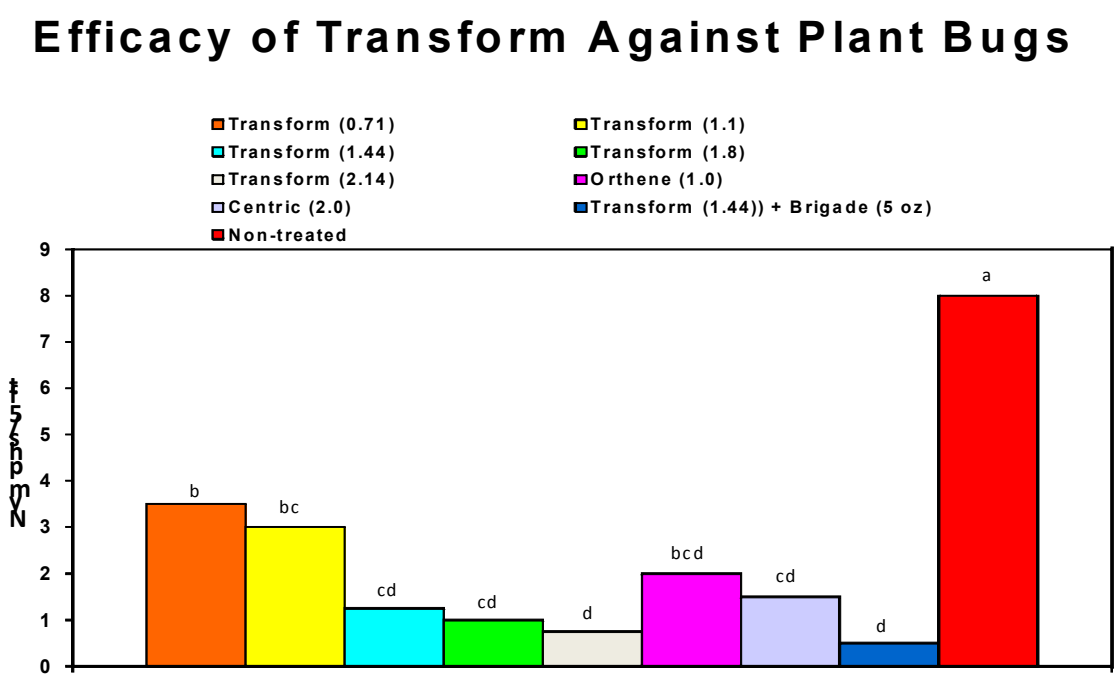


Figure 1: Efficacy of Transform across multiple use rates

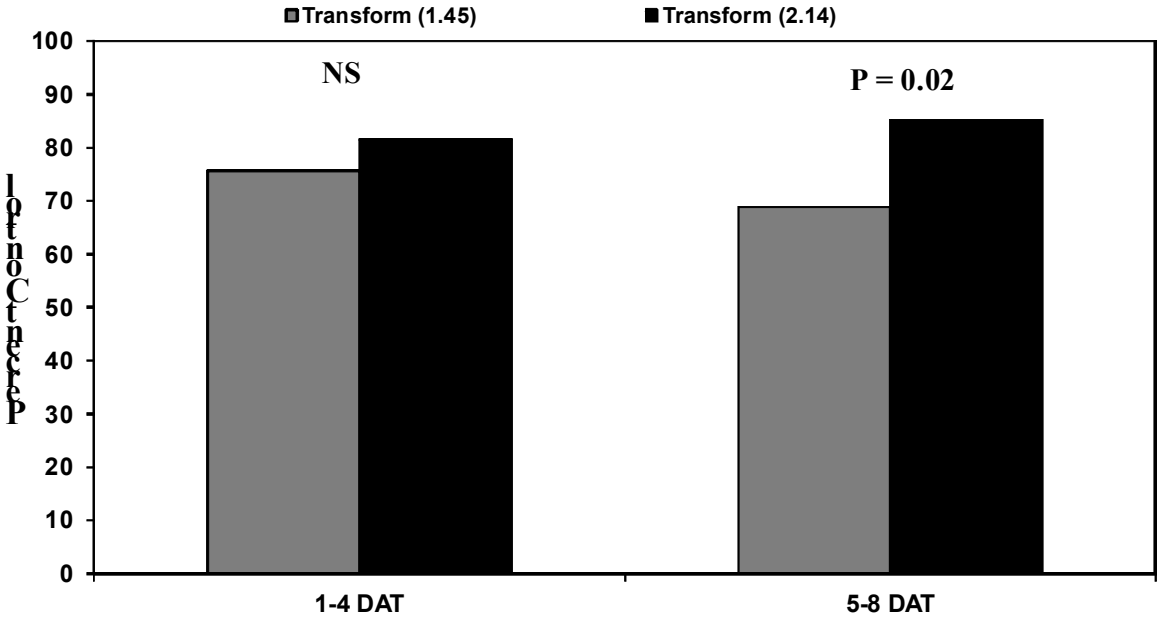


Figure 2: Residual of application rates of Transform in Stoneville, Ms. 2011

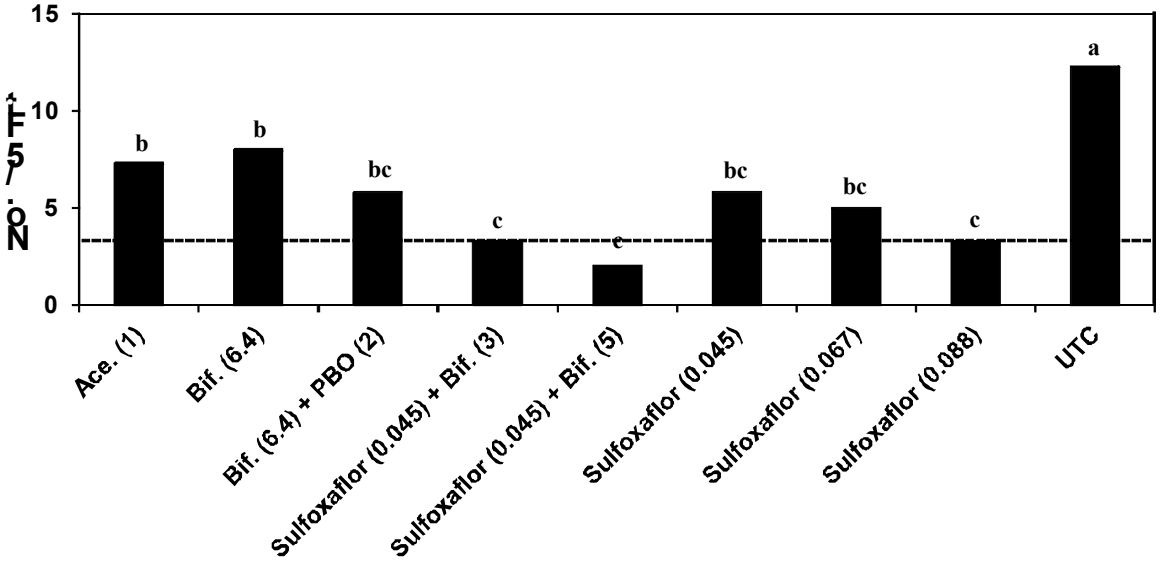
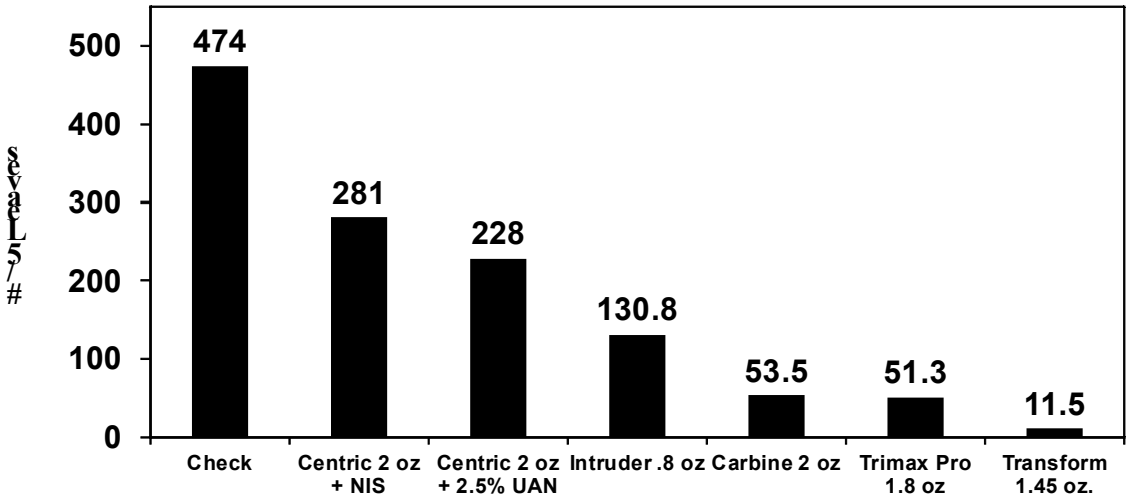


Figure 3: Tarnished plant bug management Stoneville, Ms. 2010, 9 DAT.



Centric LC50 = 10.71 at 72h

Figure 4: Foliar aphid control Grenada, Ms. 2011with Transform.

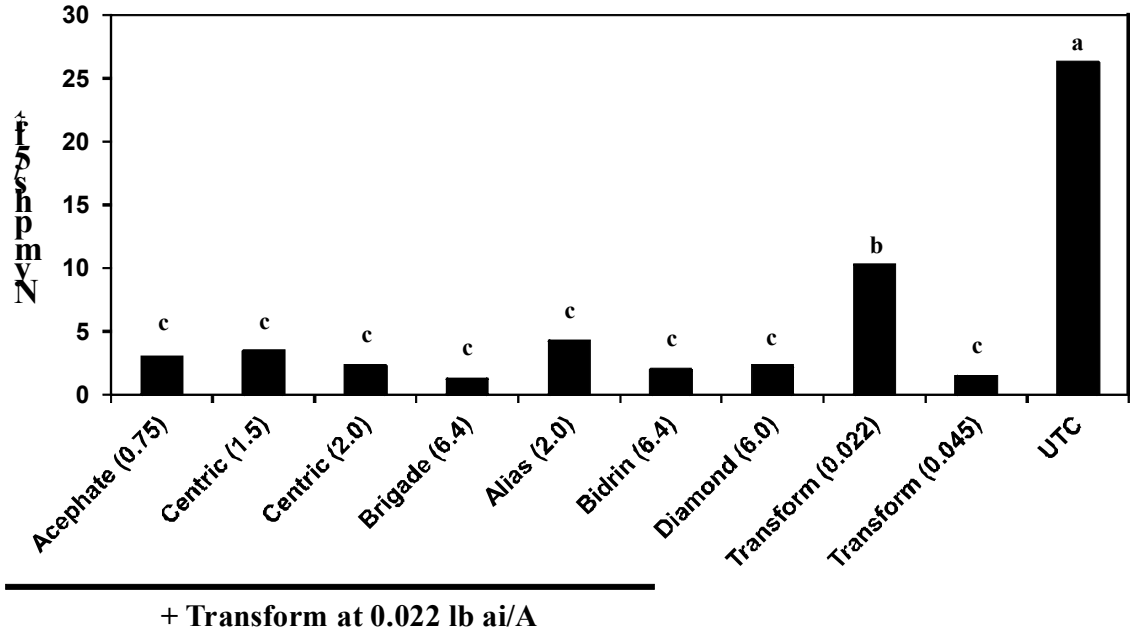


Figure 5: Tarnished plant bug management with Transform 7 DAT Stoneville, Ms.at .75oz/acre