

MIDSOUTH TARNISHED PLANT BUG THRESHOLD DEVELOPMENTS

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Abstract

The tarnished plant bug (TPB) is a major pest of cotton throughout the midsouthern region of the United States. Research was conducted during the squaring period from 2006 to 2008 in all 5 states of the Midsouth to evaluate thresholds in the current production environment. These data show that costs associated with TPB are minimized when average TPB density is 8 per 100 sweeps and when average square retention is 90%. Existing thresholds of 8 TPB per 100 sweeps and square retention of 80% are supported by these data and should be retained. More aggressive management resulted in both reduced yield and higher control costs and should be avoided.

Introduction

Tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), primarily attacks cotton from squaring until cutout. Damage is most commonly observed as aborted squares (Tugwell et al. 1976), but TPB can also feed on small bolls, causing symptoms similar to those from stink bugs (Greene et al. 1999, Musser et al. 2009). In the Midsouth, tarnished plant bug has become the target of more insecticide applications than any other insect (Williams 2008). Because existing tarnished plant bug thresholds were developed when cotton was frequently sprayed for boll weevils and various Lepidoptera, research was begun in 2006 to re-examine tarnished plant bug thresholds in the current production environment. The vulnerable period for cotton to tarnished plant bug feeding was divided into pre-bloom and bloom periods. This paper has the results of the pre-bloom research. The results of the bloom period were reported previously (Musser et al. 2008).

Materials and Methods

Large field plots (24 rows x 100 ft minimum) arranged in a randomized complete block with 4 replications were used for this trial. From 2006 to 2008, this trial was successfully conducted on 33 locations, with sites in Arkansas (14), Louisiana (3), Mississippi (7), Missouri (4) and Tennessee (5). All fields were planted with a transgenic Bt cotton variety to reduce the likelihood of needing insecticides to control Lepidoptera. In a few locations, mustard was planted beside the plots and managed to increase the local TPB population. Sweep nets and percentage square retention were the sampling methods used for threshold determination. 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 per replicate (200 plants per treatment) 3 nodes below the terminal for the presence/absence of squares. 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 bug, *Neurocolpus nubilus* (Hemiptera: Miridae), cotton fleahopper, *Pseudatomoscelis seriatus* (Hemiptera: Miridae) and tarnished plant bug were included in tarnished plant bug counts with a cotton fleahopper counting as 1 TPB and a clouded plant bug counting as 1.5 TPB in threshold calculations. All these species cause similar damage, but clouded plant bugs were expected to cause more damage per insect based on their larger size and existing thresholds (Stewart 2007, Catchot 2008). Treatments were:

1. Auto: weekly insecticide application beginning at pinhead square (average maturity from 10 plants) and continuing until first bloom
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

Most locations were sampled and treated according to the assigned treatment once per week, but in a few situations the threshold treatments only were sampled and sprayed (if above threshold) twice per week. The chloronicotinyl insecticides thiamethoxam (Centric @ 2 oz/ac) and imidacloprid (Trimax Pro @ 1.8 oz/ac) were rotated each week for the treatment applications. After first bloom all treatments were sprayed with an organophosphate insecticide and then managed uniformly according to grower standards for the remainder of the season. Yield data were collected at harvest.

Although there were replicates at each location, treatment decisions were made uniformly across all replicates, so replicates were not truly independent. Therefore the analysis presented here used means from each location as a replicate. Data were analyzed using PROC GLM in SAS (SAS Institute 1999). Differences were regarded as significant at $\alpha = 0.05$.

Results and Discussion

Tarnished plant bug pressure failed to reach the low threshold during the pre-bloom period in 13 of 33 locations. Fourteen locations reached the low threshold but did not reach the high threshold while six sites reached the high threshold at least once. Overall 43 insecticide applications were made based on reaching either the low or high threshold. Of these 43 applications, 32 applications were made based on reaching the TPB density threshold only, 6 applications were based on low square retention, and in 5 cases, both the TPB density and square retention thresholds were reached.

Treatment response was analyzed independently for each of the three levels of insect pressure (below threshold, low threshold and high threshold). While trends were apparent in the lowest and highest pressure levels, no treatments were statistically different from other treatments in any of the levels. This may have been because the maximum pressure which defined the levels was not strongly related to average pressure. While some sites had high pressure or damage for a brief period, other sites experienced less pressure over an extended period. To better reflect the overall TPB pressure experienced in each treatment from first square to first bloom, yield was compared to average TPB density and average square retention without regard to which treatment the plot was assigned. In this analysis there was a very strong relationship between TPB density and yield ($P=0.0001$) and between square retention and yield ($P=0.0003$) with the relationship best fitting a quadratic equation in both cases (Fig. 1). In fact, maximum yields were obtained when some TPB were present and some square abortion occurred. Using these yield response

estimates combined with the insecticide application data used to control pests at the different thresholds, an economic analysis revealed that economic costs for TPB were minimized when average pre-bloom TPB density was 8 TPB/100 sweeps and when average square retention was 90% (Fig. 2). The threshold needed to realize these pre-bloom averages should be slightly higher than the averages as it is unlikely that pressure would be constant over the 3-4 week squaring period. However, as seen in Fig. 2, a slight shift from the optimum has very little impact on overall economics. Overall these data suggest that existing thresholds of 8 TPB/100 sweeps and 80% square retention are close to the actual regional threshold and should be retained in squaring cotton in the Midsouth.

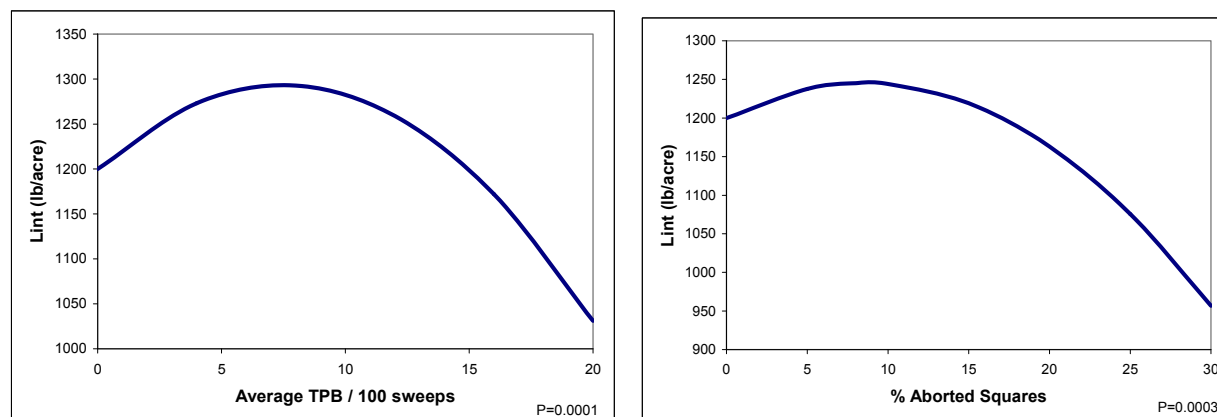


Figure 1. Curves of best-fit equations fitting yield to average tarnished plant bug density and average % aborted squares through the squaring period of cotton development. Based on data from 33 locations in the Midsouth during 2006-2008.

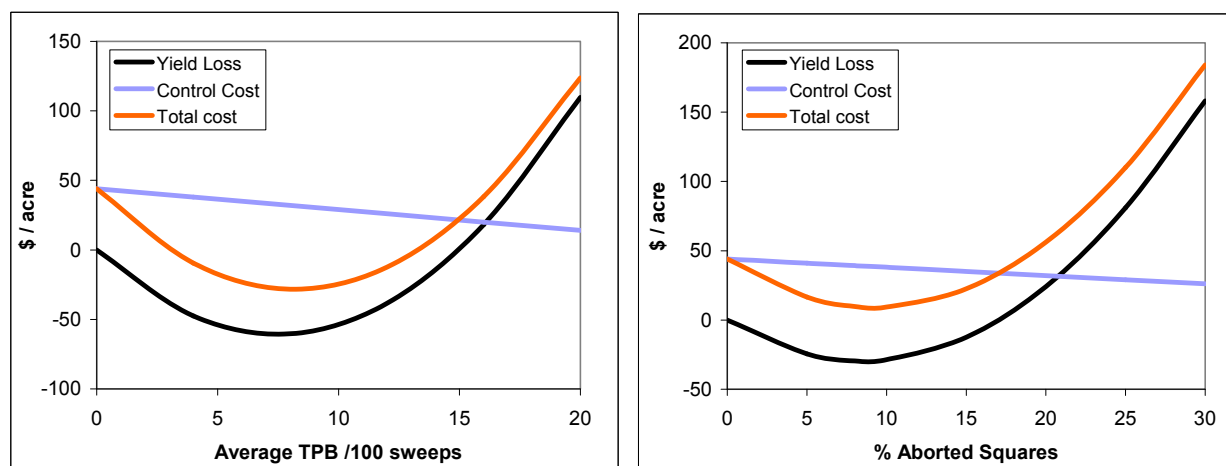


Figure 2. Economic costs from tarnished plant bug control and yield loss during the squaring period. Economic costs based on lint value of \$0.65 / lb and control costs of \$12.00 per application. Number of insecticide applications expected based on the average number of applications required when using the weekly, low and high thresholds.

Summary

Tarnished plant bug feeding during the squaring period of cotton development can reduce yield. Costs associated with TPB control and yield loss were minimized when average TPB density was 8 TPB/100 sweeps and average square retention was 90%. Actual thresholds that should be used to realize these average densities over the squaring period should generally be slightly higher than these average densities. Existing thresholds of 8 TPB/100 sweep and 80% square retention are in good agreement with our findings and can be retained with confidence. Because yields were actually lower at lower TPB densities and higher square retention rates, insecticide applications in the absence of substantial TPB pressure is costly in both control costs and yield benefits and should be avoided.

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References

- Catchot, A. 2008. Insect control guide for corn, cotton, & soybeans 2008. Publication 2471, Mississippi State University Extension Service.
- Greene, J. K., S. G. Turnipseed, M. J. Sullivan, and G. A. Herzog. 1999. Boll damage by southern green stink bug (Hemiptera: Pentatomidae) and tarnished plant bug (Hemiptera: Miridae) caged on transgenic *Bacillus thuringiensis* cotton. J. Econ. Entomol. 92: 941-944.
- Musser, F., A. Catchot, S. D. Stewart, R. Bagwell, G. M. Lorenz, K. V. Tindall, G. Studebaker, B. R. Leonard, D. S. Akin, and D. R. Cook. 2008. A midsouthern perspective on hemipteran pests. pp. 915-920. In: Proceedings, Beltwide Cotton Conferences. National Cotton Council, Memphis, TN.
- Musser, F. R., K. S. Knighten, and J. T. Reed. 2009. Comparison of cotton damage from tarnished plant bug (Hemiptera: Miridae) and southern green stink bug (Hemiptera: Pentatomidae) adults and nymphs. Midsouth Entomol. 2: In press.
- SAS Institute. 1999. SAS for Windows, Version 9.1. SAS Institute, Inc., Cary, NC, USA.
- Stewart, S. D. 2007. Cotton Insect Control Guide. Publication 387, University of Tennessee Extension.
- Tugwell, P., S. C. Young, B. A. Dumas, and J. R. Phillips. 1976. Plant bugs in cotton: importance of infestation time, types of cotton injury, and significance of wild hosts near cotton. Arkansas Agricultural Experiment Station Report. Report Series 227, University of Arkansas Agricultural Experiment Station.
- Williams, M. R. 2008. Cotton insect losses, <http://www.entomology.msstate.edu/resources/tips/cotton-losses/data/>.