Yield Loss Potential

OF TWOSPOTTED SPIDER MITES IN MIDSOUTH COTTON

Spider mite adult, immature, and eggs.
Photo by Joe MacGown

History and Current Situation

The pest status of the twospotted spider mite *(Tetranychus urticae)* in cotton *(Gossypium hirsutum* L.*)* has changed over the last decade across the Midsouth. Historically, spider mites were considered a late-season pest in this part of the region, and pesticide applications were rarely needed during the preflowering and early-flowering stages of cotton development.

Spider mite infestations have become more common in recent years across Arkansas, Louisiana, Mississippi, and Tennessee. For example, the number of Midsouth cotton acres sprayed for spider mites has nearly doubled since 2005. The majority of that increase can be attributed to applications against common infestations made during the early- to mid-flowering stages of plant development.

Several factors might have contributed to the increase in the importance of spider mites as a season-long pest. Insecticide, fungicide, and nematicide seed treatments replaced the use of aldicarb (Temik 15G) in many cotton fields. The neonicotinoids used as the insecticidal component of these seed treatments—imidacloprid (Gaucho Grande 5FS, Bayer CropScience) and thiamethoxam (Cruiser 5 FS, Syngenta Crop Protection)—do not suppress mite densities as well as aldicarb.


Severe spider mite damage on seedling cotton.
Photo by A. Catchot

Additionally, the tarnished plant bug *(Lygus lineolaris)* has become a serious pest of cotton in the Midsouth. Multiple applications of broad-spectrum insecticides are needed every year to minimize yield losses from this insect. Because of widespread resistance, the most common treatment for the tarnished plant bug is high rates of organophosphates or neonicotinoids applied in a tank mix with pyrethroids. These applications disrupt beneficial arthropod populations and create an ideal environment for rapid population increases of secondary pests such as twospotted spider mites.

Currently, little information exists about the impact of twospotted spider mites on cotton yields with the current transgenic varieties being used in Midsouth production systems. Given this lack of information, thresholds in most states are vague and not reliable. For instance, the thresholds in Mississippi, Arkansas, Louisiana, and Tennessee suggest that miticides should be applied when 30 to 50 percent of plants are infested and populations are increasing. No information exists about when to terminate miticide applications during the cotton-growing season. The objective of the current experiment was to determine the impact of twospotted spider mite infestation timing during the flowering period on cotton injury and yields.


Early-season spider mite damage on seedling cotton.
Photo by A. Catchot

Yield Loss and Infestation Timing

Experiments were conducted from 2009 to 2011 in Mississippi, Arkansas, Louisiana, Tennessee, and Missouri to determine how spider mite infestation timing and duration affect cotton yield in the Midsouth. Spider mites were successfully infested into cotton plots from greenhouse colonies in seven trials. Infestation timings were based on plant growth stage and heat unit accumulation (HU = Tmax + Tmin/2 – 60). Infestations were made at the following times: the third leaf stage, first flower, 200 heat units after first flower, 400 heat units after first flower, 600 heat units after first flower, 800 heat units after first flower, and 1,000 heat units after first flower. At each infestation interval, spider mites were maintained on plants until the plots were chemically defoliated.

Spider mites on henbit.
Photo by A. Catchot

Spider mite infestations occurring until 800 heat units past white flower significantly reduced cotton yield in the presence of uniform infestations with no control measures (Figure 1). There was no yield loss when infestations were initiated at 1,000 heat units past first flower. On average, this would result in termination of applications for spider mites approximately 35 to 45 days after first flower in the Midsouth. This would roughly correlate with "cutout" (main stem node above first position white flower = 5, NAWF 5) and no additional heat units. Although not tested in this study, populations that develop to the point of premature defoliation across substantial areas of the field before boll maturation may result in yield loss. These results are applicable to irrigated and aggressively managed acres. In nonirrigated (dryland) environments, yield loss may be substantially greater.

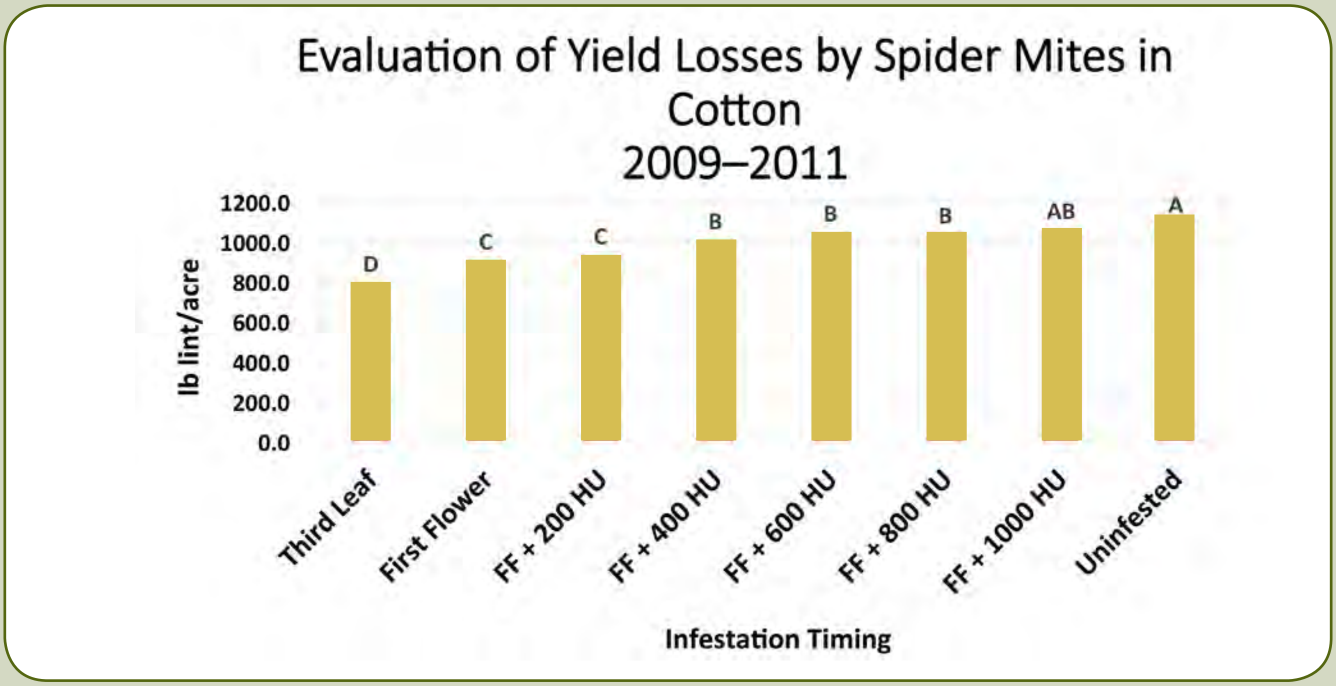

Figure 1. Average lint yield across all locations and years.
FF = first flower

Field Distribution and Localized Yield Loss

Typically, spider mite infestations in the Midsouth cotton-growing region originate from field borders and ditch banks and disperse throughout the field when environmental conditions are favorable (hot and dry). In recent years, a close association of spider mites with winter weeds, particularly henbit *(Lamium amplexicaule)*, has contributed to early-season infestations. This has been observed in fields with delayed or poor-performing spring burndown herbicide treatments. Even when herbicides were used successfully, areas where plant residue remains in the field have served as initial sources of infestation. Often, yield loss is more severe around initial points of infestation because seasonal duration of infestation is longer in these areas. When considering potential yield loss, it is also important to realize that yield loss will likely only occur where visible spots of damage are present.

Figure 2 shows a 38-acre dryland cotton field that was visually scouted for spider mite hot spots at midbloom, at which point aerial imagery of the field was taken. From site-specific scouting, areas categorized into the lowest biomass (Class 1) correlated to mite infestations. It was calculated that 19.9 percent of the field was showing visible symptomology from spider mites. Yield was taken from six replicates of damaged areas and compared to undamaged areas of the field. Areas of plants with visible spider mite injury experienced a 51.9 percent yield loss over 19.9 percent of the acres (Figure 3). This translated to a net loss of 102.2 pounds of lint per acre attributable to spider mites across the entire field. In a similar study of mite infestations within an irrigated field, the initial points of infestations (visible injury) only resulted in 9 percent yield loss. These data further confirm that stressed cotton is more likely to suffer greater yield loss, and plant condition should be taken into consideration when making management decisions.

3 Classes

Class		% of field
1	Lowest biomass	19.9
2		40.1
3	Highest biomass	40.0

51.19% yield loss across
19.9% of 38.2 acres =

102.2 lb lint/A yield loss

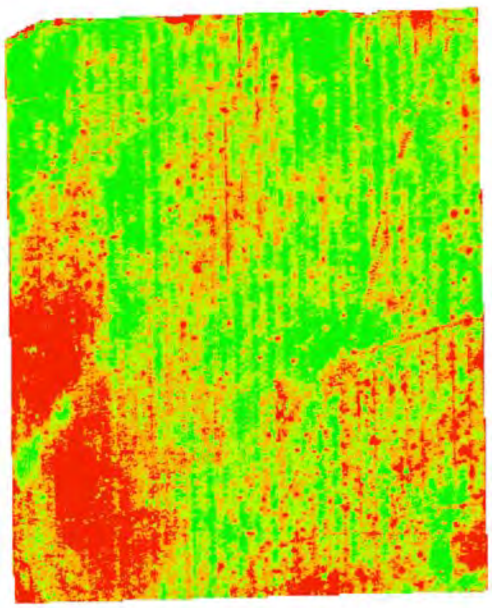

Figure 2. Aerial imagery of cotton biomass reflectance into three class groupings and percent of field within each grouping. Class 1 = red, Class 2 = yellow, Class 3 = green.

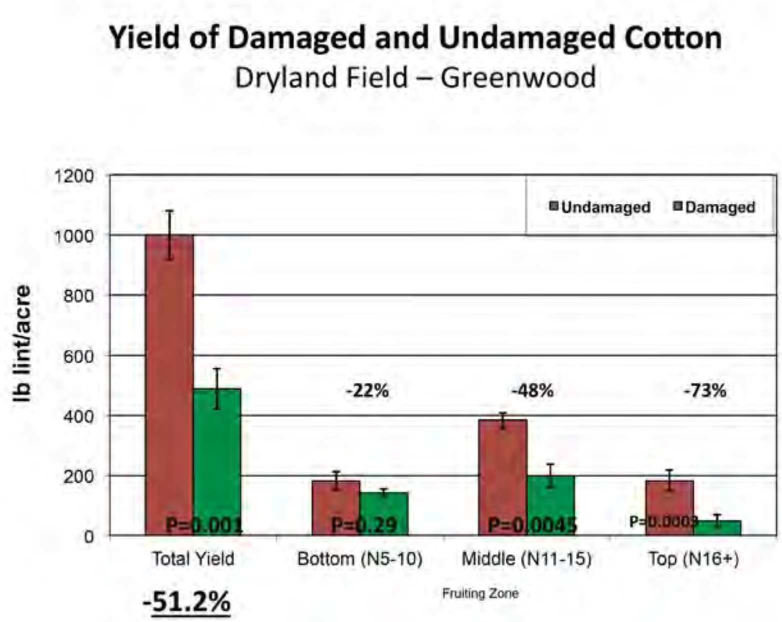

Figure 3. Overall yield reduction and yield reduction by fruiting zone of cotton affected by spider mites.

Spider mite “hot spots.”
Photo by A. Catchot

Spider Mite Management

Spider mites are capable of causing significant yield losses in Midsouth cotton-growing regions. Greater yield loss can be observed in dryland or stressed cotton than in irrigated or nonstressed cotton. Management decisions should be based on the presence of spider mites and/or damage symptoms on 25 to 30 percent of the plants in the field. Potential for population increase should also be considered. Periods of hot and dry conditions in the extended forecast will likely increase dispersal across the field. Rainfall events will delay the spread of spider mites but will not eliminate the infestation, so careful monitoring should be conducted weekly.

Be aware that the use of broad-spectrum insecticides such as pyrethroids and many organophosphates will eliminate beneficial insects and flare spider mites. Examples would be early-season thrips or tarnished plant bug applications with these classes of chemistry. Current recommendations are to control spider mites in cotton until 600 to 650 heat units past NAWF 5. These data would suggest that a conservative termination point could be more in line with other insect pests at 300 to 400 heat units past NAWF 5.

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