THE IMPACT AND MANAGEMENT OF TWO SPOTTED SPIDER MITE (Tetranychus urticae) IN COTTON

William Scott
Fred Musser
Mississippi State University
Mississippi State, MS
Angus Catchot
Mississippi State University Extension Service
Mississippi State, MS
Jeff Gore
Don Cook
Mississippi State University DREC
Mississippi State, MS

Abstract

The two spotted spider mite, *Tetranychus urticae* Koch, is a major pest of many horticultural and agricultural crops worldwide including cotton. An experiment was conducted to investigate early season inter-specific competition between two spotted spider mites and thrips in the presence of seed treatments and their impacts on cotton yields. Treatments were arranged as a randomized complete block design with 4 replications and 18 treatments. There was not a significant correlation between two spotted spider mites and thrips. Foliar applications of acephate during the third/fourth true leaf stage caused a significant increase in two spotted spider mite densities. The presence of thrips and mites reduced cotton yields.

Introduction

The two spotted spider mite, *Tetranychus urticae* Koch, will infest cotton throughout the season and can be damaging from seedling emergence through the late flowering period (Kavousi et al. 2009). It was the third most damaging pest of cotton during 2009 in Mississippi, with a total of 6,627 bales lost (Williams 2010). Early season two spotted spider mite infestations combined with early season thrips infestations can cause significant yield losses in cotton. Foliar applications of acephate (Orthene 90SW) are common for thrips management throughout the Southeast. Spider mite infestations have become more prevalent during the early season in cotton fields since 2005 (Catchot 2010). Spider mites reached new heights in 2005 becoming the 3rd most damaging pest in cotton (Williams 2005). The use of seed treatments in the absence of Temik is believed to have contributed to these infestations, but has not been fully investigated. Many biotic and abiotic factors such as insecticides, weather, and beneficial insects may affect the ability of two spotted spider mites to thrive. Common beneficial insects, such as thrips, control spider mite densities in early season cotton. Thrips are also a yield diminishing pest in early season cotton. Foliar applications of acephate 90WS to control thrips is believed to increase spider mite populations, but no research has been conducted to confirm this. The current research project will address the interaction of two spotted spider mites and thrips in the presence of seed treatments and foliar applications of acephate.

Materials and Methods

A field experiment using artificial infestations of two spotted spider mite was conducted in Starkville, MS in 2010 to investigate the interactions between thrips, two spotted spider mites, at-planting insecticides and foliar applications of acephate on cotton yields. Cotton variety Phytogen 375 WRF was planted on May 14, 2010. Treatments were in a three-way factorial arrangement within a randomized complete block design with four replications. The main effects included three levels of at-planting insecticides, three levels of foliar thrips management, and two levels of two spotted spider mite infestation. The at-planting insecticide treatments included aldicarb (Temik 15G, Bayer CropSciences) at 3.5 lbs. product per acre; Aeris (Imidicloprid + thiodicarb, Bayer CropScience) applied to the seed at a rate equivalent to 0.375 mg/ai imidacloprid per seed, and a non-treated control. The foliar thrips management treatments include acephate applied at 0.25 lb ai/A during the 1-2 leaf stage, acephate applied at 0.25 lb ai/A during the 3-4 leaf stage, and a non-treated control. The two spotted spider mite levels included infested and non-infested.

Treatments will consist of:

1. Temik, no spray, No mites
2. Temik, no spray, Infested
3. Temik, Spray 1-2 leaf for thrips, No mites
4. Temik, Spray 1-2 leaf for thrips, Infested
5. Temik, Spray 3-4 leaf for thrips, No mites
6. Temik, Spray 3-4 leaf for thrips, Infested
7. Aeris, no spray, No mites
8. Aeris, no spray, Infested
9. Aeris, Spray 1-2 leaf for thrips, No mites
10. Aeris, Spray 1-2 leaf for thrips, Infested
11. Aeris, Spray 3-4 leaf for thrips, No mites
12. Aeris, Spray 3-4 leaf for thrips, Infested
13. No seed Treatment, no spray, No mites
14. No seed Treatment, no spray, Infested
15. No seed Treatment, Spray 1-2 leaf for thrips, No mites
16. No seed Treatment, Spray 1-2 leaf for thrips, Infested
17. No seed Treatment, Spray 3-4 leaf for thrips, No mites
18. No seed Treatment, Spray 3-4 leaf for thrips, Infested

For the two spotted spider mite infested plots, a colony maintained in the greenhouse on green beans at Mississippi State University was used. The green bean plants infested with mites will be placed on top of the cotton plants to ensure migration to the cotton. All treatments that require two spotted spider mite infestations were infested at the first true leaf stage of cotton development on May 24, 2010. Only the center two rows in each plot were infested. For the foliar treatments, acephate 90 WSP was applied at 0.25 lb/acre on May 24, 2010 and June 2, 2010 for the 1-2 leaf and 3-4 leaf applications, respectively. Sampling of thrips and mites were recorded 10-14 days after emergence on May 24, 2010 and 3-5 days after infestations and foliar treatment on May 28, 2010 and June 4, 2010 for the 1-2 leaf and 3-4 leaf applications respectively, to determine thrips densities, spider mite densities and spider mite injury on cotton plants. Two spotted spider mite injury was rated on a scale of 0-5 based on reddening and stippling of leaves. Plant injury was recorded in the following manner: 0) No damage, 1) light stippling occurring on sporadic leaves, 2) Stippling and reddening occurring on 15-20% of leaves, 3) 20-50% of leaves have a definite reddening on basal portion of leaves, 4) >50% of leaves contain extensive reddening of entire leaves and area where leaves begin to excise and 5) all plants show complete reddening and damage. Thrips densities were determined using a whole plat washing technique. Five plants were randomly removed from the center two rows or equally from all four rows of each plot. Samples were placed in a plastic bag. In the laboratory, all plants were placed inside a glass jar filled with a soap/water solution. All plants were washed through a series of sieves and thrips were collected on filter paper. The filter paper was placed in a petri dish and thrips numbers were counted under a microscope (Musser and Catchot 2005). Number of adult thrips, immature thrips, adult spider mites, and immature spider mites were recorded separately. At the end of the season, the center two rows of each plot were harvested and cotton lint weights were recorded. Data were analyzed as a 3 x 3 x 2 factorial in SAS.

Results and Discussion

Two spotted spider mite densities varied among at-planting insecticides, acephate applications, and two spotted spider mite infestation. Aeris seed treatment had significantly higher two spotted spider mite densities when compared to Temik and the untreated control (Fig. 1). The foliar acephate application during the 3-4 leaf stage of cotton growth had significantly higher mite densities when compared to the 1-2 leaf cotton growth stage and the untreated control (Fig. 2). The interaction between at-planting insecticides and foliar acephate application was significant. Aeris seed treatment with an acephate application at the 3-4 leaf cotton growth stage had significantly higher mite densities than other treatments (Fig. 3). Yield from the experiment shows significant differences in seedling insecticides and two spotted spider mite infestations. Aeris seed treatment resulted in significantly higher yields than the untreated control (Fig. 4). Two spotted spider mites significantly reduced cotton yields at each of the at-planting insecticide treatments when averaged across foliar acephate applications (Fig. 5).

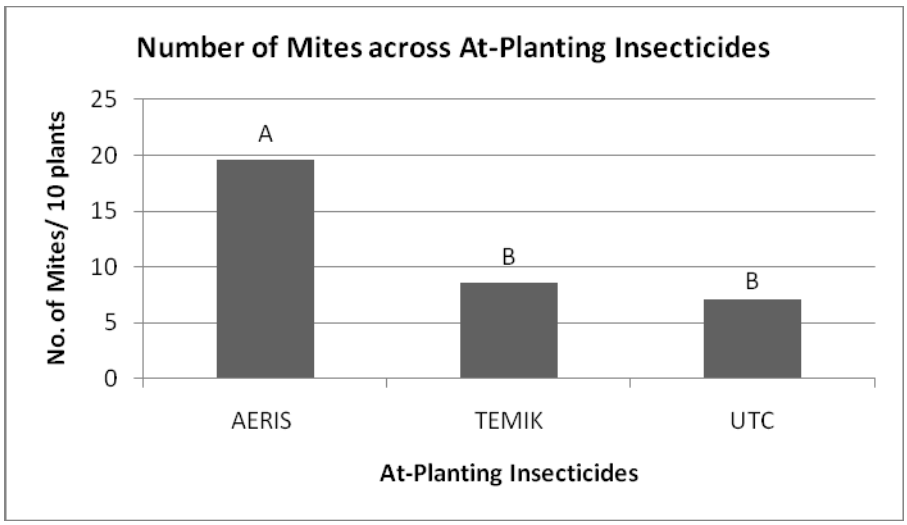

Figure 1. Two spotted spider mite densities across At-Planting Insecticides.

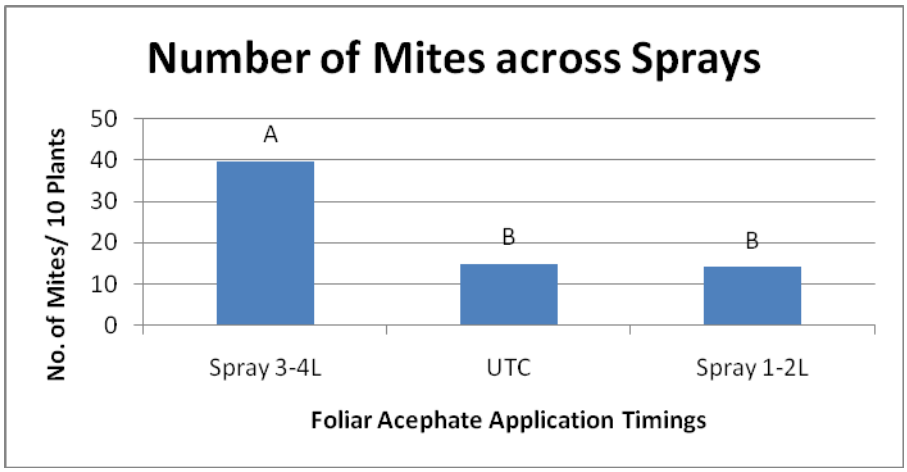

Figure 2. Two spotted spider mite densities across foliar acephate applications.

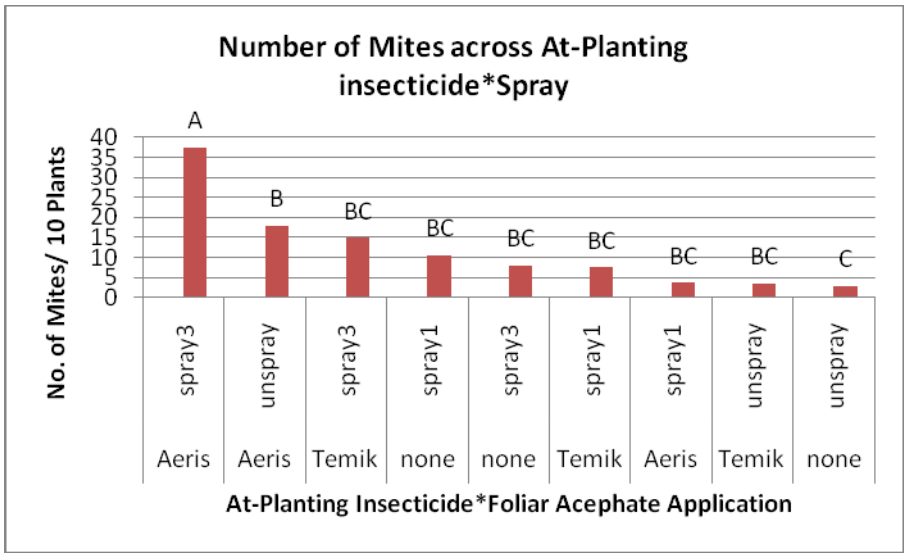

Figure 3. Two spotted spider mite densities across at-planting insecticides and foliar acephate applications.

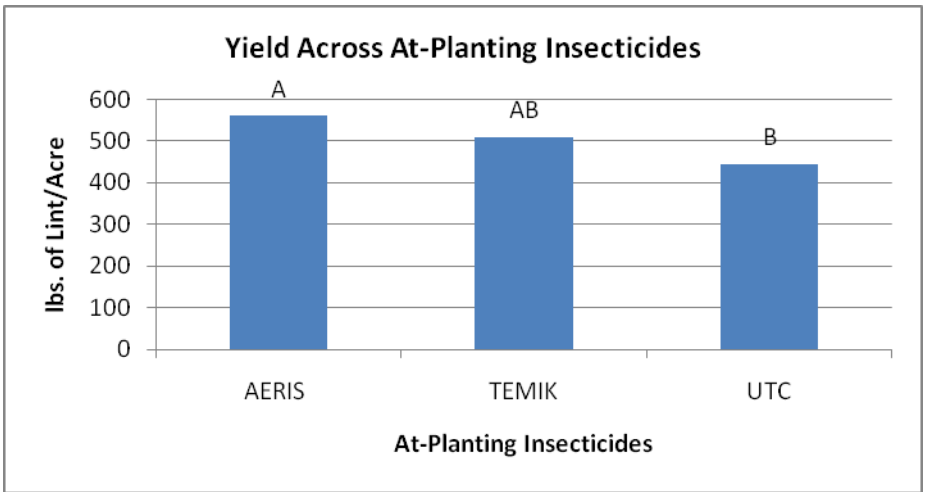

Figure 4. Yield across at-planting insecticides.

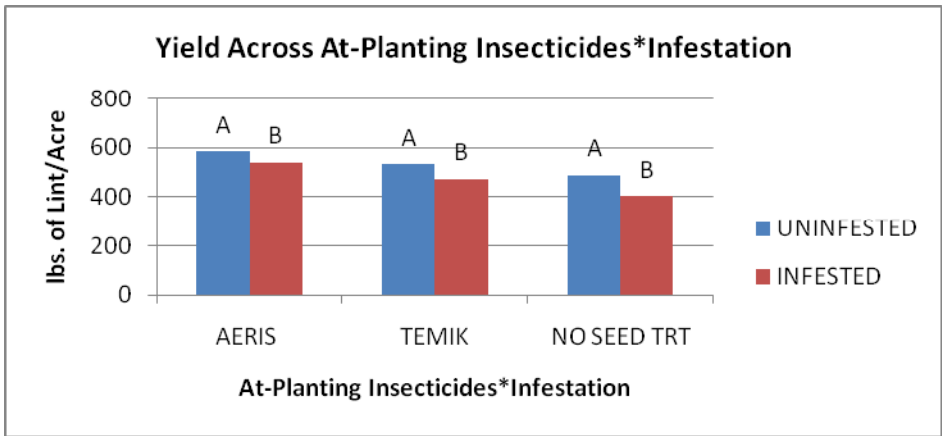

Figure 5. Yield across at-planting insecticides by infestations.

Summary

Two spotted spider mite densities were significantly higher in the Aeris treated plots when averaged across all other factors. The increase in two spotted spider mite densities in the Aeris treatment cannot be fully explained by the current experiment. Temik has been shown to reduce spider mite densities in previous research (Smith 2009). Also, extensive thrips injury was observed in the untreated plots and leaf area was reduced. These two factors may have contributed to the results observed in this experiment. The acephate application at the 3-4 leaf growth stage of the cotton had significantly more two spotted spider mites when compared to the 1-2 leaf application and the untreated control. This increase in two spotted spider mite populations may be associated with multiple abiotic and biotic factors. These data will need further analyzed to better explain this influx in spider mite densities. When spider mite densities are analyzed across at-planting insecticides and acephate application, aeris at the 3-4 leaf acephate application had significantly higher mite densities when compared to all other treatments. Although the Aeris treatment had significantly higher two spotted spider mite densities than other at-planting insecticides, yields were not significantly different between Aeris and Temik. This cannot be fully explained with these data, especially since spider mites significantly reduced yields. Primary conclusions include: 1). Aeris had significantly higher two spotted spider mite densities compared to other treatments; 2). Foliar application of acephate at the 3-4 leaf growth stage significantly increased spider mite densities; 3). Two spotted spider mites significantly reduced yield. These preliminary data serve as an initial attempt to understand the complex interactions between thrips management and two spotted spider mite infestations in cotton and the experiment will be repeated in 2011.

Acknowledgements

The authors thank Cotton Incorporated for the funding of this project, Mississippi State University and numerous support staff for their support and contributions to this research project.

References

Catchot, A. 2010. Two Spotted Spider Mite.

Kavousi, A., H. Chi, K. Talebi, A. Bandani, A. Ashouri and V. H. Naveh 2009. Demographic Traits of Tetranychus urticae (Acari: Tetranychidae) on Leaf Discs and Whole Leaves. J. Econ. Entomol. 1022: 595-601

Musser, F. R. and A. L. Catchot 2005. Roundup-Insecticide Synergy Evaluation on Thrips. Arth. Manag. Test: F32.Smith, J. F. 2009. At-Planting Treatment Effects on Spider Mite Populations. Cotton Beltwide Conferences, San Antonio, Texas.

Williams, M. R. 2005. Mississippi Summary Cotton Insect Losses – 2005

Williams, M. R. 2010. Cotton Insect Losses 2009. http://www.entomology.msstate.edu/resources/tips/cotton-losses/data/2009/2009loss.php