

IMPACT OF SPRAY ADJUVANTS ON INSECTICIDE PERFORMANCE**D. R. Cook****J. Gore****Mississippi State University****Stoneville, MS****S. D. Stewart****University of Tennessee****Jackson, TN****G. M. Lorenz****University of Arkansas****Lonoke, AR****A. L. Catchot****Mississippi State University****Starkville, MS****B. R. Leonard****LSU AgCenter****Winnsboro, LA****D. S. Akin****University of Arkansas****Monticello, AR****G. Studebaker****University of Arkansas****Keiser, AR****F. R. Musser****Mississippi State University****Starkville, MS****Abstract**

During 2011, trials were conducted to evaluate the impact of spray adjuvants on the performance of insecticides against thrips and tarnished plant bugs. None of the adjuvants tested significantly improved thrips control with Bidrin or Acephate and the addition of some adjuvants reduced thrips control in some trials. The performance of Bidrin or Transform against tarnished plant bug was not significantly improved with the addition of any of the adjuvants tested. In some trials the addition of some adjuvants negatively impacted plant bug control. Our studies indicate that with the organophosphate insecticides, Acephate and Bidrin, the addition of an adjuvant did not provide a benefit. Other insecticides from different classes or that are more systemic in action may respond differently.

Introduction

Thrips are one of the first insect pests to infest cotton after emergence. Much of the cotton planted receives an insecticide seed treatment. In some cases, the seed treatments are supplemented with foliar insecticides. Under poor growing conditions and extended or severe thrips infestations, growers may apply more than one foliar application for thrips control.

The tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), is the major insect pest of cotton within the Mid-South region. The tarnished plant bug is the target of more insecticide applications than any other insect the Mid-South (Williams 2008) with some growers making up to 15 foliar insecticide applications for plant bug control. Furthermore, tarnished plant bug is becoming resistant to many of the products currently used for their control, with few if any replacements expected in the near future (Hollingsworth et al. 1997, Holloway et al. 1998, Snodgrass and Scott 1988, Snodgrass 1994, Snodgrass and Elzen 1995, Snodgrass 2006). Currently, additional control measures are being investigated to help manage tarnished plant bug infestations.

There are numerous spray adjuvants available. Many of these substantially improve the performance of post emergence herbicides. The objective of these studies was to evaluate the impact of selected spray adjuvants representing different categories on the performance of insecticides applied to manage thrips and tarnished plant bugs.

Materials and Methods

Across LA, AR, MS, and TN, trials were conducted during 2011 to evaluate the impact of spray adjuvants on insecticide performance against thrips (two trials) and tarnished plant bug (six trials). Trials were conducted on research stations and grower farms where sufficient infestation levels were encountered. The insecticides included in these trials included Acephate 90S (0.15 lb AI/acre) and Bidrin 8E (0.15 lb AI/acre) for thrips trials and Bidrin 8E (0.3 lb AI/acre) and Transform 50WG (1 oz prod./acre) for the plant bug trials. The adjuvants included in these trials represent several classes according to the Compendium of Herbicide Adjuvants (Young 2010) and are detailed in Table 1.

Table 1. List of adjuvants used as treatments, adjuvant category, and application rates.

Adjuvant	Adjuvant Category	Rate (%v/v)
Agri-Dex	Crop Oil Concentrate	1%
Penetrator Plus	Crop Oil Concentrate + Deposition Agent + Buffering Agent	1%
Induce	Nonionic Surfactant	0.25%
Dyne-Amic	Methylated Seed Oil + Organo-Silicone Surfactant + Nonionic Surfactant	0.5%
Kinetic	Organo-Silicone Surfactant	0.25%
Dyna-Pak	Nonionic Surfactant + Nitrogen Source	1%
Hyper-Active	Deposition, Retention, and Wetting Agent	0.25%
Cohere	Nonionic Spreader-Sticker	0.125%
Cide-Winder	High Surfactant Oil Concentrate	0.5%

In each trial, one insecticide (acephate, Bidrin, or Transform) was applied at a standard rate with all or selected adjuvants listed in Table 1. The insecticide was also applied alone and a non-treated control was included. Treatments were applied with high clearance ground applicators calibrated to deliver 10 GPA. Thrips densities were determined at 2 to 6 days after treatment (DAT) by sampling five plants from the center two rows of each plot using a whole plant washing procedure described by Burris et al. (1990) or a similar procedure. Densities of tarnished plant bugs were determined by sampling 10 row feet from the center two rows with a black drop cloth at 2 to 7 DAT. Data were subjected to ANOVA procedures, with means separated according to Fisher's Protected LSD.

Results

During 2011 in Tennessee, the addition of Penetrator Plus or Kinetic to Bidrin significantly reduced control of thrips compared to Bidrin applied alone (Figure 1). Also, Dyne-Amic or Hyper-Active applied with Bidrin provided thrips control similar to that of Bidrin applied alone. During 2011 in Louisiana, at 2 DAT all of the acephate – adjuvant combinations, except acephate plus Cide Winder, resulted in significantly poorer thrips control compared to acephate alone (Figure 2). At 6 DAT, plots treated with acephate plus Penetrator Plus, Induce, Kinetic, Hyper-Active, or Cohere had significantly more thrips immatures per 5 plants compared to plots treated with acephate alone.

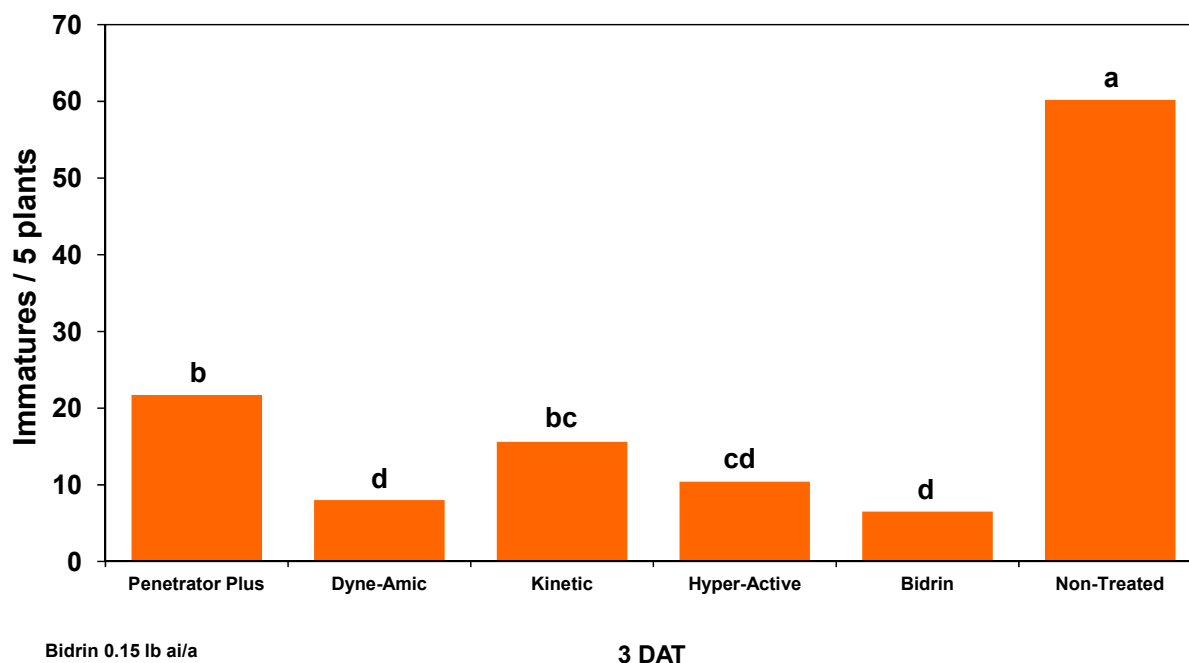


Figure 1. Impact of selected adjuvants on the performance of Bidrin against thrips at 3 DAT, 2011 TN.

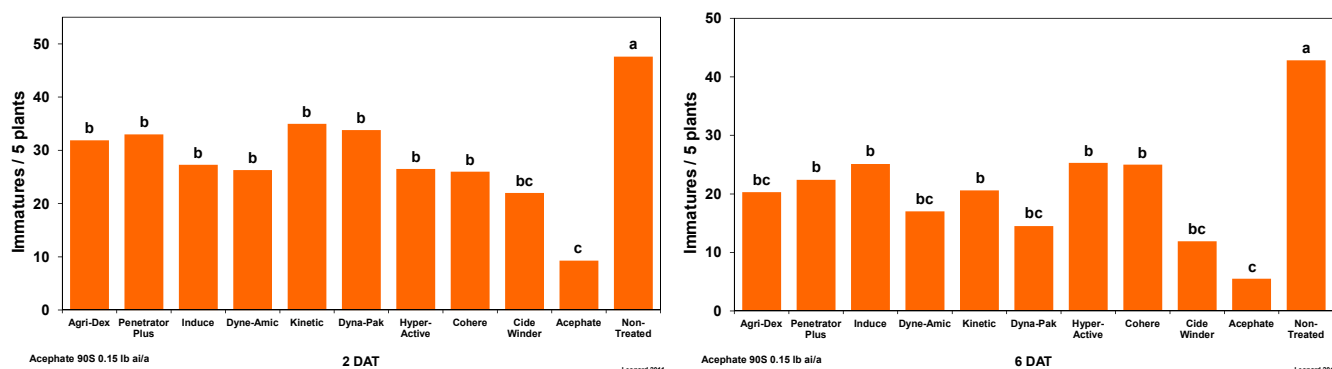


Figure 2. Impact of selected adjuvants on the performance of acephate against thrips at 2 and 6 DAT, 2011 LA.

In Arkansas, the addition of an adjuvant to Bidrin did not significantly improve control of tarnished plant bug nymphs compared to Bidrin applied alone at 4 days after the first or second application (4 DAT1, 4 DAT2) (Figure 3). At 4 DAT1, plots treated with Bidrin plus Agri-Dex had significantly fewer plant bug nymphs compared to plots treated with Bidrin plus Penetrator Plus or Bidrin plus Dyna-Pak. At 4 DAT2, plots treated with Bidrin plus Penetrator Plus, Induce, Dyne-Amic, Dyna-Pak, Hyper-Active, or Cide Winder had significantly more plant bug nymphs compared to plots treated with Bidrin alone. In Tennessee, the addition of an adjuvant to Bidrin did not significantly improve plant bug control compared to Bidrin applied alone (Figure 4). Also, plots treated with Bidrin plus Penetrator Plus or Cide Winder had significantly more plant bug nymphs compared to plots treated with Bidrin alone. In Mississippi, the addition of an adjuvant to Transform or Bidrin did not significantly improve control of tarnished plant bug nymphs (Figures 5 and 6). At 2 DAT, the addition of Dyne-Amic or Cide Winder to Bidrin significantly reduced plant bug control compared to Bidrin alone (Figure 6). At 7 DAT, the addition of Agri-Dex, Penetrator Plus, Induce, Kinetic, or Cide Winder significantly reduced plant bug control compared to Bidrin alone.

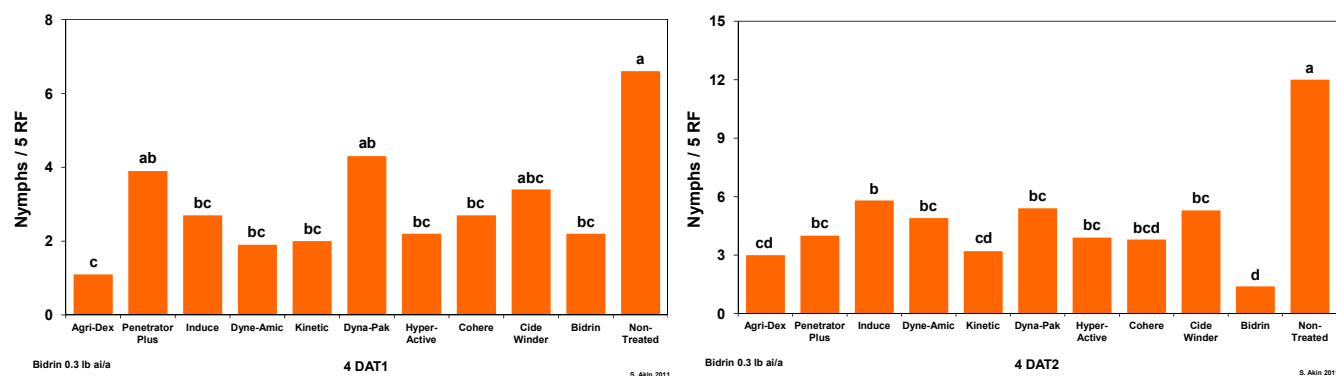


Figure 3. Impact of selected adjuvants on the performance of Bidrin against tarnished plant bug at 4 days after treatment 1 and 2, 2011 AR.

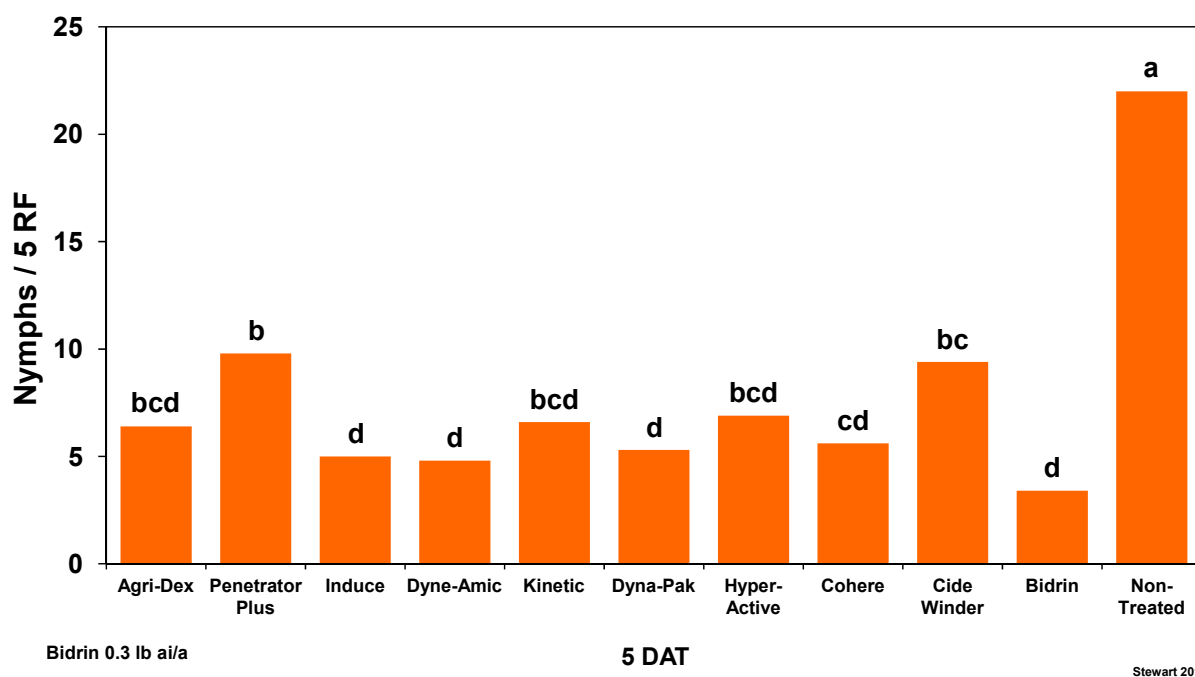


Figure 4. Impact of selected adjuvants on the performance of Bidrin against tarnished plant bug at 5 DAT, 2011 TN.

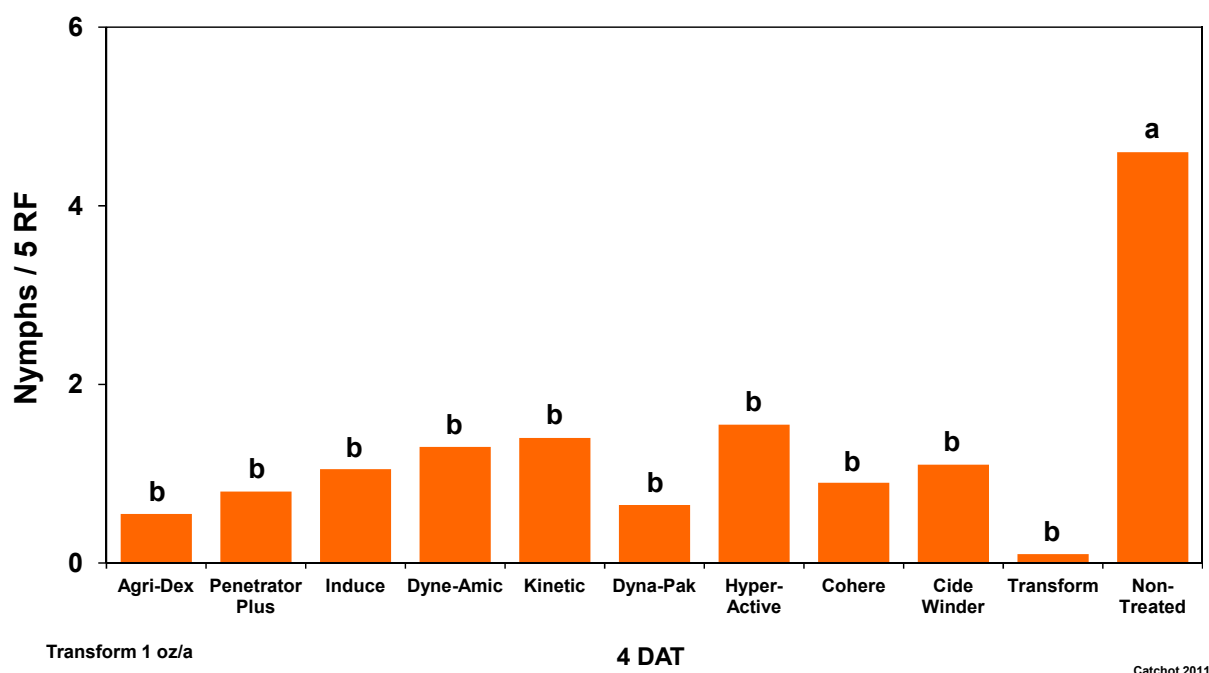


Figure 5. Impact of selected adjuvants on the performance of Transform against tarnished plant bug at 4 DAT, 2011 MS.

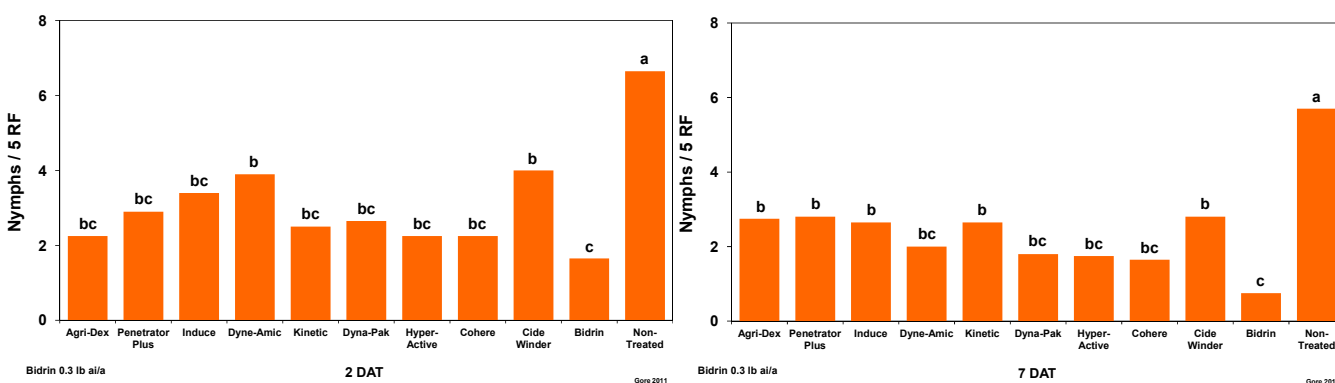


Figure 6. Impact of selected adjuvants on the performance of Bidrin against tarnished plant bug at 2 and 7 DAT, 2011 MS.

Cook et al. (2009) reported that the addition of Dyne-Amic to Radiant significantly improved thrips control. However, the addition of an adjuvant to Bidrin or Acephate did not significantly improve thrips control and the addition of some adjuvants reduced thrips control in some trials. The addition of an adjuvant to Bidrin or Transform did not significantly improve plant bug control in any of the trials. In some trials, the addition of some adjuvants negatively impacted plant bug control. Fife et al. (1996) reported that the addition of an organo-silicone surfactant to imidacloprid (Provado) significantly improved control of cotton aphid compared to imidacloprid applied alone in some instances. Our studies indicate that with the organophosphate insecticides Acephate and Bidrin the addition of an adjuvant did not provide a benefit. Other insecticides from different classes or that are more systemic in action may respond differently.

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References

- Cook, D. R., A. L. Catchot, and J. F. Smith. 2009. Efficacy of selected foliar treatments against thrips on cotton, 2008. *Arthropod Management Tests* 34:F22, doi: 10.4182/amt.2009.F22.
- Fife, J. H., B. R. Leonard, K. D. Torrey, and J. B. Graves. 1996. Efficacy of insecticides against cotton aphid in the Macon Ridge region of Louisiana, 1995. *Arthropod Management Tests* 21:249-2250.
- Hollingsworth, R. G., D. C. Steinkraus, and N. P. Tugwell. 1997. Response of Arkansas populations of tarnished plant bugs (Heteroptera: Miridae) to insecticides, and tolerance differences between nymphs and adults. *J. Econ. Entomol.* 90: 21-26.
- Holloway, J. W., B. R. Leonard, J. A. Ottea, J. H. Pankey, J. B. Graves and G. Snodgrass. 1998. Insecticide resistance and synergism of pyrethroid toxicity in the tarnished plant bug, *Lygus lineolaris* (Palisot de Beauvois), pp. 947-949. *In Proc. 1998 Beltwide Cotton Conf., National Cotton Council, Memphis, TN.*
- Snodgrass, G. L., W. P. Scott, and J. W. Smith. 1984. Host plants and seasonal distribution of the tarnished plant bug, *Lygus lineolaris* (Hemiptera: Heteroptera: Miridae), in the delta of Arkansas, Louisiana and Mississippi. *Environ. Entomol.* 13: 110-116.
- Snodgrass, G. L., and W. P. Scott. 1988. Tolerance of the tarnished plant bug to dimethoate and acephate in different areas of the Mississippi Delta, pp. 294-295. *In Proc. 1988 Beltwide Cotton Conf., National Cotton Council, Memphis, TN.*
- Snodgrass, G. L. 1994. Pyrethroid resistance in a field population of the tarnished plant bug in cotton in the Mississippi Delta, pp. 1186-1187. *In Proc. 1994 Beltwide Cotton Conf., National Cotton Council, Memphis, TN.*
- Snodgrass, G. L., and G. W. Elzen. 1995. Insecticide resistance in a tarnished plant bug population in cotton in the Mississippi Delta. *Southwestern Entomol.* 20: 317-323.
- Snodgrass, G. L. 2006. Status of resistance in tarnished plant bug, pp. 1633-1638. *In Proc. 2006 Beltwide Cotton Conf., National Cotton Council, Memphis, TN*
- Young, B. 2010. Compendium of Herbicide Adjuvants. <http://www herbicide-adjuvants.com/>.
- Williams, M. R. 2008. Cotton insect losses, <http://www.entomology.msstate.edu/resources/tips/cotton-losses/data/>.