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Report

A Multi-Tactical Approach to Managing Tarnished Plant Bugs in the Mississippi Delta Region

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Abstract. Tarnished plant bug (TPB) is the most economically important insect pest of cotton grown in the Mississippi Delta Region. Many factors contribute to the status of TPB as the number one pest producers face annually in cotton such as elimination of foliar sprays due to successful boll weevil eradication and wide spread resistance to several classes of insecticides. Successful management of TPB cannot be achieved unless producers utilize the full complement of tools available. Only an integrated approach to pest management has proven successful in recent years. The following discussion highlights some of the more commonly used approaches employed by producers to limit catastrophic yield loss and minimize environmental effects of repeated insecticidal applications. When all or most of the tactics described have been incorporated into a unified control strategy or program, yield loss by this damaging pest has been minimized and profitability maintained.

Keywords: Tarnished Plant Bug, Integrated pest management

Introduction

The tarnished plant bug (TPB) has become the most economically important pest of cotton in the mid-south states of Mississippi, Arkansas, Louisiana, Tennessee, and Missouri. There are several reasons for the tarnished plant bug's increase in pest status in Mid-South cotton including; successful boll weevil eradication and introduction of cotton cultivars in 1996 that expressed the Bt toxin. Both of these events reduced the number of foliar sprays being applied to cotton that were providing incidental control of TPB. However, the most significant reason for the increase in pest status is likely the onset of resistance to foliar insecticides, including the pyrethroid and organophosphate classes of chemistry. Over the last couple decades use rates have more than doubled with some of the more commonly used insecticides (Fig. 1). It is not uncommon for producers in the Delta Region of Mississippi to make 5-12 applications for TPB annually (Williams 2013). Over the last several years there has been an increasing trend in TPB applications with a regional average in the delta of about six applications (Fig. 2). To address this problem, researchers and extension agents throughout the Mid-South region have worked hard to develop several recommendations that independently have been shown to have an effect on TPB populations. Implementing these recommendations into a comprehensive strategy can successfully allow producers the opportunity to minimize economic loss from TPB.

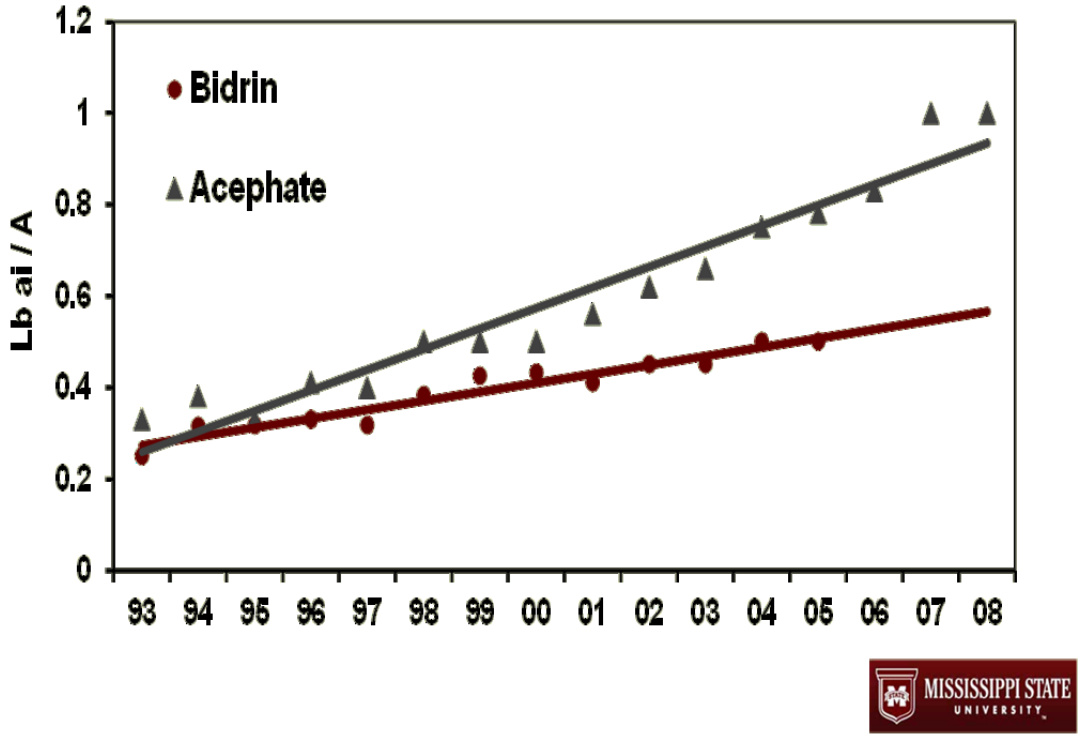

Figure 1. Evolution of insecticide use rates. Increase in use rates of two commonly used organophosphates in the Mississippi Delta Region.

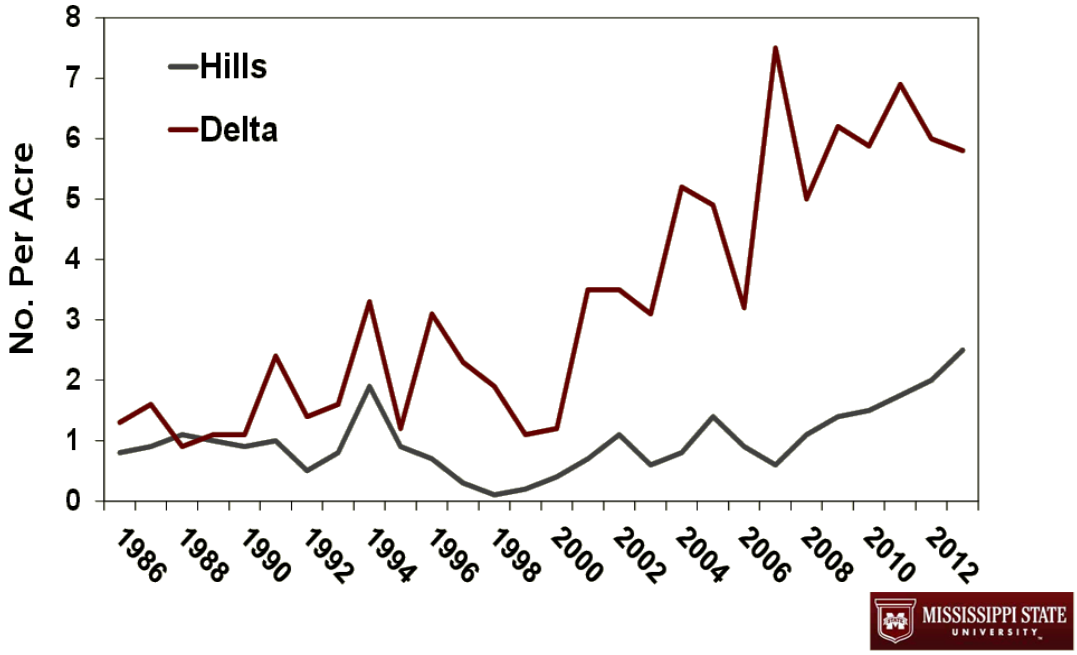

Figure 2. Applications of tarnished plant bug. Average number of insecticide applications required for tarnished plant bug in the Delta and Hill regions of Mississippi.

Wild Hosts Management

Populations of TPB in the Mid-south utilize a wide range of native and crop hosts before infesting cotton fields. Tarnished plant bugs break diapause and utilize winter annuals for a food source and for reproduction from February through June. Tarnished plant bug adults and immatures have even been found in January on warm days. Research by scientists with the US Department of Agriculture, Agricultural Research Service (USDA-ARS) has shown that managing spring hosts with a selective herbicide provides significant economic benefits in cotton. Figure 3 compares producer expenses for TPB control in cotton fields located in areas where wild host plants were treated with herbicides and non-treated areas. Treating marginal areas (turn rows, ditches, roadsides, etc.) with a selective herbicide during March to terminate broadleaf hosts provided a $5.90 per acre economic benefit for growers. Although this practice has shown benefit, it can prove hard to implement since often in adverse weather, spring burndown of cultivatable fields is delayed leaving large numbers of acres of winter weed host. This practice would likely take a community effort to successfully eliminate enough acreage to make a substantial difference.

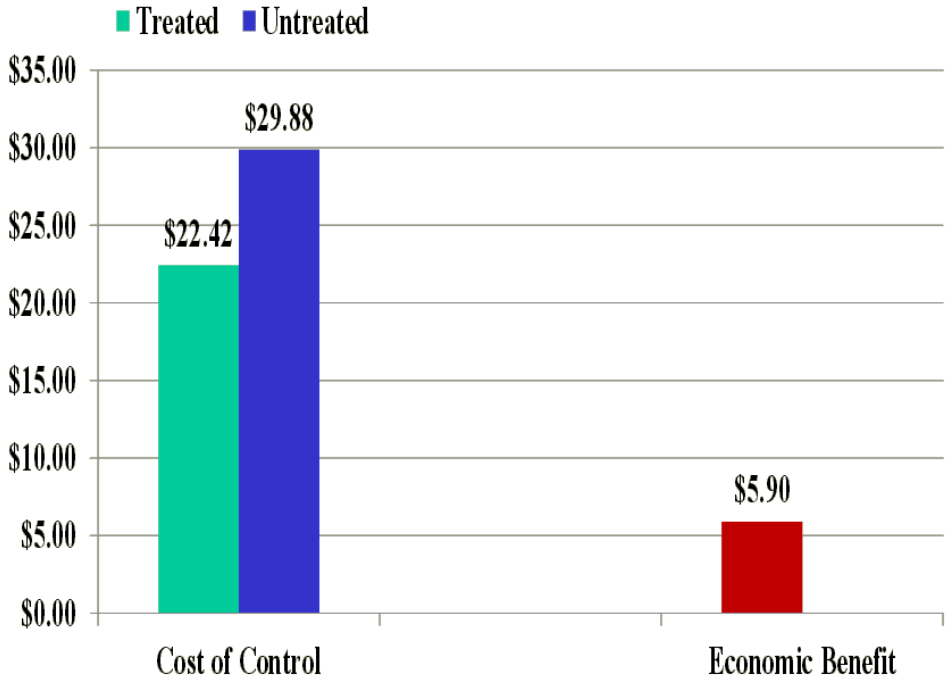

Figure 3. Economic benefits of an area wide vegetation management program for tarnished plant bugs. Economic advantage of area-wide wild host management programs for tarnished plant bug.

Variety Selection and Planting Date

Managing for an early crop has long been considered a tool for avoiding late season population increases for certain pests. In the early 1990's this tactic was widely recommended to avoid high populations of pyrethroid resistant tobacco budworms later in the season. With widespread adoption of Bt cotton in the late 1990's, many producers began to utilize later maturing cultivars again because they provided 100% control of tobacco budworms. As TPB emerged as the key threat to cotton production in the Mid-south region in the mid 2000's, this cultural practice again began to be explored as a possible way to reduce input costs associated with TPB. In fact, it was found that planting date alone could influence number of insecticide applications required to control TPB by as much as 40% (Fig. 4) (Adams et. al., 2013).

Although early planting cannot always be achieved due to environmental factors and risk management it is highly encouraged, particularly in areas that have a history of severe infestations. Earliness can also be achieved to a lesser degree by cultivar selection. Currently, farmers have options to grow early maturing, mid maturing, and late maturing cultivars. If early planting cannot be achieved, an early maturing variety can shorten the exposure window.

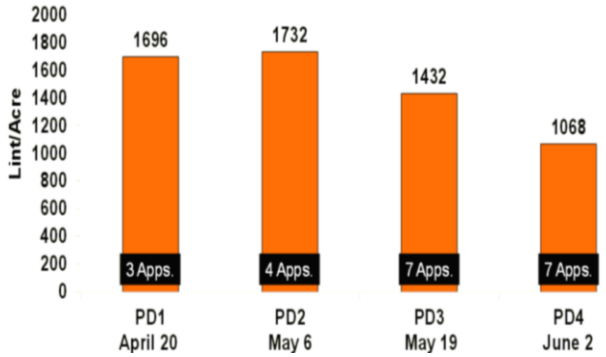

Figure 4. Yield and required tarnished plant bug applications across four planting dates. Yield of and number of tarnished plant bug applications required for four planting dates of cotton in the Mississippi Delta region.

Field Border Management

Tarnished plant bug populations are often much higher when cotton is planted next to a suitable wild host or a cultivated crop. Field corn has long been considered a potential source for extremely high numbers of TPB when planted adjacent to cotton (Fig. 5). Cotton planted adjacent to corn often requires many more insecticide applications than cotton that is not in the vicinity of field corn. Migration of TPB from corn to adjacent cotton is highest during silking and tassel and subsides shortly after brown silk stage is reached. Growers in the Delta Region are encouraged to block their cotton away from corn whenever possible.

Figure 5. Tarnished plant bug damage to cotton adjacent to corn that received 15 applications during the season in Leland, MS 2007 (photo by Chism Craig).

Management of Excessive Plant Growth

Tarnished plant bugs are preferentially attracted to rank or lush cotton. Several factors influence cotton plant growth such as fruit retention, varietal selection, and use of plant growth regulators. With increases in price of nitrogen fertilizer, more research efforts are being directed at determining optimum use rates. Most growers in the Delta Region are currently using 100-120 lbs. of nitrogen per acre. Recent research has shown adequate yields can be maintained at levels as low as 80 lbs. per acre with no loss of yield. Also, total numbers of plant bugs sprays were reduced by 1 compared with the 100 lb. rate, and 2 compared with the 120 lb. rate (Fig. 6).

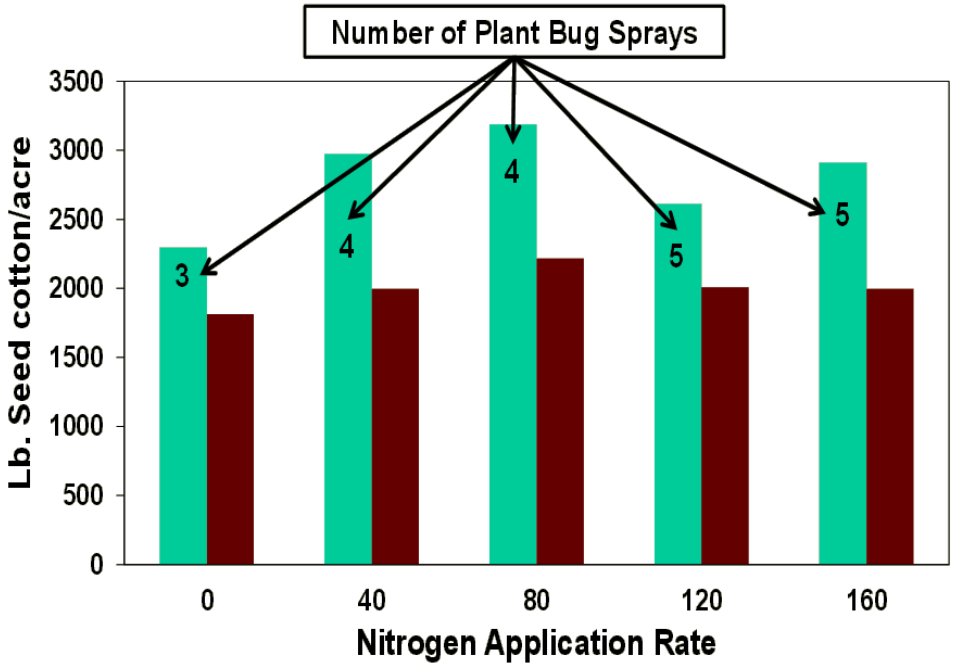

Figure 6. Impact of nitrogen rate on final cotton and yield and number of tarnished plant bug applications required in the Mississippi Delta region.

Insecticide Mixtures and Use Strategies

Because of widespread resistance to pyrethroids and organophosphate insecticides, to achieve adequate control during the bloom period, it is often recommended to tank-mix insecticides with different modes of action. Although resistant to pyrethroids and organophosphates, when the two are tank-mixed adequate control is often achieved during normal population densities. When populations greatly exceed economic thresholds, it is often required to make two applications 4-5 days apart to achieve adequate control. Selection can also be a very important factor when applying insecticides to control TPB nozzle. Figure 7 illustrated how control varies across nozzle type and size when all other factors are held constant. Generally plant bug nymphs are in protected places in the canopy and proper control depends on adequate coverage. Control can vary greatly depending on droplet size produced by the nozzle. Often larger droplet sizes typically used with systemic herbicides perform poorly for TPB control. Smaller droplets such as those produced by hollow cone or flat fan nozzles generally provide better control especially when used under higher pressure and volume. Smaller droplet sizes are much more prone to drift so care should be taken if applications are occurring in sensitive areas.

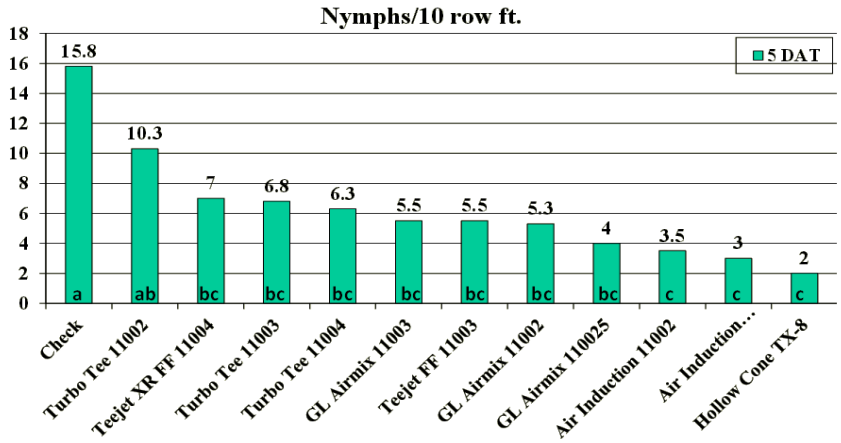

Figure 7. Nozzle type efficacy with acephate tarnished plant bug. Influence of nozzle type on tarnished plant bug control.

Sampling and Thresholds

Considerable research has been conducted across the Mid-south to evaluate sampling methods and thresholds for TPB. A large regional project sponsored by Cotton Incorporated showed that 3 TPB per 5 row ft. using a black drop cloth was the optimum sampling method/threshold combination for TPB during flowering. With the recent decline in efficacy of standard insecticides, frequency of applications with alternative insecticides (e.g., neonicotinoids and Diamond) has increased. Activities of these insecticides are slower than organophosphates and pyrethroids. Therefore, a plant based threshold was developed as a means to evaluate insecticide applications and trigger subsequent applications. Based on research conducted in Mississippi, Arkansas, and Louisiana, a damaged square (dirty squares) threshold of 10% resulted in a similar number of applications and similar yields to the standard threshold of 3 TPB per 5 row feet on a black drop cloth (Musser et. al., 2009). Subsequent research has shown that a combination of sampling methods and thresholds provided more consistent results than a single sampling method for TPB. In general, a black drop cloth is better than sampling squares during the early flowering period. A black drop cloth will also detect the presence of small nymphs before significant square injury occurs. During the later flowering period, a 10% square damage threshold is similar to a drop cloth threshold.

Summary

Many factors have led to the increased pest status of TPB since the mid 2000's such as insecticide resistance and fewer sprays for boll weevils and tobacco budworms. It has even been hypothesized that the steady decrease in cotton acres since 2006 has also contributed. Because cotton is a sink for TPB, rather than a source, many believe that TPB populations in the Mississippi Delta region have actually not increased in recent years, but rather are concentrated on fewer acres of cotton when they leave alternate hosts. Regardless of the reason, many producers have shied away from growing cotton or increasing their cotton acres due to fear of yield loss associated with TPB, despite higher prices received.

In the Delta regions of the Mid-south, yield loss in cotton from TPB can be minimized, but no single factor will likely prove successful. Producers must utilize all tools currently available in a season long control program. This will include cultural, host plant resistance, and chemical control incorporated into an integrated pest management program.

Acknowledgements

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