INFLUENCE OF AGRONOMIC PRACIICES ON COTTON APHID, *APHIS GOSSYPII* GLOVER, DENSITIES IN LOUISIANA COTTON

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Abstract

A series of agronomic systems examining the influence of tillage systems (conventional-till, ridge-till, and no-till), winter cover crops (native vegetation, crimson clover, hairy vetch, and wheat), and nitrogen fertilization rates (0, 35, 45, 70, 80, 90, 105, 110, and 140 lb N/ acre) on cotton production were evaluated in Northeast Louisiana during 1995 to 1998. The effects of these factors on cotton aphid, *Aphis gossypii* Glover, densities were determined during the last week of June using a visual rating on 25 plants per plot. Cotton plants with >10 cotton aphids per plant terminal were considered infested with an active colony. The most important agronomic factor influencing cotton aphid populations appeared to be a reduction in tillage practices. Winter cover crops increased the percentage of aphid infested plants above that of native vegetation in only one year of one test. Nitrogen rates did not directly affect the percentage of aphid infested cotton plants.

Introduction

The cotton aphid, *Aphis gossypii* Glover, is considered an important secondary insect pest of cotton, *Gossypium hirsutum* L., throughout the United States. During the 1999 growing season, approximately 75% of the cotton acreage in the United States was infested with cotton aphids (Williams 2000). Historically, cotton aphid populations increase following selected insecticide applications for other insect pests (Isley 1946, Bothrell 1977, and Slosser 1989). However several agronomic practices can influence cotton aphid densities as well. Higher densities of aphids have been observed in no-till and reduced tillage plots compared to conventional-till plots in Louisiana (Torrey et al. 2000). Ruberson et al. (1995) observed higher cotton aphid populations in cotton planted into crimson clover plots to conventional-till plots. Research has shown that soil nitrogen level can influence cotton aphid densities (Slosser 1989, Godfrey and Keillor 1999). However, in Mississippi, Andrews et al. (2000) showed no differences in aphid populations on cotton treated with various nitrogen fertilizer rates.

Problems with cotton aphid management have increased in recent years with the implementation of the boll weevil eradication program throughout the Southeast and Mid-South. Malathion, used in boll weevil eradication programs, provides minimal control of cotton aphids. However, natural enemy populations are often reduced after malathion applications and cotton aphids may increase to damaging levels (Layton 1999). In addition, reduced tillage practices for cotton production have increased greatly across the Mid-South with the adoption of herbicide resistant (Round-up Ready) cultivars. Nitrogen rates also have increased due to additional cotton acreage on marginal soils that have higher fertilizer requirements. With conditions optimal for aphid outbreaks, additional data concerning the influence of agronomic factors on cotton aphid densities are needed in order to refine management practices for this pest. The objective of these tests was to evaluate the influence of tillage systems (conventional-till, ridge-till, and no-till), winter cover crops (native vegetation, crimson clover, hairy vetch, and wheat), and nitrogen rates (0, 35, 45, 70, 80, 90, 105, 110, and 140 lb N/ acre) on cotton aphid infestations in Louisiana.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1097-1099 (2001)
National Cotton Council, Memphis TN

Materials and Methods

Tillage x Cover Crop x Nitrogen Rate (TCN) Study

Several agronomic systems, including conventional-till and no-till practices, winter cover crops (native vegetation, hairy vetch, and wheat), and nitrogen rates (0, 35, 70, 105, 140 lb N/acre), utilized in cotton production were evaluated at the Macon Ridge Location of the Northeast Research Station (MR-NERS) near Winnsboro, Louisiana, during 1995 to 1997. A full description of materials and methods for agronomic practices in this report is provided in Boquet et al. (2000). Plots were arranged in a split-plot within a randomized complete block with three to four replications. Main plots were tillage systems. Sub-plots consisted of a factorial arrangement of cover crops and nitrogen rates. The effects of these factors on cotton aphid densities were determined during the last week of June using a visual rating test on 25 plants per plot. Cotton plants with >10 cotton aphids per plant terminal (all apical shoot growth including first fully expanded leaf) were considered infested with an active colony. No foliar insecticides were applied prior to these ratings. Data were converted to percentage of plants infested with cotton aphids, subjected to ANOVA, and treatment means were compared using Fisher's protected LSD (SAS 1989).

Conservation Tillage Study

In a second study, the effects of alternate tillage systems (conventional-till, ridge-till, and no-till), winter cover crops (wheat, hairy vetch, crimson clover, and native vegetation), and nitrogen rates (80 or 110 lb N/acre and 45 or 90 lb N/acre) on aphid infested plants were evaluated at the MR-NERS during 1995 to 1998. Plots were arranged in a split plot within a randomized complete block design with four replications. Main plots were tillage system and sub-plots consisted of a factorial arrangement of cover crops and nitrogen rates. Cotton infestations were determined the last week of June. All data were summarized using procedures similar to those used in the TCN study.

Results and Discussion

TCN Study

Tillage System. Cotton aphid infested plants ranged from 54.3% to 86.3% across the test area during 1995 to 1997 (Table 1). No significant differences in cotton aphid infested plants were observed among the tillage systems in 1995 ($P > 0.1$). In 1996 and 1997, no-till plots had significantly more aphid infested plants compared to conventional-till plots.

Winter Cover Crop. Cotton aphid infested plants ranged from 55.0% to 78.6% among cover crop and native vegetation plots during 1995 to 1997 (Table 2). In all test years, there were no significant differences in aphid infested plants among winter cover crops ($P > 0.1$). The percentage of aphid infested cotton plants were similar in both hairy vetch and wheat cover crop systems. Plots with native vegetation contained the highest percentage of aphid infested cotton plants in 1995 and 1996.

Nitrogen Rate. Cotton aphid infested plants ranged from 44.0% to 81.3% among nitrogen fertilizer treated plots during 1995 to 1997 (Table 3). There were no significant differences in cotton aphid infested plants among nitrogen rates ($P > 0.1$).

Conservation Tillage Study

Tillage System. Cotton aphid infested plants ranged from 14.7% to 96.1% across the test area during 1995 to 1998 (Table 4). Significant differences in aphid infested cotton plants were observed among tillage systems in all years ($P < 0.05$). In 1995, no-till plots contained significantly fewer aphid infested plants than conventional-till plots. In 1996, 1997, and 1998, conventional-till plots contained significantly fewer aphid infested plants than both ridge-till and no-till plots. In 1997, ridge-till plots contained significantly fewer aphid infested plants compared to no-till plots.

Winter Cover Crop. Cotton aphid infested plants ranged from 17.2% to 88.5% among cover crop plots and native vegetation plots during 1995 to 1998 (Table 5). No significant differences in aphid infested plants was observed among winter cover crop systems in 1996 to 1998 ($P > 0.1$). In 1995, cotton planted into native vegetation contained significantly more aphids than those planted into hairy vetch and wheat ($P < 0.05$). Percentage of aphid infested cotton plants varied < 5% among the native vegetation and cover crops in all years except 1995.

Nitrogen Rates. Cotton aphid infested plants ranged from 19.8% to 86.7% between plots treated with nitrogen fertilizer during 1995 to 1998 (Table 6). No significant differences in cotton aphid infested plants were observed among nitrogen rates ($P > 0.1$). There was less than a 2% variation in cotton aphid infested plants among the high and low nitrogen treatments with a year.

Summary

In all years except 1995, the most important agronomic factor influencing cotton aphid populations appeared to be a reduction in tillage practices. Winter cover crops influenced the percentage of aphid infested plants in only one year of one test. Nitrogen fertilizer rates did not affect the percentage of aphid infested cotton plants in either study.

Acknowledgments

The authors would wish to express their appreciation to Ralph Sheppard, Jimmy Thomas, Rhett Gable, Don Cook, Jeff Gore and the Macon Ridge student employees for their assistance in conducting these tests. Appreciation is also extended to the LSU Agricultural Center, Cotton Incorporated, and Louisiana's cotton producers for their funding of this project.

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Table 1. Effects of tillage systems on cotton aphid infestations recorded on a single date during late June in Louisiana, (TCN study).

	% Aphid Infested Plants		
Tillage System	**1995**	**1996**	**1997**
Conventional-till	58.9a	54.3b	63.9b
No-till	54.9a	78.1a	86.3a
(P>F)	0.78	<0.01	0.07

Means in columns followed by same letter are not significantly different (Fishers Protected LSD, P=0.1).

Table 2. Effects of winter cover crop systems on cotton aphid infestations recorded on a single date during late June in Louisiana, (TCN study).

	% Aphid Infested Plants		
Cover Crop	**1995**	**1996**	**1997**
Native Vegetation	59.2a	72.3a	68.5a
Hairy Vetch	55.0a	62.2a	78.7a
Wheat	56.0a	64.2a	78.0a
(P>F)	0.79	0.17	0.13

Means in columns followed by same letter are not significantly different (Fishers Protected LSD, P=0.1).

Table 3. Effects of nitrogen rates on cotton aphid infestations recorded on a single date during late June in Louisiana, (TCN study).

Nitrogen Rate	% Aphid Infested Plants		
(lb./acre)	**1995**	**1996**	**1997**
0	59.6a	60.0a	68.3a
35	60.7a	67.5a	77.8a
70	44.0a	66.1a	81.4a
105	61.1a	64.4a	74.5a
140	59.3a	73.1a	73.6a
(P>F)	0.11	0.5	0.45

Means in columns followed by same letter are not significantly different (Fishers Protected LSD, P=0.1).

Table 4. Effects of tillage systems on cotton aphid infestations recorded on a single date during late June in Louisiana, (Conservation Tillage study).

	% Aphid Infested Plants			
Tillage System	**995**	**1996**	**1997**	**1998**
Conventional-till	38.3a	74.4b	74.4c	14.7b
Ridge-till	34.9ab	93.1a	89.7b	22.6a
No-till	27.9b	87.5a	96.1a	22.7a
(P>F)	0.02	<0.01	<0.01	0.02

Means in columns followed by same letter are not significantly different (Fishers Protected LSD, P=0.1).

Table 5. Effects of winter cover crop systems on cotton aphid infestations recorded on a single date during late June in Louisiana, (Conservation Tillage study).

	% Aphid Infested Plants			
Cover Crop	**1995**	**1996**	**1997**	**1998**
Native Vegetation	38.3a	86.7a	87.5a	23.0a
Crimson Clover	37.8ab	83.5a	85.2a	17.2a
Hairy Vetch	29.5bc	86.7a	85.6a	19.8a
Wheat	29.1c	83.3a	88.5a	20.2a
(P>F)	0.04	0.86	0.95	0.45

Means in columns followed by same letter are not significantly different (Fishers Protected LSD, P=0.1).

Table 6. Effects of nitrogen rates on cotton aphid infestations recorded on a single date during late June in Louisiana, (Conservation Tillage study).

Nitrogen Rate	% Aphid Infested Plants			
(lb./acre)	**1995**	**1996**	**1997**	**1998***
80/45	33.6a	86.0a	86.7a	19.8a
110/90	33.8a	84.0a	86.8a	20.3a
(P>F)	0.92	0.48	0.96	0.67

Means in columns followed by same letter are not significantly different (Fishers Protected LSD, P=0.1).

* Nitrogen rates were 45 and 90 lb./ acre in 1998.