Midsouth Multistate Evaluation of Treatment Thresholds for Tarnished Plant Bug in Flowering Cotton

Authors

Angus Catchot, Fred Musser, Jeff Gore, Don Cook, and Chris Daves
of Mississippi State University

Gus Lorenz, Scott Akin, and Glenn Studebaker
of University of Arkansas

Kelly Tindall of University of Missouri

Scott Stewart of University of Tennessee

Ralph Bagwell and B. Rogers Leonard of LSU AgCenter

Ryan Jackson of USDA-ARS

Acknowledgements

The authors wish to thank Cotton Incorporated, University of Arkansas, LSU AgCenter, Mississippi State University, University of Missouri, U.S. Department of Agriculture ARS, and University of Tennessee for partial funding of this project.

Introduction

The tarnished plant bug (TPB), *Lygus lineolaris*, has been considered a cotton pest in the Midsouth states for as long as records have been maintained. For nearly 30 years, these states have reported cotton yield losses associated with TPB.

In recent years, the TPB has become a "key" pest of cotton. Prior to 1995, TPB generally was controlled with insecticides targeting other insect pests, such as tobacco budworm and boll weevil. Since the widespread adoption of Bt-cotton and eradication of the boll weevil, the frequency of insecticide applications targeting these pests has declined.

As a result, the TPB has become the primary insect pest of cotton in this region of the Cotton Belt. More recently, TPB has become resistant to several classes of insecticides, further compounding the problem, particularly in the Delta regions of the Midsouth states.

While TPB is a pest of cotton throughout the growing season, it is particularly damaging during the flowering period when high levels of reproduction occur. Both adult and immature stages of TPB feed on cotton during the flowering period. Most feeding occurs on reproductive structures where the pests insert their mouthparts into squares and small bolls. It is not uncommon for TPB to cause near-total crop loss in the absence of effective control strategies in some areas of the Delta region.

Action threshold recommendations to initiate treatments for TPB control in flowering cotton are similar among all Midsouth cooperative extension services. The preferred action threshold in flowering cotton is three TPB per 5 row-feet using a black drop cloth. Alternative action thresholds include 12 to 15 TPB per 100 sweeps with a sweep net or 9 to 15 TPB per 100 plants for visual plant searches. This multistate experiment was conducted during 2006 and 2007 to reevaluate the accuracy of TPB action thresholds on flowering cotton.

Procedure

In 2006 and 2007, the experiments were conducted at 19 locations across the Midsouth. Experiments were designed as large replicated plots (24 rows x 100 feet). The locations and number of individual sites included: Arkansas (7), Louisiana (3), Mississippi (3), Missouri (2), and Tennessee (4).

The treatments included:

- Automatic: Weekly insecticide applications initiated at first bloom and repeated every 7 days until plants matured to the NAWF 5 and 350 DD60s growth stage.
- Low: Insecticide application triggered when TPB density reached 1 TPB per 5 row-feet on a black drop cloth.
- Medium: Insecticide application triggered when TPB reached 3 TPB per 5 row-feet on a black drop cloth.
- High: Insecticide application when TPB density reached 5 TPB per 5 row-feet on a black drop cloth.
- Very High: Insecticide application triggered when TPB reached 10 TPB per 5 row-feet on a black drop cloth.

All action thresholds were adjusted for feeding habits of the other hemipteran species when present and were converted to TPB equivalents. Cotton fleahoppers represented 1 TPB, clouded plant bugs were counted as 1.5 TPB, and stink bugs represented 3 TPBs. All fields were planted with transgenic Bt cultivars to minimize the impact of caterpillar pests. Prior to first bloom, all plots were treated with a neonicotinoid insecticide when TPB infestations reached a pre-bloom action threshold. At first bloom, a black drop cloth (2.5 feet per side) was used to sample TPB densities. Insecticide applications were triggered when the average of the four replicates for each treatment exceeded the designated action threshold.

Insecticides during the flowering period were made with organophosphate insecticides. Bidrin (dicrotophos at 8 ounces per acre) and Orthene (acephate at .83 pounds per acre). The insecticides were alternated for each subsequent application. At the end of the season, the tests were harvested and lint yields were determined for each plot.

Results

Average lint yields over all action thresholds ranged from 936 to 1,540 pounds per acre at six locations in 2006 and from 659 to 1,715 pounds per acre at 13 locations in 2007. Across all tests within a year, average lint yields were 1,272 and 1,087 pounds per acre in 2006 and 2007, respectively.

At all locations, TPB exceeded the low threshold at least once during both years (**Figure 1**). The current threshold of 3 TPB per 5 row-feet was reached in 79 percent (15 of 19) of the trials. The high and very high thresholds were reached in 68 percent and 26 percent of the trials, respectively.

Figure 2 shows average yields and numbers of applications from 12 locations in 2006 and 2007 where at least the high threshold (5 TPB per 5 row-feet) was reached. In those trials, lint yield declined as the action threshold increased but insecticide application frequency decreased. An approximately 1.5 percent yield loss was observed for every increase of 1 TPB per drop cloth sample.

Economic Injury Levels

To demonstrate how changes in insect control inputs influence the economic injury level, action thresholds were estimated using several cost-benefit scenarios. When cotton price is set at $0.65 per pound of lint, economic thresholds range from a low of 2.4 TPB per drop cloth sample if yield expectations are 1,200 pounds per acre to 3.8 TPB per drop cloth sample if yield expectations are only 600 pounds per acre (**Figure 3**).

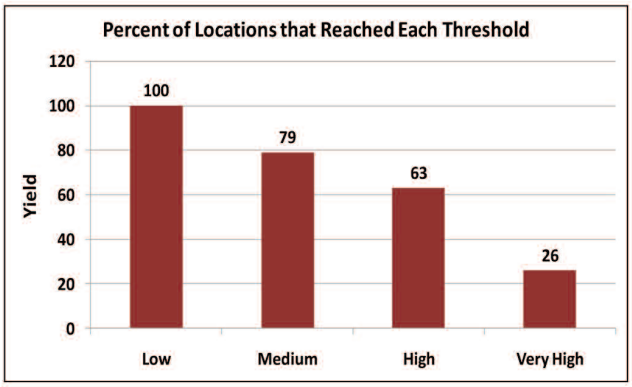

Figure 1. Percentage of locations that received insecticide sprays within each action threshold in 2006 and 2007.

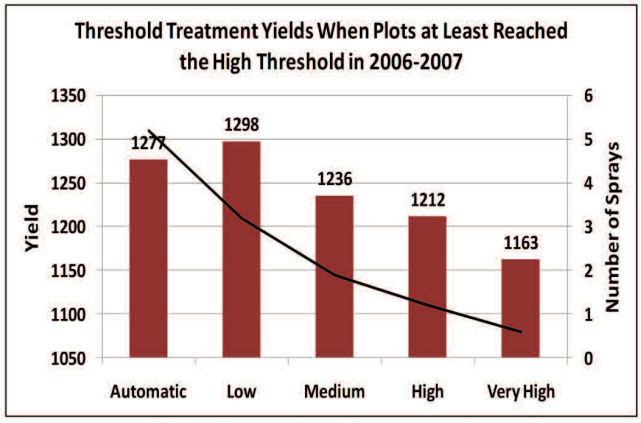

Figure 2. Yield and number of insecticide applications of plots in 12 locations in 2006 and 2007 only where at least the actual "high" threshold was reached.

When crop value increases to $0.85 per pound of lint, action thresholds are slightly lower. Under this scenario, 1,200 pounds per acre of lint yield expectation would decrease the action threshold to 1.7 insects per drop cloth sample compared to 3.3 insects per drop cloth sample when yield expectations are only 600 pounds of lint per acre (**Figure 4**).

When cotton prices are lower than those listed, the action threshold will continue to increase and further reduce the actual number of sprays needed to provide a positive economic return.

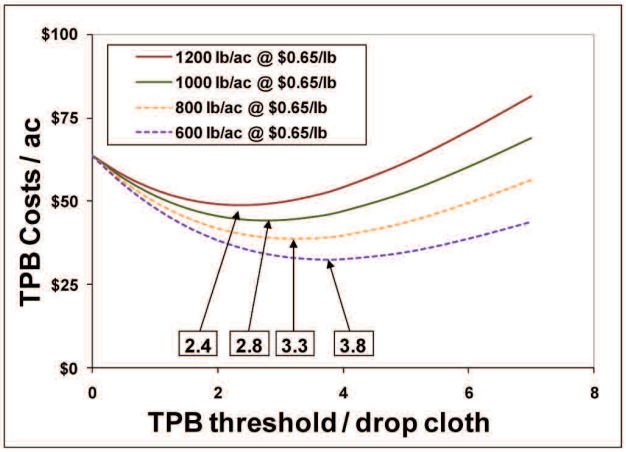

Figure 3. The relationship of yield potential on TPB thresholds per drop cloth sample when cotton price is $0.65 per pound and insecticide cost is fixed at $12 per acre.

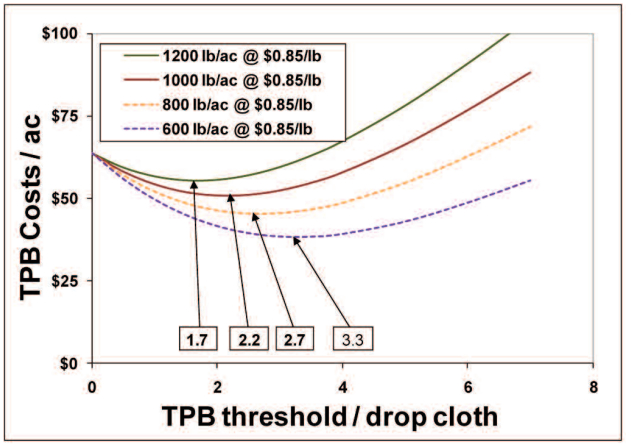

Figure 4. The relationship of yield potential on TPB thresholds per drop cloth sample when cotton price is $0.85 per pound and insecticide cost is fixed at $12 per acre.

Discussion

In these trials, natural TPB populations feeding during the flowering period had a significant impact on cotton yield. Economic threshold levels for average conditions ($0.65 per pound) were estimated to be between 2.4 and 3.8 TPB per drop cloth sample (Figure 3). When higher prices are considered for the crop ($0.85 per pound), action thresholds were shifted to a slightly more conservative position, ranging between 1.7 and 3.3 TPB per drop cloth sample (Figure 4).

These results were shaped by two factors that may vary in some situations. The first factor was sampling frequency. All locations in these trials were sampled and sprayed (if needed) once per week. This frequency was longer than desirable for a pest such as TPB that can build populations rapidly through movement and

reproduction. As a result, populations just under the action threshold during a sample for one week occasionally greatly exceeded the action threshold during the following week. A shorter scouting interval should raise the action threshold since pests will not have time to reach very high densities.

The second factor that could not be controlled was insecticide effectiveness. Resistance to organophosphate insecticides has been reported for TPB in the Midsouth, particularly in the Delta region. In a region without insecticide-resistant TPB populations, or if more effective insecticide were available, the frequency of sprays required to maintain the lower thresholds would likely be lower. This should increase the economic injury level because insecticide costs would be lower.

Given the range of action thresholds derived from economic factors associated with cotton, the results generated in this project actually support a threshold "range" of approximately 2–4 TPB per drop cloth sample. Therefore, these results confirm that the existing drop cloth threshold of 3 TPB per drop is well within the range of the findings for this study.

The action threshold can be adjusted slightly and adapted to the particular situation depending on expected yield, commodity prices, insecticide cost, and insecticide resistance in an area. For instance, in Delta regions where TPB pressure is typically very high and significant insecticide resistance is likely, a producer may opt to treat at numbers as low as 2–3 TPB per drop cloth sample. But in areas where TPB pressure is low to moderate and insecticide resistance has not evolved, producers may opt to treat at numbers closer to 4 TPBs per drop cloth sample.

Figure 5. Damage from tarnished plant bug.

E0022
Extension Service of Mississippi State University, cooperating with U.S. Department of Agriculture. Published in furtherance of Acts of Congress, May 8 and June 30, 1914. MELISSA J. MIXON, Interim Director (POD-06-09)