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EFFICACY OF SELECTED INSECTICIDES FOR CONTROL OF APHIDS, *APHIS GOSSYPII* (GLOVER), IN ARKANSAS, 2003

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Abstract

Various insecticides at different rates were used in Lincoln County Arkansas in 2003 to determine the efficacy of those insecticides for controlling the cotton aphid, *Aphis gossypii* (Glover), population. The control methods for this study consisted of a single spray application of selected rates for cyfluthrin (Baythroid® 2 EC), acetamiprid (Intruder® 70 WP), thiamethoxam (Centric® 40 WG), imidacloprid (Trimax® 4 SL), and bifenthrin (Capture® 2 EC). This spray application was applied on June 24, 2003 with a two man CO_2-pressurized hand boom at a rate of 10.17 gallons per acre (GPA). One whole plot consisted of 14.25 feet by 50 feet of Deltapine 451®. Two subsequent evaluations were conducted at 2 and 5 days after treatment (DAT). These evaluations were conducted on a five leaf per plot basis, with each leaf selected at random from the tops of the plants. A one inch square area at the leaf / petiole junction was visually evaluated to provide a uniform evaluation method for determining the aphid population numbers. An average across the two evaluation dates indicates that acetamiprid (0.03570 lbs. ai / A) had the highest control rate at 99.0 % of the untreated check. On the same average, bifenthrin (0.06 lbs. ai / A) had the lowest rate of control at 19.4 % of the untreated check. At 5 DAT the aphid population in the bifenthrin (0.06 lbs. ai / A) treated area was higher than the aphid population in the untreated check.

Introduction

Since 1991 the cotton aphid has developed as a major economically important pest throughout the cotton belt. Damage caused by the aphid during the early season growth stages of cotton can range from discoloration, to a misshaped plant, and even death in cases of extreme infestations. Aphid infestations in the later developmental stages of cotton can cause damage ranging from sooty mold to sticky cotton (Wells et al. 1998). In both the 2000 and 2001 cotton production seasons, the aphid infested area in Arkansas remained constant at 1,000,000 acres of cotton (Williams 2001 and Williams 2002). The Arkansas recommendation for cotton is to apply insecticides when aphids are present on approximately 50 % of the plant population (Greene 2003). Research has shown that aphid populations of approximately 75 to 125 aphids per leaf can cause a 0.075 to 0.185 oz. drop in the average boll weight (Karner et al. 1997). Research has also shown that higher aphid populations of ~ 475 per leaf can reduce plant boll production by 13 to 14 %, reduce boll size by 5 to 6 %, and reduce photosynthetic rates by 6 to 7 % (Godfrey and Wood 1998). A high reproductive rate and fast developmental life cycle have given the cotton aphid a superior chance of developing resistance to insecticides (Wells et al. 1998). Therefore, this study was conducted to determine the efficacy of selected insecticides in controlling cotton aphid populations. The insecticides that were selected for this study that are recommended for aphid control in the MP144 2003 Insecticide Recommendations for Arkansas (acetamiprid, thiamethoxam, and imidacloprid) were applied at low and reduced rates to determine there effectiveness in controlling aphids at these rates. These reduced rates were also meant to expose the aphid population to a less concentrated chemical application thereby exposing the aphids to lower chemical levels and reducing exposure to higher rates of these insecticides. The insecticides that were selected for this study that are not recommended for aphid control in the MP144 (cyfluthrin and bifenthrin) were applied to determine their effectiveness in controlling a cotton aphid population. The aphid population will not have developed as strong a resistance factor to these lesser used insecticides.

Materials and Methods

The irrigated field was plant to Deltapine 451® on May 13, 2003. This field was located approximately five miles southwest of Tamo, AR, in Lincoln County. This field was located inside the Arkansas Boil Weevil Eradication Zone. The single spray application was made on June 24, 2003 using a two man CO_2-pressurized hand boom at a rate of 10.17 GPA. The hand boom housed nine TX 6 cone type spray tips on 19 inch spacing and was pressurized to 45 pounds per square inch (PSI) with a mix size of approximately three gallons. Nine treatments of the selected insecticides were applied to the test area: cyfluthrin at 0.03 lbs. ai / A, acetamiprid at 0.03570 and 0.025 lbs. ai / A, thiamethoxam at 0.03125 and 0.025 lbs. ai / A, imidacloprid at 0.03125 and 0.04687 lbs. ai / A, bifenthrin at 0.06 lbs. ai / A, and the Untreated Check. The plot size was four rows wide, on 38 inch spacings (14.25 feet), by 50 feet long. Subsequent evaluations were made at 2 and 5 DAT. These evaluations consisted of a random selection of five leaves from each plot taken from the tops of the plants. Using an insect scouting magnifying glass, a one inch square at the leaf / petiole junction was visually evaluated to provide a uniform evalua-

tion method for determining the aphid populations after treatment. Aphid population numbers collected from this test were then entered into the Agriculture Research Manager (ARM) version 6.1 where a statistical analysis was performed.

Results and Discussion

The 2 and 5 DAT evaluation numbers shows that the untreated check (UTC) had a higher average aphid population than all treatments in the trial (Table 1). All control percentages are based on the aphid numbers in the UTC (Table 2). Aphid populations were effectively controlled using acetamiprid, thiamethoxam and imidacloprid at different rates (Table 1). An average of the aphid population numbers across both evaluation dates (Table 1) indicates that acetamiprid (0.03570 lbs. ai / A) had the highest degree of control at 99.0 % (Table 2). The percent control at 2 DAT ranged from 28.1 % with cyfluthrin (0.03 lbs. ai / A) to 98.8 % with acetamiprid (0.03570 lbs. ai / A). The percent control at 5 DAT ranged from 0.0 % with bifenthrin (0.06 lbs. ai / A) to 99.7 % with acetamiprid (0.03570 and 0.025 lbs. ai / A), and thiamethoxam (0.03125 lbs. ai / A) (Table 2). At the second evaluation date the aphid population numbers in the bifenthrin (0.06 lbs. ai / A) treated area exceeded aphid population numbers in the UTC. All other treatments on the first observation date had statistically significantly lowered the aphid population numbers in comparison to the untreated check (Table 1). Cyfluthrin (0.03 lbs. ai / A) showed an increase from 28.1 % control at 2 DAT to 78.6 % control at 5 DAT (Table 2). Lady beetle adults and larvae were abundant in the test area and probably contributed significantly to the decline in aphid numbers between the 2 observations dates.

Summary

This study was conducted to evaluate the potential benefits of selected insecticides at low and reduced rates for controlling cotton aphid populations. Acetamiprid, thiamethoxam, and imidacloprid were each applied at two rates, while cyfluthrin and bifenthrin were applied at only one rate apiece. Acetamiprid, thiamethoxam, and imidacloprid are all recommended in Arkansas for cotton aphid control, while cyfluthrin and bifenthrin were included in this study to determine there impact on aphid populations. Acetamiprid, thiamethoxam, and imidacloprid exhibited control rates that ranged from 77.1 % to 99.7 % at 2 and 5 DAT in relation to the UTC (Table 2). An average across both evaluation dates (Table 1) indicates that the higher applied rate of acetamiprid (0.03570 lbs. ai / A) was the most effective exhibiting 99.0 % control (Table 2). Cyfluthrin (0.03 lbs. ai / A) exhibited a low control rate at 2 DAT, but improved by 50.5 % by the 5 DAT evaluation. Bifenthrin (0.06 lbs. ai / A) exhibited the lowest level of control at 19.4 % on an average across the evaluation dates (Table 2). The 5 DAT evaluation of the binfenthrin treated areas showed an aphid population of 124.0. This level of infestation was higher than the UTC level (91.0) at 5 DAT (Table 1). The control levels of acetamiprid, thiamethoxam, and imidacloprid at the low and reduced rates that were applied for this test indicates that the current Arkansas aphid population may be controlled effectively using current recommendations and rates.

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Table 1. Evaluation of Aphid Control Using Selected Insecticides , Lincoln County AR, 2003.

Treatment	(lbs ai / A)	Aphids per 5 Leaf 6/27/03 2 DAT	Aphids per 5 Leaf 6/30/03 5 DAT	Aphids per 5 Leaf Average
UTC		294.3 a	91.0 ab	192.6 a
Baythroid 2 EC (cyfluthrin)	(0.03)	211.5 ab	19.5 b	115.5 abc
Intruder 70 WP (acetamiprid)	(0.03570)	3.5 d	0.3 b	1.9 d
Intruder 70 WP (acetamiprid)	(0.025)	13.3 d	0.3 b	6.8 d
Centric 40 WG (thiamethoxam)	(0.03125)	47.5 cd	0.3 b	23.9 cd
Centric 40 WG (thiamethoxam)	(0.025)	12.5 d	1.0 b	6.8 d
Trimax 4 SL (imidacloprid)	(0.03125)	67.3 cd	6.0 b	36.6 cd
Trimax 4 SL (imidacloprid)	(0.04687)	26.5 d	2.5 b	14.5 cd
Capture 2 EC (bifenthrin)	(0.06)	186.5 abc	124.0 a	155.3 ab

Means followed by same letter not significantly different P value = 0.05.

Table 2. Percent Aphid Control Evaluation of Selected Insecticides - Lincoln County AR, 2003.

Treatment (ai)	(lbs. ai / A)	% Control 6/27/03 2 DAT	% Control 6/30/03 5 DAT	% Control 6/27 & 6/30 of 2003
UTC		0.0%	0.0%	0.0%
Baythroid 2 EC (cyfluthrin)	(0.03)	28.1%	78.6%	40.0%
Intruder 70 WP (acetamiprid)	(0.03570)	98.8%	99.7%	99.0%
Intruder 70 WP (acetamiprid)	(0.025)	95.5%	99.7%	96.5%
Centric 40 WG (thiamethoxam)	(0.03125)	83.9%	99.7%	87.6%
Centric 40 WG (thiamethoxam)	(0.025)	95.8%	98.9%	96.5%
Trimax 4 SL (imidacloprid)	(0.03125)	77.1%	93.4%	81.0%
Trimax 4 SL (imidacloprid)	(0.04687)	91.0%	97.3%	92.5%
Capture 2 EC (bifenthrin)	(0.06)	36.6%	0.0%	19.4%

All percentages are based on the aphid populations numbers in the Untreated Check (UTC) (Table 1).