Best Management Practices for Tarnished Plant Bug in Cotton

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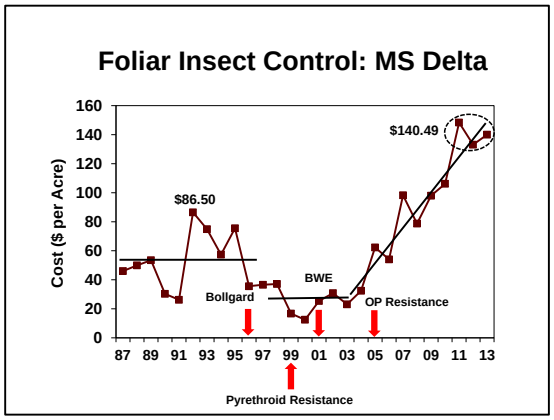
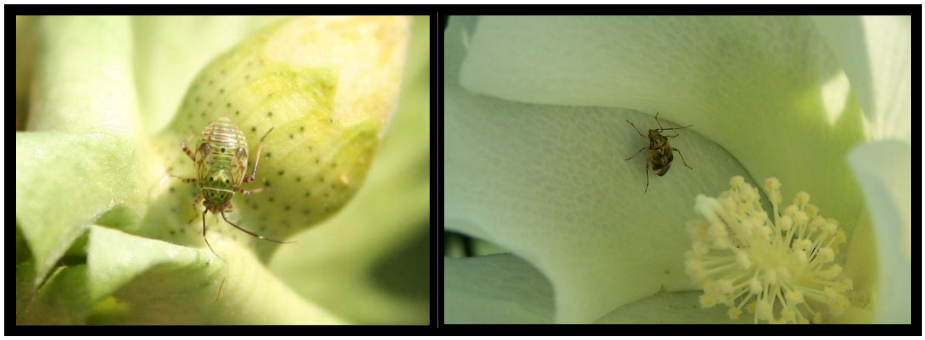
Introduction

The tarnished plant bug is the most important insect pest of cotton in Mississippi and the surrounding states. Several factors have contributed to their pest status in Mississippi. They include a significant reduction in cotton acres combined with a substantial increase in the area planted to corn and indeterminate soybean. This has changed the balance in the sink-source relationship where there is a much bigger source (corn and soybean) of tarnished plant bug relative to the sink (cotton). As a result, the populations that migrate into cotton during the late squaring and early flowering stages are greater than they were several years ago. This has been confounded by the fact that resistance to the pyrethroids was widespread by 1999 and to the organophosphates by 2005 as confirmed by Dr. Gordon Snodgrass (USDA-ARS). Because of those two factors, growers have to spray more often and with higher rates and tank mixtures of insecticides to prevent yield losses. This has resulted in very high foliar control costs for cotton growers in the Mississippi Delta.



The graph above shows foliar insect control costs for cotton growers in the Mississippi Delta from 1987 through 2013. This cost only includes insecticide and application costs, and does not include technology fees, seed treatment costs, and boll weevil eradication assessments. Prior to the introduction of Bt cotton and boll weevil eradication, foliar insect control costs peaked at $86.50 per acre in 1992. Bt cotton and boll weevil eradication significantly reduced foliar insecticide costs, but inputs for insect control have been steadily increasing since 2005. Over the last couple of years, foliar control costs have averaged $140.49 per acre. When the other insect control costs are factored in, this is clearly not sustainable and a more holistic approach to tarnished plant bug management is needed that does not rely only on foliar insecticides.



Best Management Practices

Research at Mississippi State University over the last decade has focused on managing tarnished plant bug in cotton. The focus has been on identifying crop production practices that can minimize the impact of tarnished plant bug or reduce their populations in cotton. The following best management practices are based on numerous experiments conducted throughout the Mississippi Delta.

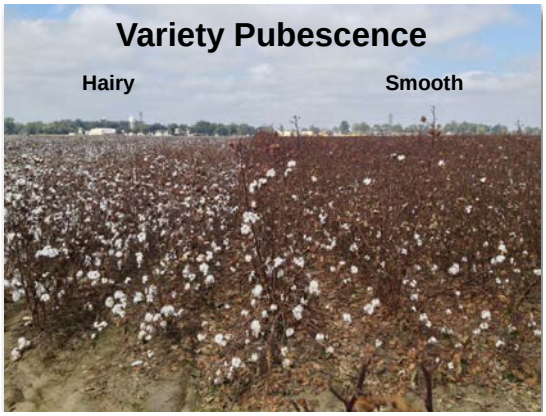
Field Selection and Planting Arrangement

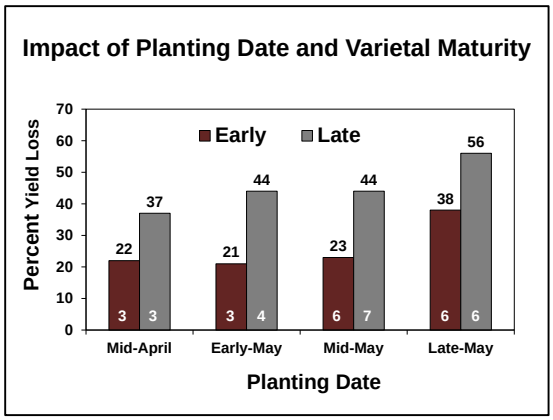
Tarnished plant bug infestations within a cotton field are significantly influenced by other agronomic crops and wild hosts adjacent to that field. Edge effects can be minimized by blocking cotton fields together and separating them from corn and early planted soybean fields. Additionally, care should be taken to manage wild hosts before they flower and hold heavy infestations of tarnished plant bugs. The overall goal of field selection should be to minimize the "edge effect" or minimize the number of edges where cotton is adjacent to other plant hosts.

Variety Selection and Planting Date

Variety selection is one of the most important decisions a grower can make. Obviously, the most important factor related to variety selection is yield potential. Growers have numerous resources available to help them with selection of the best variety for their area based on yield. However, little consideration is given to tarnished plant bug management when a grower selects which variety to plant. Things a grower should consider that can help with tarnished plant bug management include leaf pubescence and varietal maturity.

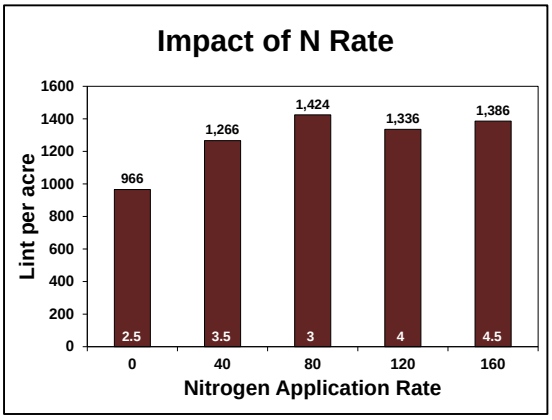
The density of hairs on cotton leaves can have an impact on tarnished plant bug injury in cotton. With similar numbers of plant bugs, a hairy leaf variety maintains significantly greater levels of square retention compared to a smooth leaf variety. The picture to the left shows plots of cotton that were not sprayed for tarnished plant bug. Yields are not very good in either variety, but the hairy leaf variety on the left had more cotton than the smooth leaf variety on the right. Square retention and yield was intermediate with a semi-smooth variety.

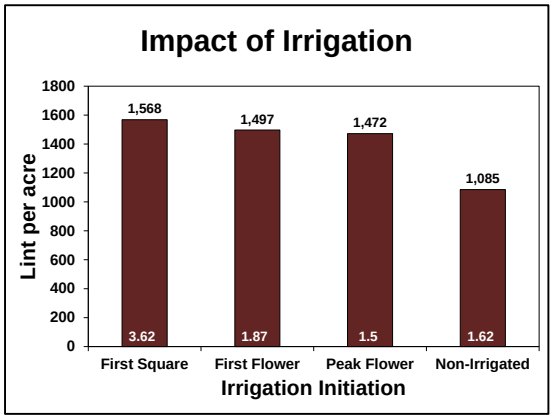




The graph on the left shows the impact of varietal maturity and planting date on tarnished plant bug management in cotton. An early maturing variety suffered less yield loss than a later maturing variety. Additionally, the numbers at the bottom of the bars show number of insecticide applications. When cotton was planted from mid-April to early-May, fewer sprays were needed than when cotton was planted from mid- to late-May. Growers should promote earliness in the crop through variety selection, planting date, and other factors such as early season thrips, disease, and weed management.

Fertilization can also impact tarnished plant bug management. The graph to the right shows cotton yields at different nitrogen application rates. Yields were maximized at 80 lbs of nitrogen per acre. However, 1 to 1.5 fewer sprays were needed to achieve that yield compared to 120 and 160 lb per acre rates. This suggests that a significant savings are possible from lower nitrogen costs and lower insect control costs without sacrificing yields. This research was done on a silty loam soil and greater nitrogen rates may be needed with clay soils.

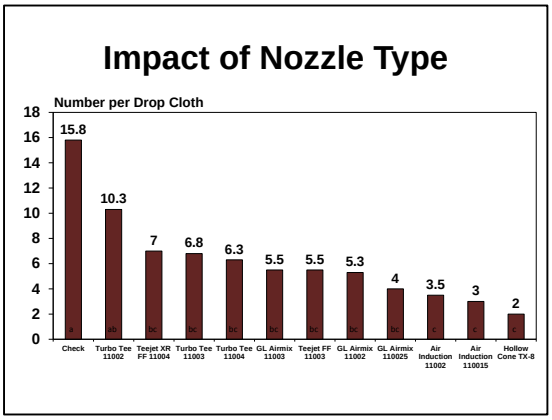


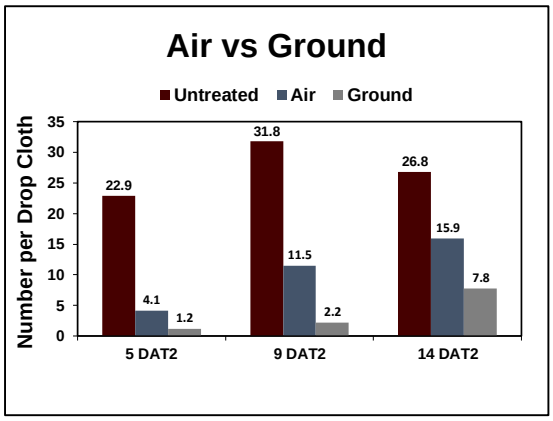


Irrigation scheduling is another factor that can impact tarnished plant bug management in cotton. This graph shows the impact of initiating irrigation at different times on cotton yield in 2013. No differences in yield were observed in 2014. In 2013, no differences were observed among irrigation timings, but all irrigation timings had greater yields than the non-irrigated. The numbers at the bottom of the bars show the number of times each irrigation reached threshold for tarnished plant bug averaged across both years. Irrigations initiated at first square resulted in more sprays for tarnished plant bugs.

Insecticide Use Strategies

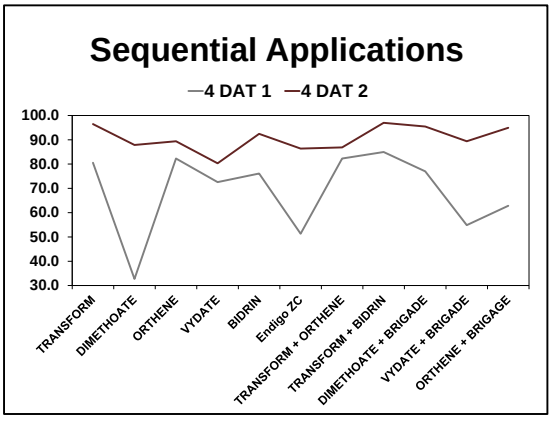
With resistance to pyrethroids and organophosphates widespread in tarnished plant bug populations across the Mid-South, proper application is very important. For ground applications, nozzle type can have a big impact on insecticide performance. The graph to the right shows a range in tarnished plant bug control achieved with 11 different nozzles using the same insecticide. In general, hollow cone nozzles provided the best control. Some of the low drift nozzles used for herbicide applications substantially reduced tarnished plant bug control.

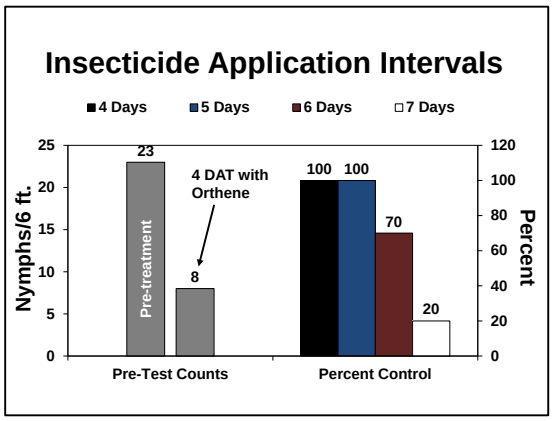




The majority of applications for tarnished plant bug are made by air in the Delta. The graph to the left shows the level of control with the same insecticide comparing an aerial application to a ground application. Overall, the ground application provided better control than the aerial application. Additionally, residual control was slightly better with the ground application as can be seen at 9 (9 DAT2) and 14 (14 DAT2) days after the second application. However, the timeliness of aerial applications makes it a better choice in most situations.

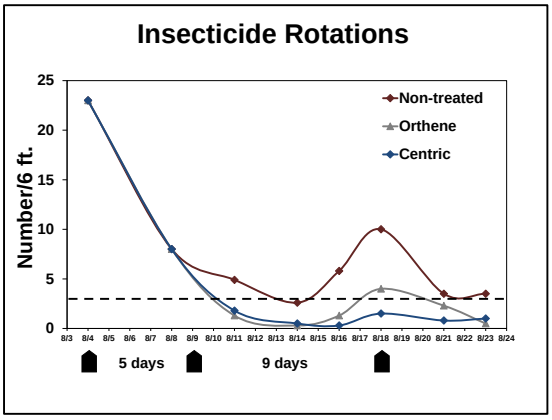
This graph shows percent control of tarnished plant bugs with several different insecticides and mixtures. The grey line shows percent control 4 days after 1 spray and the red line shows percent control 4 days after 2 sprays. Tarnished plant bug control was better after 2 applications regardless of the insecticide used. Overall, no insecticide or mixture provided better than 80% control after 1 application. In contrast, all of the insecticides provided better than 80% control after 2 applications. This was true even for insecticides that provided poor control after one application.

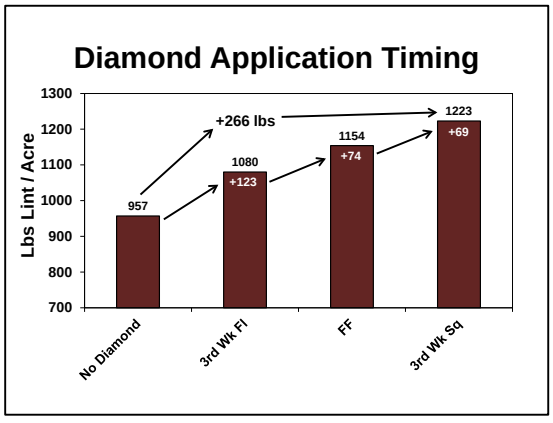




The interval between the first and second application is also important. This graph shows the impact of application interval on the efficacy of 2 applications with acephate. The grey bars on the left show the pretreatment numbers and numbers after 1 application. The bars on the right show percent control where the second application with acephate is made 4 to 7 days after the first application. Tarnished plant bug control was best when the second application was made 4-5 days after the first application. The level of control with the second application declined when the interval was longer.

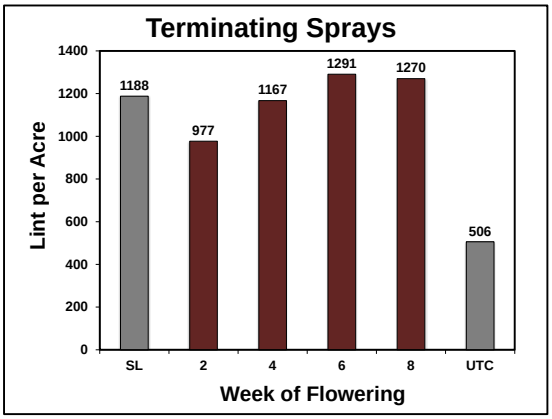
Rotating insecticides is also very important for tarnished plant bug control. This graph shows tarnished plant bug control with Orthene and Centric. At the first arrow, the entire field was sprayed with Orthene. Five days later, plots within the sprayed area were sprayed with Orthene or Centric, or left untreated. Nine days after the second application, the plots sprayed with Orthene had exceeded the threshold, but the plots sprayed with Centric were still below threshold. The entire field was sprayed again with Orthene at 9 days, but this shows the importance of rotating insecticides.





Diamond is an insect growth regulator that has become important for tarnished plant bug management. This graph shows different application timings with a single application of Diamond. From left to right, the bars represent no Diamond, third week of flowering, first flower, and third week of squaring. A single application of Diamond at any time during the season resulted in a 123 lb increase in lint yield. When the application was made during the late squaring period, there was a 266 lb increase in lint yield. This corresponded to adults migrating into the cotton from corn.

When to terminate sprays for tarnished plant bug is an important consideration. Considerable money can be spent at the end of the season that provides little return in terms of yield. This graph summarizes 2 years of research where sprays for tarnished plant bug were terminated after weeks 2-8 of flowering (red bars). This was compared to season long control and an untreated control (grey bars). Yields where sprays were terminated after weeks 4-8 were not different than the season long. This suggests that 1-2 sprays may be eliminated late in the season without a negative effect on yield.



Summary

Tarnished plant bug is the most important pest of cotton in the Mississippi Delta. In recent years, some growers have spent over $100.00 per acre to manage this pest with foliar insecticides because more frequent applications with higher rates and tank mixtures of multiple insecticides are needed to provide acceptable control. A complete reliance on insecticides is not sustainable for Mississippi growers and alternative control measures should be incorporated into an overall IPM plan. All of the research discussed above can help reduce the impact of tarnished plant bug on cotton yields, or reduce the number of insecticide applications needed to manage them in the Mississippi Delta. None of these practices are likely to eliminate tarnished plant bug as a pest and their effects are not likely to be additive. However, it is important to incorporate as many of these practices as possible into an overall best management plan to complement and enhance insecticidal control.

The Best Management Practices include:

1) **Plant as early as possible (before May 7)**
2) **Plant an early maturing variety**
3) **Arrange plantings to avoid "edge effects"**
4) **Promote earliness (early season thrips, disease, and weed management)**
5) **Avoid smooth leaf varieties**
6) **Reduce nitrogen rates (Excess nitrogen leads to rank growth and delayed maturity)**
7) **Delay irrigation as long as possible (can cause rank growth and delayed maturity)**
8) **Use optimum application practices (nozzle type, ground vs air, timeliness, etc.)**
9) **Make sequential sprays and shorten intervals to 4-5 days during heavy pressure**
10) **Rotate insecticide classes**
11) **Use Diamond during late squaring/early flowering (when adults are migrating)**
12) **Do not chase a few pounds of lint in the top of the plant with multiple sprays (more research is needed on when to stop spraying for plant bugs).**

Research was conducted across the Mississippi Delta and included several graduate student projects. They include Brian Adams (M.S. Thesis), Chase Samples (M.S. Thesis), and Wilks Wood (M.S. Thesis) Funded was provided by Cotton Incorporated.