INFLUENCE OF BOLL WEEVIL ERADICATION ON COTTON APHID POPULATIONS IN MISSISSIPPI COTTON: YEAR TWO

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Abstract

Year two of a survey to monitor aphid populations in areas inside and outside of boll weevil eradication was conducted in the summer of 1999. Beginning this year Mississippi was involved in 3 different phases of boll weevil eradication. This survey was conducted in those 3 regions to determine the effects that ULV malathion used in the program had on aphid populations. Flaring of aphids due to boll weevil eradication was much less in 1999 than in 1998. However, early flaring of bandedwinged whitefly populations was observed in the South Delta region. This region was involved in the second season of boll weevil eradication, which has historically been the year of heaviest ULV malathion use and has thus had greatest risk of flaring secondary pests.

Introduction

Although the cotton aphid, *Aphis gossypii* Glover, is not a major pest of cotton, it is capable of causing damage and yield loss under certain conditions. Aphids damage cotton by sucking plant sap, causing physical damage to leaves, causing stunting of plants, and by the production of honeydew which can result in sticky lint. Because the damage caused by aphids is indirect, yield losses are generally less than those caused by fruit feeding pests such as bollworms, and aphid infestations do not always result in measurable yield loss. Yield losses attributed to aphids have ranged from 0 lbs. (Weathersbee & Hardee; 1995) to 220 lbs. lint per acre (Layton, et al., 1996).

To treat or not to treat aphid infestations is a question asked year after year by producers. Unfortunately there currently are few aphicides on the market that are effective against aphids. Of the currently labeled aphicides, Bidrin (dicrotophos) and Provado (imidacloprid) provide the most consistent control, and Furadan (carbofuran) has been available for use in Mississippi under Section 18 emergency exemption. These chemicals provide short-term control but are not as effective or as long lasting as the naturally occurring fungal disease *Neozygities fresnii*.

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Predators and parasites such as lady beetles and the parasitic wasp, *Lysiphlebus testacepies*, play a very important role in suppressing aphid populations. These beneficial insects often keep populations at sub-damaging levels until the *N. fresnii* appears (Layton 1999). However, during the early stages of boll weevil eradication programs the frequent applications of ULV malathion used to control the boll weevil often disrupt this natural control and cause flaring of aphids and other pests. The primary objective of this survey was to examine the impact of boll weevil eradication efforts on the development of cotton aphid populations and incidence of the fungal disease, *N. fresnii*. A secondary objective was to observe the response of bandedwinged whitefly *Trialeurodes abutiloneus* (Haldeman).

Methods

During the 1999 growing season there were three distinct phases of boll weevil eradication underway in Mississippi. The Hill region of the state was involved in the third season of eradication; the South Delta was involved in the second season; and the North Delta began eradication efforts in early August of 1999. Because the timing and frequency of ULV malathion treatments was expected to vary considerably among these three regions, this provided a unique opportunity to examine the impact of boll weevil eradication treatments on cotton aphid infestations.

A survey line was established across the state to include fields in all 3 boll weevil eradication program regions (Figure 1). There were a total of 4 fields in the North Delta. Because these fields did not receive applications of ULV malathion until the first week of August, boll weevil eradication treatments did not influence aphid populations observed in June and July. Six of the survey fields were located in the South Delta region, which was involved in the second year (first full season) of boll weevil eradication. Because early season use of ULV malathion is normally most intensive during year 2, this is typically when the greatest problems are experienced with secondary pests. The remaining 5 survey fields were located in the Hill region of the state, which was involved in the third season of boll weevil eradication.

Beginning the week of June 1, fields were visited weekly and sampled to determine cotton aphid population levels. Fields were sampled by examining 20 randomly chosen leaves per field, counting the number of aphids per leaf and determining the average number of aphids per leaf for each sample date. When aphid populations were sufficiently high, an additional sample of aphids was collected, preserved in ethanol and mailed to the University of Arkansas. Fifty aphids from each of these samples were crushed and examined microscopically for the presence of the entomopathogenic fungus, *Neozygities fresnii*. Results from these samples were recorded as percent infected aphids. A sample of beneficial insects was made by taking a series of 50 sweeps per field. Also, bandedwinged whitefly populations were sampled by collecting 20 randomly selected leaves per field, counting the number of immature whiteflies in 1 sq. inch, and determining the number of immature whiteflies per 20 sq. inches.

Results and Discussion

Average seasonal aphid populations for each region are shown in Figure 2. Aphid populations peaked in all 3 regions on or around June 28, with the highest population being observed in the Hills at an average of 133.6 aphids per leaf. Note however that only one of the five fields in Hills had been treated for aphids by July 2, but all fields in the South Delta and North Delta were treated by this date (Figure 3). Furthermore, the South Delta had the highest season long average number of aphid sprays per field at 1.3 while the Hills averaged only 0.2 aphid sprays (Table 1). Thus the South Delta would likely have had a higher population than the Hills if the aphid populations had not been suppressed by these additional aphicide sprays.

Aphid populations in all three regions drop sharply following the June 28 peak. This sharp decrease in populations, is due to aphicide treatments and/or the occurrence of an epizootic of the naturally occuring fungal disease *Neozygites fresenii* (Steinkraus, et al, 1991; 1992). This disease usually appears in Mississippi between July 1 and July 15 (Layton 1998) and provides excellent control of aphid populations. Once this outbreak occurs, populations are usually suppressed for the remainder of the growing season.

Figure 4 shows the seasonal incidence of *N. fresnii* in the cotton aphid populations for each region. Although this disease was present in all 3 regions, incidence was much higher in the Hill region. The lower incidence of *N. fresnii* in the Delta regions is attributed to the higher frequency of aphicide treatments which artificially reduced aphid populations and interfered with development and/or detection of the disease. The apparent sharp decline of infected aphids in the Hills that follows the peak incidence on July 6 is simply the result of the crash in aphid populations and the inability to continue collecting aphid samples. The second peak of *N. fresnii* infection that occurred in the Hill region in early August is the result of a slight resurgence in aphid populations (Figure 2) that often occurs in late season, and is quickly suppressed by a second epizootic of fungal disease (Figure 4).

Although aphid populations were similar in all 3 regions in 1999 (Figure 2), fields in the South Delta received considerably more aphicide treatments than fields in the Hill region (Table 1). While boll weevil eradication treatments did appear to cause some flaring of aphid populations in the South Delta, this was much less distinct than the flaring observed in the Hill region in 1998 (Layton et al. 1999), when that area was involved in the second season of eradication. There was little difference between the South Delta and North Delta in either seasonal aphid populations (Figure 2) or average number of aphid sprays per field (Table 1) despite the fact that South Delta fields had received an average 3.2 malathion treatments and 2.2 other non-aphicide treatments by July 1, compared to 0 malathion treatments and 1.5 other non-aphicide treatments in the North Delta (Table 1). The fact that the Hill region received approximately twice as many total non-aphicide treatments before July 1 as the North Delta (3.2 vs. 1.5), yet received fewer aphid treatments (0.2 vs. 1.25) may cause one to question the role of early season insecticide treatments in flaring aphid infestations. However it must be noted that producers in the Hill region seem to be more tolerant of low to moderate aphid infestations and thus more inclined to wait on the fungal disease to provide control than are Delta producers. It is interesting that seasonal aphid populations were similar in all three Regions despite the fact that aphid populations in the two Delta regions were suppressed primarily by aphicide treatments while most fields in the Hill Region relied on the fungal disease to provide control.

This year we did observe initial flaring of bandedwinged whitefly in the South Delta region where late July and early August populations were much higher than in the Hills and North Delta (Figure 5). However, highest whitefly populations were eventually observed in the North Delta, peaking at 237.6 immatures per 20 square inches on August 16. Whitefly populations declined in all three regions during late August as a result of early crop cutout.

In summary, flaring of aphid populations as a result of early season boll weevil eradication efforts was less obvious in 1999 than was observed in a similar 1998 survey (Layton, et. al., 1999). Although boll weevil eradication efforts can contribute to increased problems with both aphids and whiteflies, the long term benefits of eradication far outweigh these short-term negative consequences. Regions of the country where boll weevil eradication has been successful also have reduced cost and yield losses from aphids, tobacco budworm, and other insect pests (Layton 1999). As the Boll Weevil Eradication Program continues in Mississippi, producers will begin to experience the long term benefits that this program has to offer.

Acknowledgements

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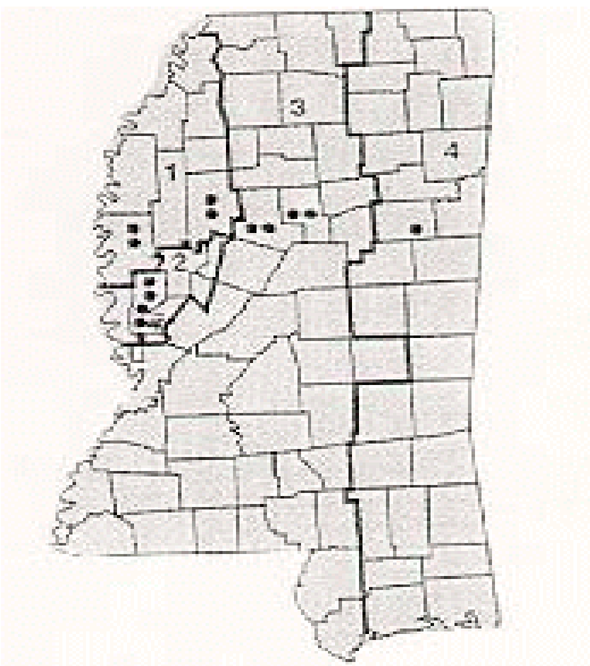

Figure 1. Distribution of aphid population survey fields. Fields in the North Delta (Region 1) were not under active eradication until August of 1999. The South Delta (Region 2) was in the second year of eradication, and the Hills (Regions 3 & 4) were in the third year of boll weevil eradication.

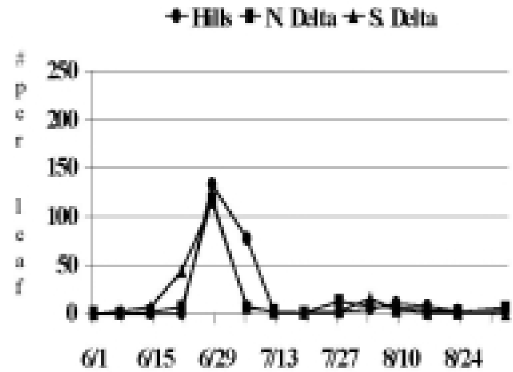

Figure 2. Average seasonal cotton aphid populations in the Hills (n=5), North Delta (n=4), and South Delta (n=6), 1999.

Figure 3. Distribution of aphid survey fields that had received one or more aphicide treatements (▲) or exceeded an average population of 100 aphids per leaf but were not treated (■) by July 2. Region 3&4 = Hills; Region 2 = South Delta; Region 1 = North Delta.

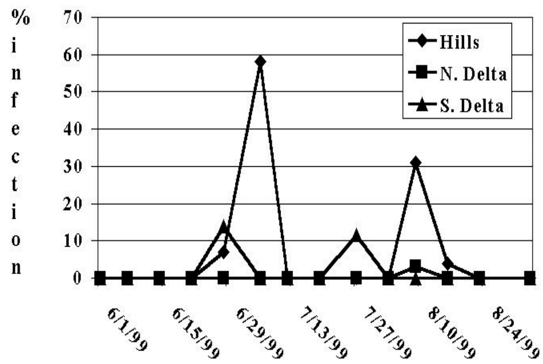

Figure 4. Average percent of cotton aphids with the fungal disease, *Neozygites fresnii* in the Hills (n=5), South Delta (n=6), and North Delta (n=4) in 1999.

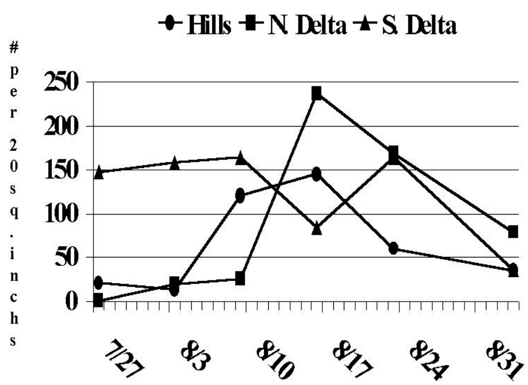

Figure 5. Average seasonal bandedwinged whitefly populations for the Hills (n=5); South Delta (n=6) and North Delta (n=4).

Table 1. Average number of ULV malathion treatments, other non-aphicide treatments, and total non-aphicide treatments applied before July 1 and average season-long number of aphid treatments applied to survey fields in the Hill region (n=5), South Delta region (n=6), and North Delta region (n=4) in 1999.

	# Mal. sprays before 7/1	**# Other sprays before 7/1**	**Total # non-aphid sprays before 7/1**	**Avg. # aphid sprays**
S. Delta	3.16	2.17	5.33	1.33
N. Delta	0	1.5	1.5	1.25
Hills	2.4	0.8	3.2	0.20