A MIDSOUTHERN PERSPECTIVE ON HEMIPTERAN PESTS

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Introduction

The bug complex in the Mid-South consists primarily of the tarnished plant bug (TPB) *Lygus lineolaris* (Palisot de Beauvois) (Hemiptera: Miridae), with more sporadic populations of clouded plant bug *Neurocolpus nubilus* (Say) (Hemiptera: Miridae), southern green stink bug *Nezara viridula* (L.) (Hemiptera: Pentatomidae), green stink bug *Acrosternum hilare* (Say) (Hemiptera: Pentatomidae), and brown stink bug *Euschistus servus* (Say) (Hemiptera: Pentatomidae). Prior to 1995, populations of the bug complex during bloom were controlled by insecticides directed at other pests, so damage from bugs during bloom was rare. However, with >80% of Mid-South cotton now being planted to Bt-transgenic cotton and the eradication of the boll weevil, many of the foliar applications for pests during bloom have been eliminated. One consequence of this change is that hemipteran pests have become the dominant pest complex during bloom in Mississippi, Louisiana, Arkansas, Tennessee and Missouri during the last five years. Control costs and crop losses associated with bugs have increased dramatically during the flowering period, with 4-8 insecticide applications targeted at bugs in some years (Williams 2006).

Action thresholds have been developed so that insecticides are only applied when economically justified based on an estimate of the current insect population. However, these thresholds were generally established 30 or more years ago when boll weevil and Lepidoptera were the primary targets of foliar insecticides. These thresholds need to be re-examined under current production practices and economics to provide growers the best opportunity to maximize profit and use the current pest management tools wisely. Beginning in 2006 we undertook a series of experiments to evaluate thresholds before and during bloom for the bug complex in the Mid-South.

Materials and Methods

<u>Pre-bloom Plant Bug threshold trial:</u> Large field plots (24 rows x 100 ft minimum) arranged in a randomized complete block with 4 replications were used for this trial with each state conducting this trial in 2 or more locations

for a total of 13 locations. Bt cotton was planted to reduce the likelihood of needing insecticides to control Lepidoptera. Where possible, mustard was planted beside the plots to increase the local TPB population. Sweep nets and square retention were the sampling methods used for threshold determination. Drop cloth counts were used to compare this sampling method to sweep nets in pre-bloom cotton. Sweep net sampling was 2 sets of 25 sweeps in each replicate (200 sweeps per treatment). Square retention in each replicate was determined by examining 50 plants 3 nodes below the terminal for the presence/absence of squares. Crop maturity for each treatment was determined from the average of 10 randomly selected plants. Weekly monitoring and insecticide decisions were made from the average pest density from the four replicates of a treatment and applied to all replicates of the treatment. Clouded plant bugs and tarnished plant bugs were included in tarnished plant bug counts with clouded plant bugs counting as 1.5 TPB in threshold calculations. Treatments were:

1. Auto: Automatic insecticide application at pinhead square (average maturity from 10 plants) and 7 and 14 days later

2. Low: Insecticide application when TPB density reached 8 TPB/ 100 sweeps or square retention dropped below 80%

3. High: Insecticide application when TPB density reached 16 TPB/ 100 sweeps or square retention dropped below 60%.

4. UTC: No treatment prior to first bloom

After first bloom all treatments were sprayed with an organophosphate and then managed uniformly according to growers standards for the remainder of the season. Centric (2 oz/ac) or Trimax Pro (1.8 oz/ac) were rotated each week for the treatment applications prior to bloom and organophosphates were used after first bloom for all treatments.

Flowering cotton Plant Bug threshold trial: Large field plots (24 rows x 100 ft minimum) arranged in a randomized complete block with 4 replications were used for this trial with each state conducting this trial in 2 or more locations for a total of 13 locations. Bt-cotton was planted to reduce the likelihood of needing insecticides to control Lepidoptera. A black drop cloth (2.5 ft x 2 rows) was used for threshold determinations. Drop cloth sampling was 2 drops per replicate (8 drops per treatment). Spray decisions were made from the average pest density from the four replicates of a treatment and applied to all replicates of the treatment. Sweep net (25 sweeps/plot), dirty squares (25 squares/plot) and dirty bloom (25 blooms/plot) data were collected to compare threshold decisions using other sampling methods. Stink bugs, clouded plant bugs, cotton fleahoppers and tarnished plant bugs were included in plant bug counts. Cotton fleahoppers counted as 1 TPB, clouded plant bugs counted as 1.5 TPB and stink bugs counted as 3 TPB in threshold calculations. Beginning at first bloom, plots were monitored once per week and treatments were:

1. Auto: Automatic insecticide application every 7 days
2. Low: Insecticide application when PB density reached 1 TPB/ 5 row ft on drop cloth
3. Med: Insecticide application when PB density reached 3 TPB/ 5 row ft on drop cloth
4. High: Insecticide application when PB density reached 5 TPB/ 5 row ft on drop cloth
5. VHigh: Insecticide application when PB density reached 10 TPB/ 5 row ft on drop cloth

Before first bloom all plots were treated according to grower standard practices. Neonicotinoids were used where needed prior to bloom and organophosphates (minimum rates of 6 oz/ac Bidrin or 0.5 lb/ac acephate) were applied after first bloom as needed in all treatments. Monitoring and insecticide applications were applied from first bloom until the cotton reached NAWF5+ 350 heat units.

Results and Discussion

Pre-Bloom Thresholds. Pre-bloom TPB pressure reached the low threshold at least once in 7 of 13 locations. Two sites that had the most severe pressure had significant yield differences (Figs. 1, 2). In Stoneville, MS (Fig. 2), the high threshold was exceeded each week. Therefore the trial protocol was adjusted to spray an extra insecticide application on the threshold plots. This extra application improved square retention and ultimately yield, showing that weekly insecticide applications may not be enough to preserve yield under severe infestations. When the seven sites that reached at least the low threshold were pooled together, there were no significant yield differences among the treatments (Fig. 3). This may be a reflection of variable insect pressure and environmental stress on these trial locations later in the season that influenced the plant's ability to compensate for pre-bloom bug damage. Some plots were irrigated while others were not. Some experienced severe mid-season insect pressure after bloom while others experienced little. Where TPB pressure did not reach the pre-bloom low threshold, the weekly insecticide application treatment yielded about 40 lb/ac less lint than the untreated control, similar to our results in 2006 (Fig. 4). However, in 2007 this yield difference was not statistically significant (P=0.43), while in 2006 it was significant (P=0.05).

Bloom Thresholds. In 5 of the 13 sites, TPB density never reached the high threshold and in these sites there were no significant yield differences among treatments. In the remaining 8 sites, significant yield differences among treatments could only be measured at 2 locations. However, numerical yield losses when using higher thresholds were frequently observed, so all the sites that reached the high threshold at least once during the season were combined using the mean per site as a replicate (Fig. 5). Analyzing these data, the lint yield losses show a linear relationship with TPB density (P=0.0003) where yield decreased 11 lb/ac for each increase of 1 TPB/drop cloth in the threshold (Fig. 6). This was consistent with 2006 data that showed a 13 lb/ac loss for the same threshold change. Since the yield loss and application data were similar for both years of this trial, an economic analysis was conducted using average data for both years. Given current economic costs and returns, the optimum TPB threshold is between 2.5 and 3 TPB/ 5 row ft. on a black drop cloth (Fig. 7). This is very similar to the existing threshold in most of the MidSouth states.

In these studies, insecticide resistance may have been a factor that was not measured. As insecticides get less effective, control is compromised and more insecticide applications are required to achieve the same result. Insecticide resistance in TPB has been documented for pyrethroids and organophosphate chemistries, especially in the MS delta where TPB applications are most common.

Literature Cited

Williams, M. R. 2006. Cotton Insect Losses, http://www.msstate.edu/Entomology/Cotton.html.

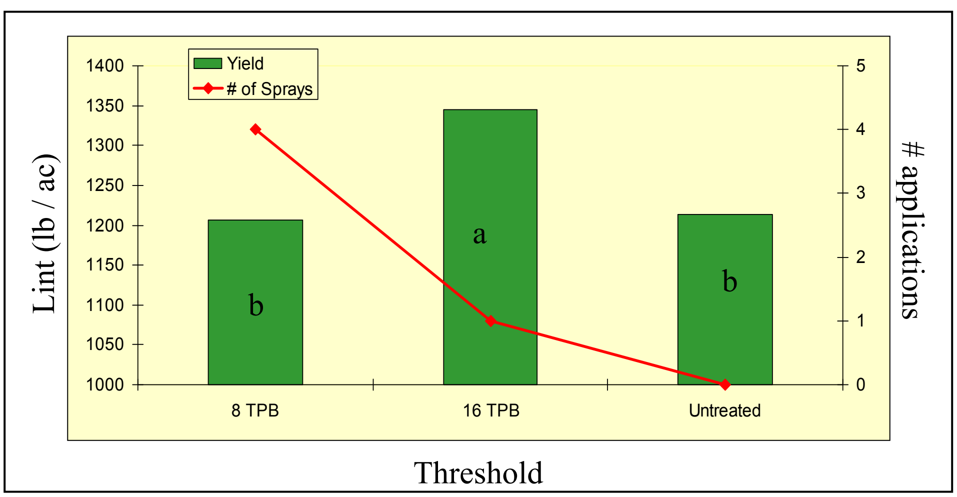
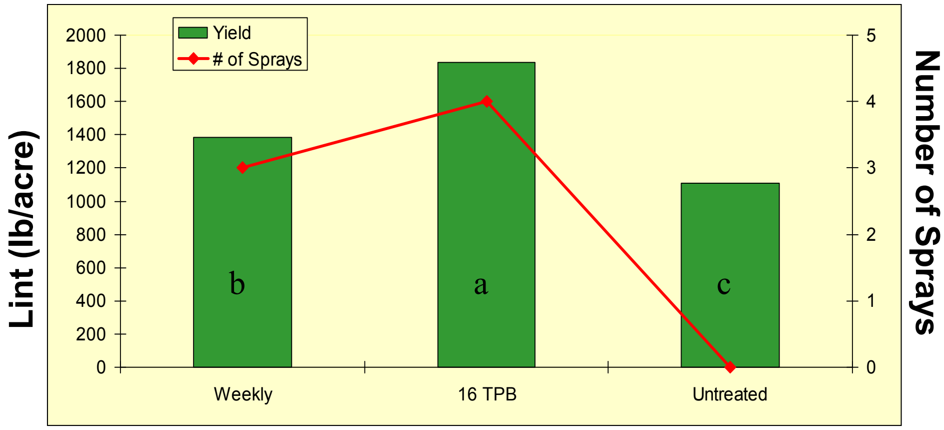


Figure 1. Yield and insecticide applications used at various thresholds in a pre-bloom threshold trial in AR, 2007.



Weekly	16 TPB	Untreated
Wk 1 = 36/100 sweeps	Wk 1 = 30/100 sweeps	Wk 1 = 29/100 sweeps
Wk 2 = 37/100 sweeps	Wk 2 = 33/100 sweeps	Wk 2 = 33/100 sweeps
Wk 3 = 50/100 sweeps	Wk 3 = 46/100 sweeps	Wk 3 = 53/100 sweeps
Wk 3.5 = 17/100 sweeps	Wk 3.5 = 20/100 sweeps	Wk 3.5 = 48/100 sweeps

Figure 2. Yield, insecticide applications and TPB sampling data from thresholds in a pre-bloom threshold trial in Stoneville, MS, 2007.

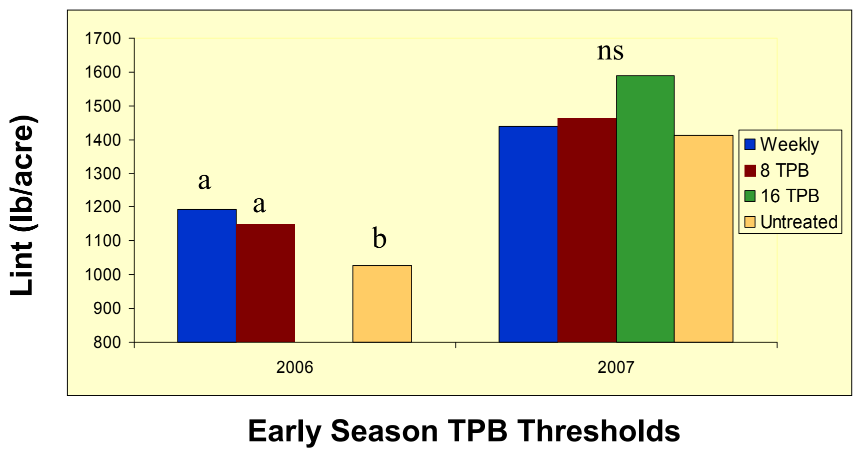


Figure 3. Pooled yield response in 2006 and 2007 to pre-bloom threshold treatments where TPB reached low threshold at least once. 1 site in 2006, 7 sites in 2007.

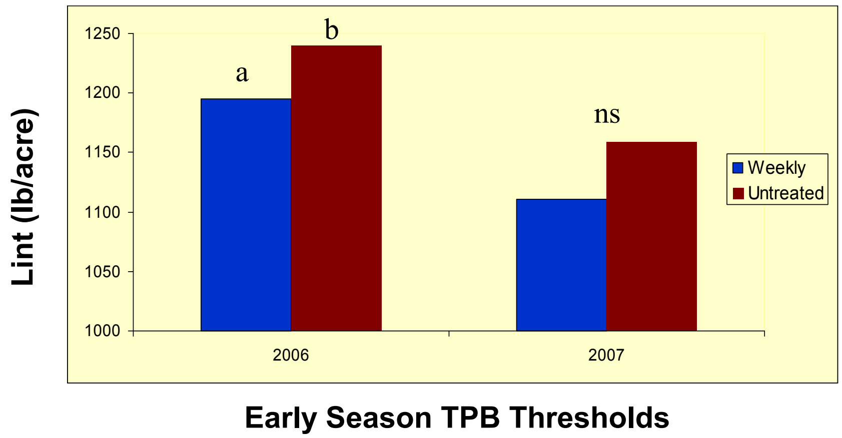


Figure 4. Pooled yield response in 2006 and 2007 to pre-bloom threshold treatments where TPB failed to reach the low threshold. 7 sites in 2006, 6 sites in 2007.

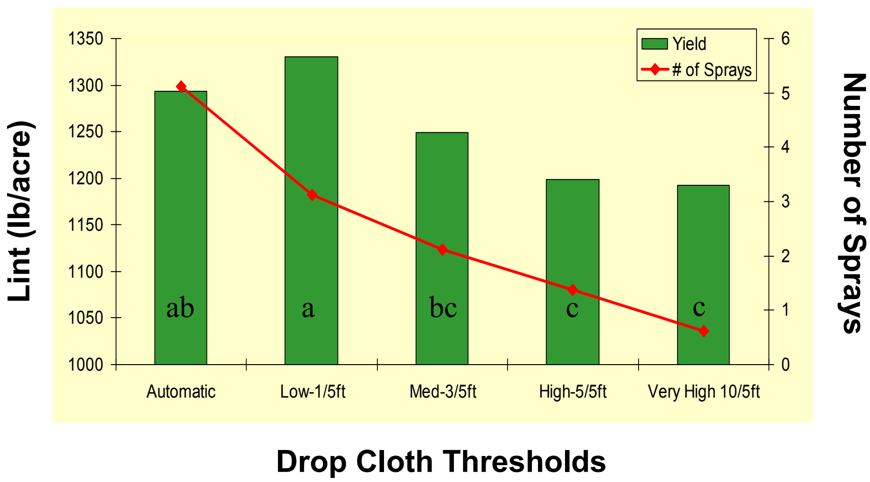


Figure 5. Pooled yield and application data of 8 locations where TPB reach the high threshold at least once during the bloom threshold trial in 2007.

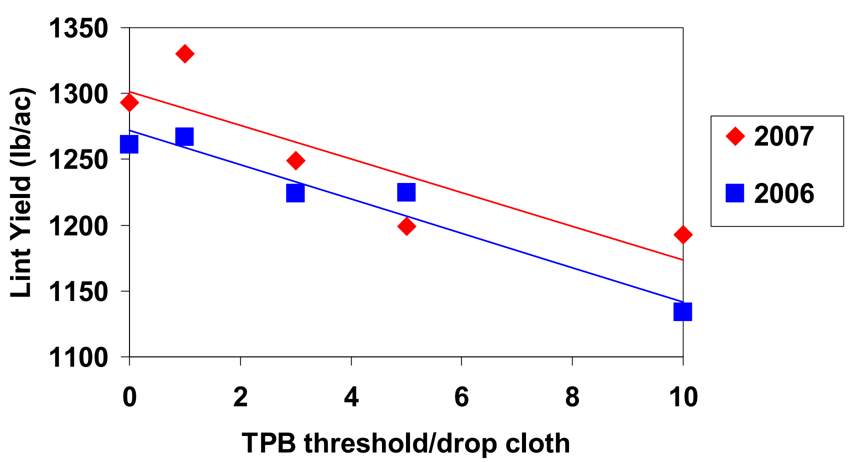


Figure 6. Pooled lint yield data from locations that reached the high threshold with linear trend lines for 2006 and 2007 from using different thresholds.

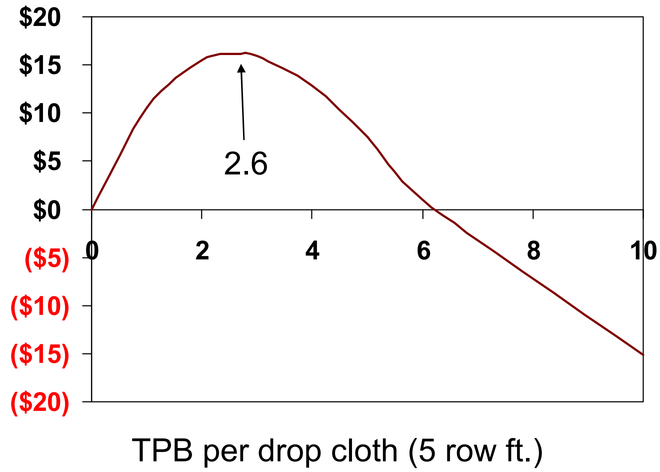


Figure 7. Incremental profit (loss) per acre from choosing a threshold different from the automatic weekly application based on 2006 and 2007 data shown in Fig. 6.