MITICIDE EFFICACY, THRESHOLD EVALUATION AND IMPACT OF FERTILITY ON SPIDER MITE OUTBREAKS

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Abstract

Spider mites are an occasional pest of cotton in the Texas High Plains. Outbreaks of mites in cotton tend to be associated with high early-season rainfall and insecticide applications targeting other pests. In this study we investigated the efficacy of various miticides to twospotted spider mite, the relationship between spider mites, nitrogen fertility and aphids, and we evaluated the Texas spider mite action threshold. Of the products evaluated for efficacy, Oberon, Epi-Mek, Athena, GWN 1708 and Portal all provided good efficacy. The addition of 28% UAN to Oberon did not appear to enhance efficacy. Zeal appeared somewhat weaker or slower acting, and Brigade gave knock down, but sustained efficacy was questionable. We observed a significant negative linear relationship between yield and mite density in our efficacy tests. The current Texas spider mite action threshold for cotton (50% of plants showing reddening) appears to be a valid threshold, although thresholds below 50% need further investigation. We found that mite populations tend to be greater with decreasing N fertility and fewer aphids. This may be a result of an antibiotic effect on spider mites from previous aphid feeding, a plant stress relationship, or the presence of predators in the higher nitrogen plots associated with more aphids.

Introduction

The two types of spider mites that are often a pest of cotton in the Texas High Plains are the *Tetranychus urticae* (twospotted spider mite) and the *Tetranychus cinnabarinus*e (carmine spider mite). Outbreaks of spider mites often occur in a wet growing season, probably due to mites building up on weedy host and then moving into cotton (known as the green bridge effect). Mite outbreaks are also often associated with insecticide applications such as neonicotinoids, pyrethroids and acephate, targeting other pests. Spider mite outbreaks may also be associated with plants suffering stress. There are two types of classifications for spider mite damage, phase I and phase II. Phase I is early stages of damage where only stipules appear on the leaves. Phase II damage is actual reddening of the leaves. Phase II damage is associated with decreased photosynthesis and yield loss. The current Texas action threshold is to treat when 50% of the plants observed show noticeable signs of reddening (phase II damage). However, there has not been sufficient data supporting this threshold. Producers in the Texas High Plains rely primarily on Oberon and Brigade to manage these outbreaks. Because Oberon is generally considered an expensive treatment, the cheaper alternative Brigade is sometimes preferred. However, Brigade is sometimes ineffective or the mite population resurges.

There were three objectives addressed concerning this pest. The first objective was to field validate the current Texas spider mite action threshold. There has not been sufficient data supporting this threshold. The current Texas threshold is to treat when 50% of the plants observed show noticeable signs of reddening. Second, efficacy for different miticides was tested and last, we observed the effects of fertility on spider mite outbreaks.

Materials and Methods

Threshold Evaluation

This test was conducted on a farm near Idalou, TX. The variety FM 9180 B2F was grown on forty-inch rows irrigated with a drip system. This test was implemented to observe the effects of different percentage levels of spider mite damage on cotton. The test was a randomized complete block design with four replicates. Treatments were 30, 50, 70 and 90% damage. A “glance and go” method was used to calculate the ratio of hits to misses. A

"hit" being was recognized as apparent phase II damage and a "miss" recognized as no apparent damage. 25 samples were recorded per plot. When the ratio of "hits" to "misses" reached the designated percentage, a treatment of Oberon at 4 fl-oz. per acre was initiated. Lint samples were taken using a hand basket stripper on 8 October. One one-thousandth of an acre was harvested and ginned at the ginning facility at the Texas AgriLife Research and Extension Center in Lubbock, TX and yields were then recorded.

Efficacy

These tests were conducted on a farm near Idalou, TX. The variety FM 9180B2F was grown on forty-inch rows irrigated with a drip system. These tests were performed to observe the efficacy of different miticides. Test one was a randomized complete block design with four replicates. The treatments for test one are included in Table 1.

Table 1.

Treatment[a]	Active Ingredient	Rate/ ac
GWN 1708	Fenazaquin	16 fl-oz
GWN 1708	Fenazaquin	20 fl-oz
GWN 1708	Fenazaquin	24 fl-oz
Portal	Fenproximate	1 pt
Athena	Abamectin 1.33% + Bifenthrin 8.84%	13.45 fl-oz
Brigade	Bifenthrin	6.4 fl-oz
Untreated		

[a]*All treatments included NIS, Dyne-Amic at 0.25% v/v*

Test two was a randomized complete block design with four replicates. The treatments for test one are included in Table 2.

Table2.

Treatment[a]	Active Ingredient	Rate/ ac
Oberon 4SC	Spiromesifin	4 fl-oz
Oberon 4SC	Spiromesifin	8 fl-oz
Oberon 4SC + 28% UAN	Spiromesifin	4 fl-oz
Oberon 4SC + 28% UAN	Spiromesifin	8 fl-oz
Epi-Mek	Abamectin	4 fl-oz
Zeal	Etoxazole	1 oz
Untreated		

[a]*All treatments*

Five leaves per plot were collected, bagged and processed using a spider mite brush. Motiles and eggs were counted in a one-inch diameter section in the middle of the plate. Lint samples were taken using a hand basket stripper on 8 October. One one-thousandth of an acre was harvested and ginned at the ginning facility at the Texas AgriLife Research and Extension Center in Lubbock, TX and yields were then recorded.

Fertility

This was an aphid fertility test planted at the Halfway Research Station near Plainview, TX. The purpose of this test was to observe the effects of different levels of fertility on aphid outbreaks. This test was a randomized complete block design with five replicates. Treatments were 0, 50, 100, 150 and 200 lbs. nitrogen per acre. A spider mite outbreak was observed late in the year and numbers were observed. Ten leaves per plot were collected, bagged and processed using a mite brush. Motiles and eggs were counted in a one-inch diameter section in the middle of the plate.

All data were analyzed using ANOVA, and means were separated using an F protected LSD ($P \leq 0.05$). Regression analyses were performed using Sigma Plot.

Results and Discussion

Threshold Evaluation

The current action threshold in Texas cotton for spider mites is treatment when 50% of the plants observed show signs of spider mite damage. However, this threshold is empirically derived and needs validation. In this test, the 30% treatment was missed. The ratio of hits to misses was already over 30% when we entered the field. Based on our test, treatments initiated at each percentage stopped the damage from progressing further (Figure 1).

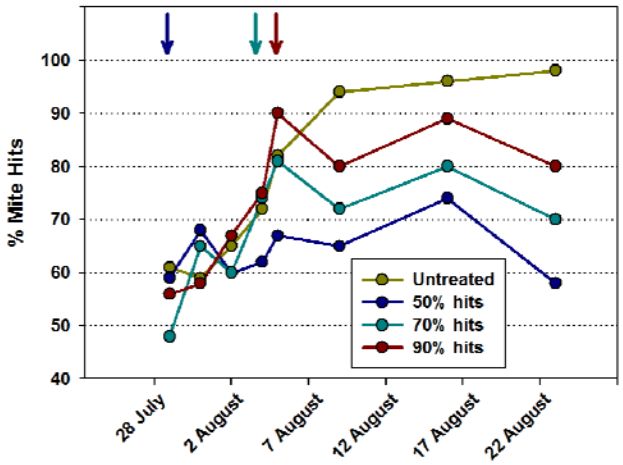

Figure 1. Percent of plants with spider mite hits in the form of leaf reddening.

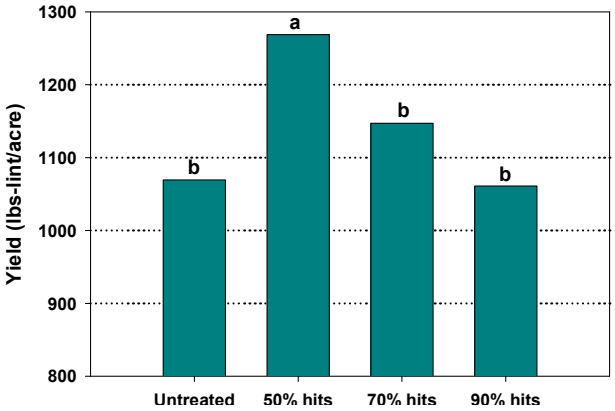

Figure 2. Columns capped with the same letter are not significantly different based on an F protected LSD ($P > 0.05$).

Yield data suggests that the current Texas threshold of a treatment at 50% damage is valid. 90% damage did not differ from the untreated check while 70% only yielded slightly more than the previously mentioned two. 50% was significantly higher than the other test treatments yielding over 100 lbs. more. (Figure 2) The 30% treatment was missed. Future testing will determine if treatments under 50% are advised.

Efficacy Test One

Data from test one revealed that all products tested showed efficacy. Pre-treatment counts showed no significant differences in mite density. Spider mite counts at 6 and 12 DAT showed that all products were significantly lower than the untreated check. 19 DAT counts showed the same, with the exception of Brigade, which showed some resurgence. This is explained by Brigade's known inability to provide residual effects (Figure 3).

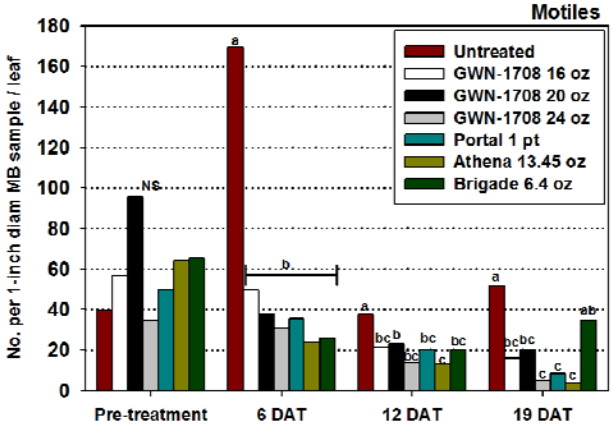

Figure 3.Test 1columns capped by the same letter are not significantly different based on an F protected LSD ($P > 0.05$).

Yield data from the test one plots showed no significant differences (Figure 4A). Yields of the tested products were all higher than the untreated check, but not significantly different. When the test was initiated, the ratio of "hits" to "misses" was at 72%. Significant damage had already been sustained at the test site, resulting in compromised yield data. However, a strong relationship between mite density and yield was observed (Figure 4B).

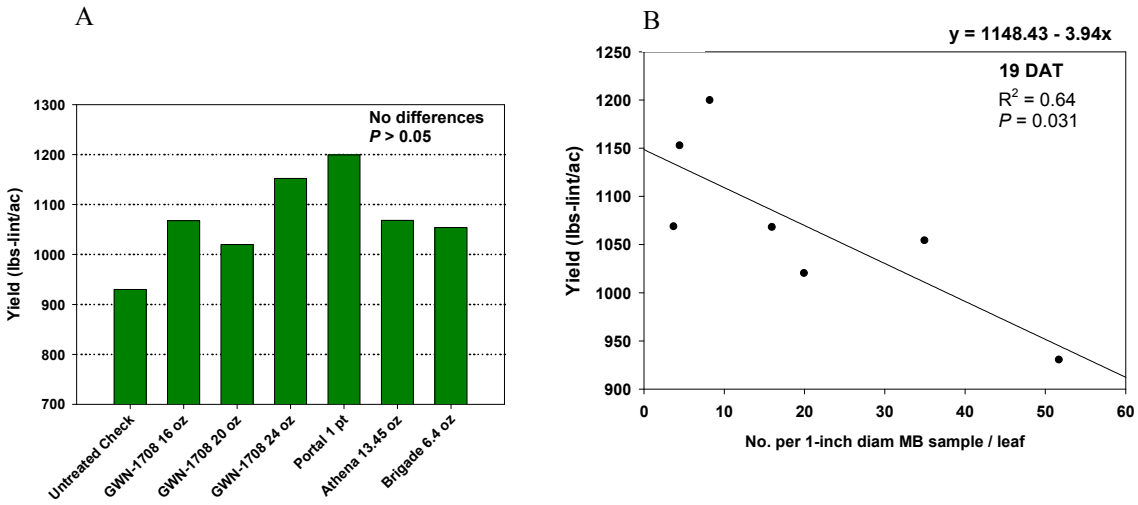

Figure 4. (A) No significant differences in yield in Test 1. (B) Relationship between yield and mite density in Test 1.

Efficacy Test Two

Data from test two revealed that all products showed efficacy. Pre-treatment counts showed no significant differences. Spider mite counts at 6 DAT showed that all products were significantly lower than the untreated check, with the exception of the low rate of Oberon + UAN and Zeal. Zeal appeared to be weak or slow acting. Zeal's primary mode of action results in egg sterility. It had little impact on adult mites. Thus, products such as Zeal often appear slow acting. UAN was included with Oberon in attempt to increase efficacy, however, it did not appear to help. Oberon was extremely efficacious without UAN. All treatments were significantly lower than the untreated check at 12 DAT. At 19 DAT the population of spider mites crashed (Figure 5).

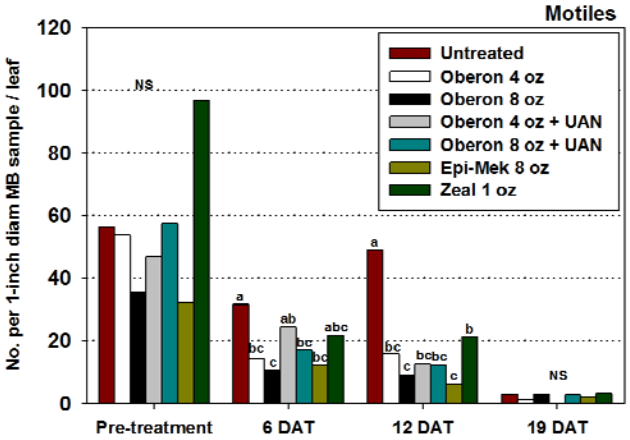

Figure 5. Columns capped with the same letter are not significantly different based on an F protected LSD ($P > 0.05$).

Yield data from the test two plots showed no significant differences (Figure 6A). When the test was initiated, the ratio of "hits" to "misses" was at 72%. Yield data of the tested products were all higher than the untreated check, but were not significantly different. Significant damage had already been sustained at the test site, likely resulting in compromised yield data. However, a strong relationship between spider mite density and yield was observed (Figure 6B).

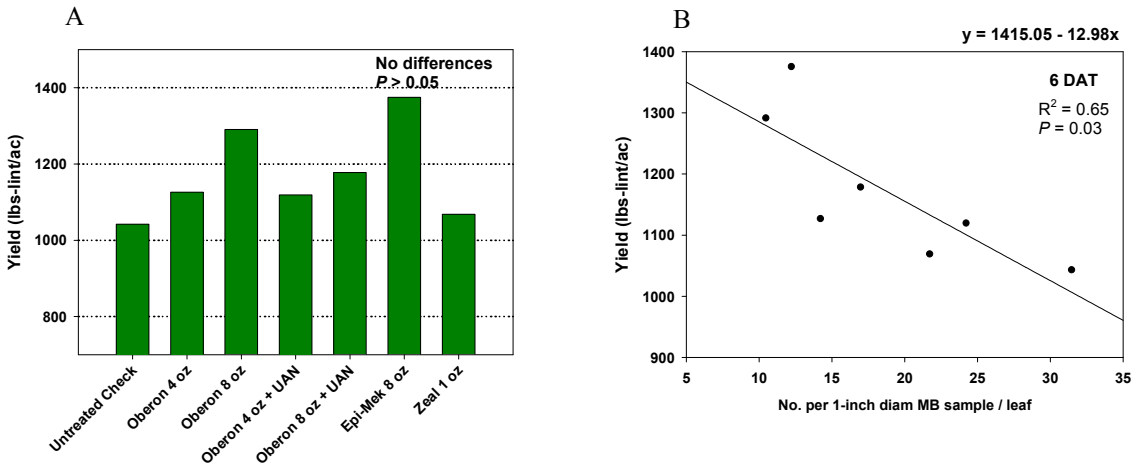

Figure 6. (A) No significant differences in yield in Test 2. (B) Relationship between yield and mite density in Test 2.

Fertility

Contrary to most literature, more spider mites were observed where there was the least amount of nitrogen applied to the plots (Figure 7). An exponential decay relationship was also observed between aphids per leaf and mite density (Figure 8). The reason for this relationship is unclear. There were higher numbers of aphids in the higher nitrogen plots. Previous aphid feeding in the higher nitrogen plots could have caused an antibiotic effect on the spider mites infestation resulting in higher numbers of spider mites in the lower nitrogen plots. More likely, the higher number of aphids in the higher nitrogen plots attracted predators that fed on the early spider mite infestation. The lower nitrogen plots had the least number of aphids and predators which likely let the spider mite infestation grow. The higher number of mites in the low N plots may also be the result of a plant stress relationship, where the spider mite population is healthier and does better on stressed plants.

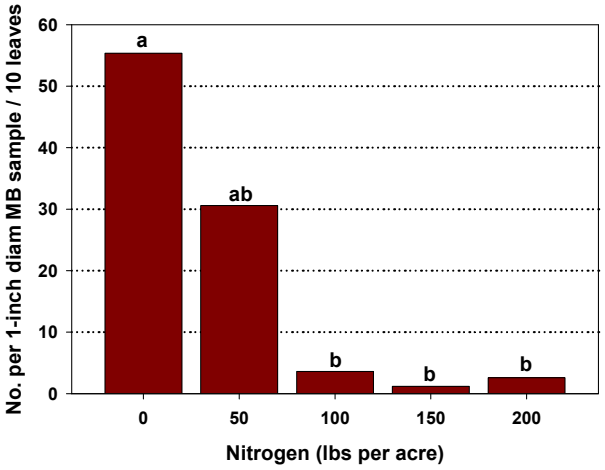

Figure 7. Columns capped with the same letter are not significantly different based on an F protected LSD ($P > 0.05$).

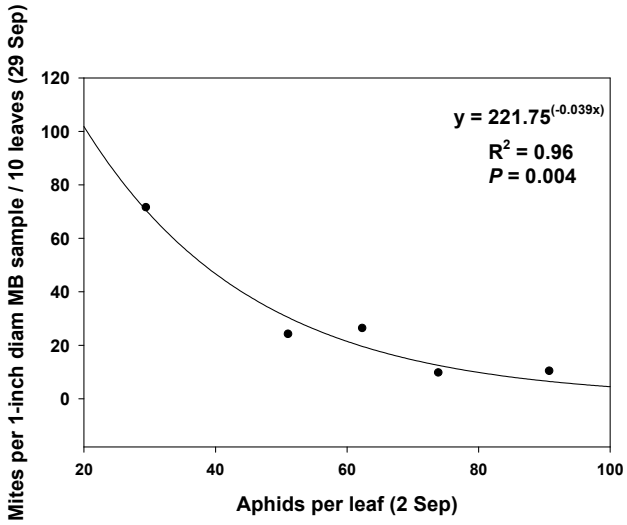

Figure 8. Exponential decay relationship between ahids and mite density.

Summary

The current spider mite action threshold for Texas cotton seems to be valid. This test needs repetition, and the percentage levels under 50% need to be evaluated. Of the products evaluated for efficacy, Athena, Oberon, Epi-Mek, GWN 1708 and Portal all provided good efficacy. The addition of 28% UAN did not appear to enhance efficacy of Oberon. Zeal appeared to be somewhat weaker or slower acting. Brigade gave knock down but sustained efficacy is questionable, and there was a negative linear relationship between yield response and mite density. An observation was made of an obvious relationship between fertility and spider mite outbreaks. There were more mites observed in the lowest nitrogen plots. This relationship contradicts previous literature. This may be a result of an antibiotic effect on spider mites from previous aphid feeding, a plant stress relationship, or the presence of predators in the higher nitrogen plots associated with more aphids.

Acknowledgements

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