COTTON APHID INSECTICIDE EFFICACY IN THE SOUTHEAST

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Abstract

Field trials were conducted at six locations in the Southeast to evaluate insecticidal control of cotton aphid. Percent control among insecticides varied by location and is likely due to differing susceptibilities of cotton aphid populations to some insecticides and timing of applications. Mean percent control for all locations was calculated for the various insecticides evaluated at 4, 7, and 14 days after treatment. Mean control ranged from 18-91 percent at 4 days after treatment, 6-85 percent control at 7 days after treatment, and 22-66 percent control at 14 days after treatment. It should be noted that no insecticide evaluated completely eliminated aphids in any trial.

Introduction

Cotton aphids, *Aphis gossypii*, infest a high percentage of cotton acreage in the Southeast and is a potential pest of cotton in the region. This highly polyphagous species feeds and reproduces on many cultivated and weedy plant host plants. Parthenogenic reproduction and a high reproductive capacity make this species prone to developing resistance to insecticides. Historically only a small percentage of cotton acres have been treated with insecticide for control of cotton aphid in the Southeast (Cotton Crop Loss Data at https://www.biochemistry.msstate.edu/resources/cottoncrop.php). However, the recent detection of Cotton leafroll dwarf virus transmitted by cotton aphid, necessitates further investigation into the biology and ecology of cotton aphid in cotton production systems as well as insecticidal control options in the region. The objective of these trials was to quantify insecticidal efficacy of multiple classes of insecticides for cotton aphid.

Materials and Methods

Standard small plot trials were conducted in five Southeastern states during 2019 to evaluate insecticides for efficacy on cotton aphid. Plot size ranged from four to eight rows wide and 30 to 40 feet in length and were arranged in a randomized complete block design with four replications. Trials were initiated when aphids were present and alate and apterous aphids were enumerated 4, 7, and 14 days after treatment (DAT) by examining the 4th expanded main stem leaf below the terminal from 10 randomly selected plants in each plot (apterous and alate aphids were not distinguished in NC). Yield data was optional. In total 14 active ingredients from multiple classes of insecticides were evaluated for control of cotton aphid and compared with a water control or untreated check (Table 1). Maximum labeled rates were used for most insecticides. Trial locations and (treatment application dates) included Jay, FL (July 10 and 15), Brewton, AL (July 2), Tifton, GA (June 20), Blackville, SC (July 11), Barnwell, SC (July 11), and Williamston, NC (July 18). Individual trials were subjected to analysis of variance and means were separated using LSD (p=0.05). Percent control for each insecticide was calculated in individual trials and overall means and range of

control by location were summarized.

Table 1. Insecticides evaluated for control of cotton aphid during 2019.

Active Ingredient	Trade Name	IRAC Group	Rate
untreated	Water	-	-
dicrotophos	Bidrin 8E	1B	8 ozs/a
bifenthrin	Brigade 2 EC	3A	6.4 ozs/a
acetamiprid	Assail 30 WG	4A	1.1 ozs/a
thiamethoxam	Centric 40 WG	4A	2.5 ozs/a
imidacloprid	Admire Pro 4.6 SC	4A	1.7 ozs/a
dinotefuran	Venom 70 WG	4A	3.0 ozs/a
sulfoxaflor	Transform 50 WG	4C	1.5 ozs/a
flupyradifurone	Sivanto prime 1.67	4D	14 ozs/a
pymetrozine	Fulfill 50 WG	9B	2.75 ozs/a
pyrifluquinazon	PQZ 1.87 SC	9B	3.2 ozs/a
afidopyropen	Sefina 0.42 SC	9D	3.0 ozs/a
spirotetramat	Movento**	23	5.0 ozs/a
cyantraniliprole	Exirel 0.83 SC	28	17.0 ozs/a
flonicamid	Carbine 50 WG	29	2.8 ozs/a

** not labeled in cotton

Results and Discussion

Apterous, or wingless aphids, were the primary form present in trials; alate or winged aphids were present but significant differences were rarely observed. Thus, total aphids or apterous plus alate forms were reported.

Florida:

Due to the occurrence of a rainfall event, treatments were evaluated in two separate trials at the Jay FL location. Six insecticides were compared with an untreated check on July 10 in trial 1 and the remaining eight insecticides were compared with an untreated check on July 15 in trial 2. All insecticides in trial 1 significantly reduced total aphids compared with the untreated (Figure 1). In trial 2, Assail, Transform, and Sivanto significantly reduced total aphids compared with the untreated check, Centric, Admire Pro, Fulfill, Brigade, and Venom. Aphid populations at 14 DAT are not reported due to low populations.

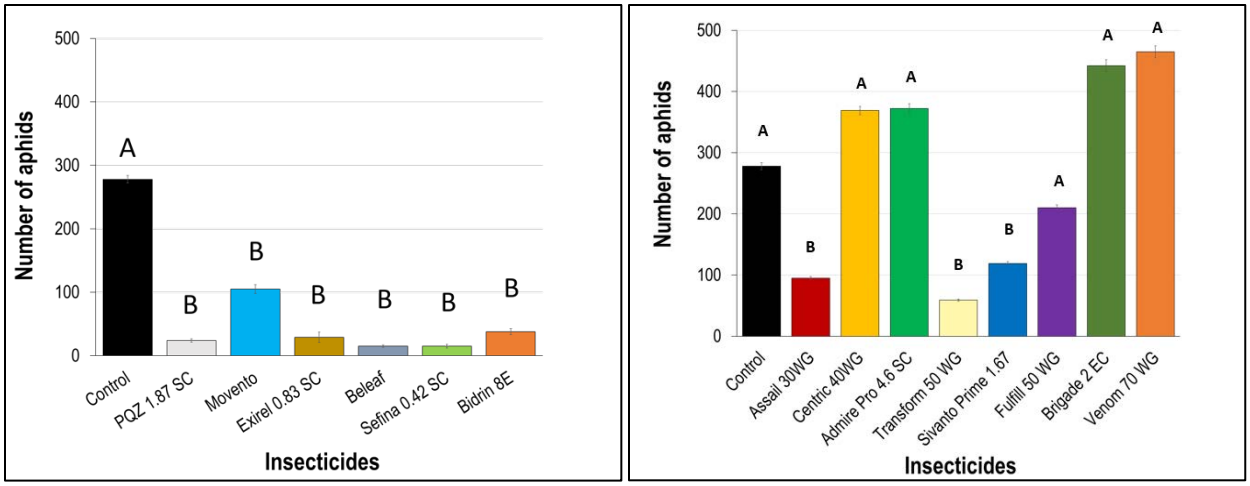

Figure 1. Total number of aphids sampled 7 DAT in Trial 1 (left) and Trial 2 (right) in Jay Florida. Bars with the same letter are not significantly different; LSD (p=0.05).

Alabama:

Insecticides were applied on July 2 at the Brewton AL location. Aphid populations were building at the time of application and continued to increase at 4 and 7 DAT before declining due to the naturally occurring fungus at 14 DAT. Bidrin, Transform, Sivanto Prime, Carbine, and PQZ significantly reduced total aphids per leaf at 4 DAT (Table 2). At 7 DAT, Bidrin, Strafer Max, Centric, Transform, Sivanto, Carbine, PQZ, Sefina, and Movento significantly reduced total aphids compared with the untreated. No significant differences in aphid counts were observed at 14 DAT. Yield data were collected in this trial and no significant differences were observed among treatments.

Table 2. Total number of aphids sampled 4, 7, and 14 DAT in Brewton AL. Columns with the same letter are not significantly different (LSD (p=0.05).

Brewton AL	Total Aphids per 4th Main Stem Leaf		
Treatment	4 DAT	7 DAT	14 DAT
Untreated	23.58 ab	44.4 a	4.58 n.s.
Bidrin 8E	4.95 e	10.95 d-g	2.75 n.s.
Strafer Max 70 WG	12.55 a-e	15.60 c-f	4.03 n.s.
Centric 40 WG	17.18 a-d	18.00 b-e	4.15 n.s.
Admire Pro 4.6 SC	18.48 abc	35.53 ab	7.25 n.s.
Transform 50 WG	2.70 e	3.80 g	3.55 n.s.
Sivanto Prime 1.67	7.73 cde	7.10 efg	4.65 n.s.
Fulfill 50 WG	21.03 ab	21.20 a-d	3.85 n.s.
Carbine 50 WG	3.63 e	3.80 g	1.9 n.s.
Brigade 2 EC	19.20 abc	43.60 a	2.6 n.s.
Venom 70 WG	25.80 a	21.68 a-d	2.03 n.s.
PQZ 1.87 SC	4.58 de	6.50 fg	3.88 n.s.
Sefina 0.42 SC	12.70 a-e	7.48 efg	3.13 n.s.
Movento	9.63 b-e	10.75 d-g	3.63 n.s.
Exirel 0.83 SC	18.18 abc	38.13 abc	2.65 n.s.

Georgia:

Aphid populations were present in the trial area when treatments were applied on June 20 at the Tifton GA location. Although aphid populations were low, the trial was initiated with the objective of making a 14 DAT observation prior to the fungal epizootic. At 4 DAT aphid numbers were low, only 5.38 aphids per leaf in the untreated control. Assail, Admire Pro, Transform, Sivanto, Carbine, Venom, and Movento significantly reduced aphid counts at 4 DAT (Table 3). At 7 DAT, only Transform and Carbine significantly reduced aphids compared with the untreated. The pyrethroid Brigade had significantly greater aphids compared with the untreated control at 7 DAT. Aphid populations reached

moderate to high levels by 14 DAT, and untreated plots averaged 87.30 aphids per leaf. All insecticide treatments significantly reduced aphid populations compared with the untreated at 14 DAT. However greater than 20 aphids per leaf were observed in all treatments. Early indications of the fungal epizootic were observed in heavily infested plots at 14 DAT and populations declined quickly in the trial area. No significant differences in lint yield were observed among treatments.

Table 3. Total number of aphids sampled 4, 7, and 14 DAT in Tifton GA. Columns with the same letter are not significantly different (LSD (p=0.05).

Tifton GA	Total Aphids per 4th Main Stem Leaf		
Treatment	4 DAT	7 DAT	14 DAT
Untreated	5.45 a	14.98 bcd	87.30 a
Bidrin 8E	3.73 abc	13.08 b-f	39.45 bcd
Assail 30 SG	2.38 bcd	9.63 c-f	47.25 bcd
Centric 40 WG	4.05 ab	13.95 b-e	39.68 bcd
Admire Pro 4.6 SC	2.78 bcd	27.03 a	35.95 bcd
Transform 50 WG	1.13 d	7.40 ef	54.03 b
Sivanto Prime 1.67	1.58 cd	8.65 def	50.88 b
Fulfill 50 WG	4.00 ab	17.35 b	48.65 bc
Carbine 50 WG	2.88 bcd	6.50 f	41.50 bcd
Brigade 2 EC	3.78 ab	30.35 a	24.23 cd
Venom 70 WG	2.58 bcd	17.33 b	25.75 d
PQZ 1.87 SC	3.33 abc	9.30 c-f	50.88 b
Sefina 0.42 SC	3.20 abc	12.35 b-f	52.13 b
Movento	2.15 bcd	12.23 b-f	50.30 b
Exirel 0.83 SC	3.48 abc	15.75 bc	37.75 bcd

South Carolina:

Two trials were conducted in South Carolina. Both the Blackville and Barnwell location were treated on July 11. Aphid populations were moderate to high and declined significantly after the 4 DAT evaluation. In Blackville, all insecticides except Brigade and Movento significantly reduced aphid counts compared with the untreated control. Treatments providing the greatest reduction in aphids included Bidrin, Sivanto, Carbine, Assail, PQZ, Sefina, Transform, and Venom. At the Barnwell location, all insecticides with the exception of Brigade significantly reduced aphids per leaf compared with the untreated control at 4 DAT. Insecticides providing the greatest reduction of aphids included Bidrin, Sivanto, Carbine, Assail, PQZ, Sefina, Transform, and Exirel. Percent control with insecticides was greatest in South Carolina trials compared with other locations.

Table 4. Total number of aphids sampled 4 DAT in Blackville and Barnwell SC. Columns with the same letter are not significantly different (LSD (p=0.05).

Blackville/Barnwell SC	Total Aphids per 4th Main Stem Leaf	
Treatment	Blackville SC 4 DAT	Barnwell SC 4 DAT
Untreated	81.54 a	45.42 a
Bidrin 8 E	3.08 e	0.37 ef
Assail 30 WG	3.48 e	0.32 ef
Centric 40 WG	15.39 c	4.27 c
Admire Pro 4.6 SC	18.94 bc	3.27 cd
Transform 50 WG	0.98 e	0.06 f
Sivanto Prime 1.67	5.54 e	0.14 ef
Fulfill 50 WG	12.02 cd	3.39 cd
Carbine 50 WG	3.12 e	0.42 ef
Brigade 2 EC	88.78 a	52.26 ab
Venom 70 WG	6.62 de	1.42 cde
PQZ 1.87 SC	2.18 e	0.85 def
Sefina 0.42 SC	1.98 e	0.65 ef
Movento	47.36 ab	24.03 b
Exirel 0.83 SC	19.41 c	0.82 ef

North Carolina:

Aphid populations were moderate to high when insecticides were applied on July 18 at the Williamston NC location. Populations in the trial area began to decline at 7 DAT. At 4 DAT, Assail, Centric, Transform, Sivanto, Fulfill, Carbine, Venom, PQZ, Sefina, and Movento significantly reduced aphids per leaf compared with the untreated control. Although aphid populations were declining, all insecticides except Brigade and Movento had significantly lower aphids per leaf compared with the untreated. Sivanto, Carbine, and Fulfill provided the greatest reduction of aphids. When populations of aphids dropped to less than 2 per leaf at 14 DAT, no significant differences were observed among treatments.

Table 5. Total number of aphids sampled 4, 7, and 14 DAT in Williamston NC. Columns with the same letter are not significantly different (LSD (p=0.05).

Williamston NC	Total Aphids per 4th Main Stem Leaf		
Treatment	4 DAT	7 DAT	14 DAT
Untreated	59.70 a	13.20 a	1.50 n.s.
Bidrin 8E	27.90 abc	3.50 cde	0.48 n.s.
Assail 30 SG	2.88 cd	2.53 cde	0.33 n.s.
Centric 40 WG	6.00 cd	4.75 bcd	0.45 n.s.
Admire Pro 4.6 SC	14.05 abc	6.05 abc	0.68 n.s.
Transform 50 WG	6.30 cd	3.53 cd	0.53 n.s.
Sivanto Prime 1.67	2.08 d	1.50 def	0.30 n.s.
Fulfill 50 WG	16.88 bcd	5.58 abc	1.08 n.s.
Carbine 50 WG	6.83 bcd	0.58 f	0.75 n.s.
Brigade 2 EC	35.20 ab	10.05 ab	0.58 n.s.
Venom 70 WG	8.30 bcd	3.38 cd	0.50 n.s.
PQZ 1.87 SC	10.68 bcd	3.30 cd	0.75 n.s.
Sefina 0.42 SC	2.98 cd	0.95 ef	0.43 n.s.
Movento	12.53 bcd	6.83 abc	1.08 n.s.
Exirel 0.83 SC	12.70 abc	3.98 bcd	0.75 n.s.

Mean percent control of cotton aphids at 4 DAT was calculated for trials conducted in GA, SC, NC, and AL. Percent control at 4 DAT ranged from a low of 18 percent for Brigade to 91 percent for Transform (Figure 2). The range of control observed in trials at 4 DAT tended to be more variable for insecticides providing less control.

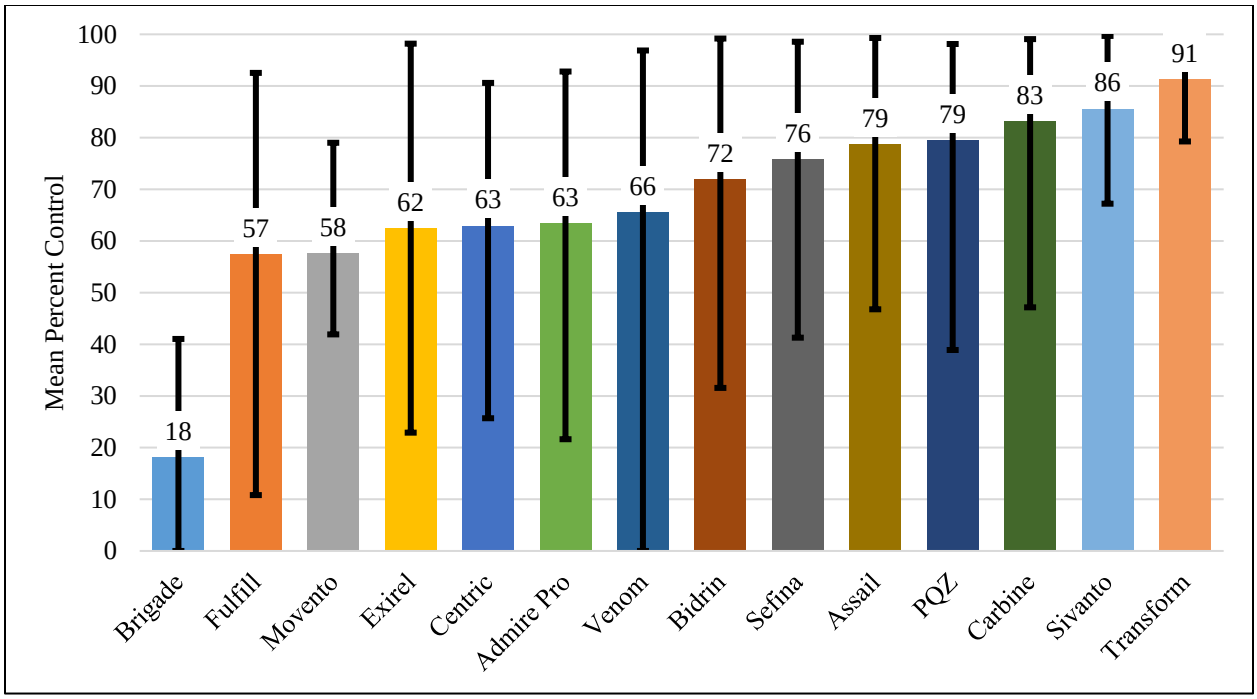

Figure 2. Mean percent aphid control at 4 DAT from GA, SC, NC, and AL trial locations. Error bars illustrate the range of aphid control observed in trials summarized.

Mean percent control of cotton aphids at 7 DAT was calculated for trials conducted in GA, FL, NC, and AL. Percent control at 7 DAT ranged from a low of 6 percent for Brigade to 85 percent for Carbine (Figure 3). Similar to observations at 4 DAT, the range of control observed in trials at 7 DAT tended to be less variable for insecticides providing the greatest control, but overall more variability was observed at 7 DAT compared with observations at 4 DAT.

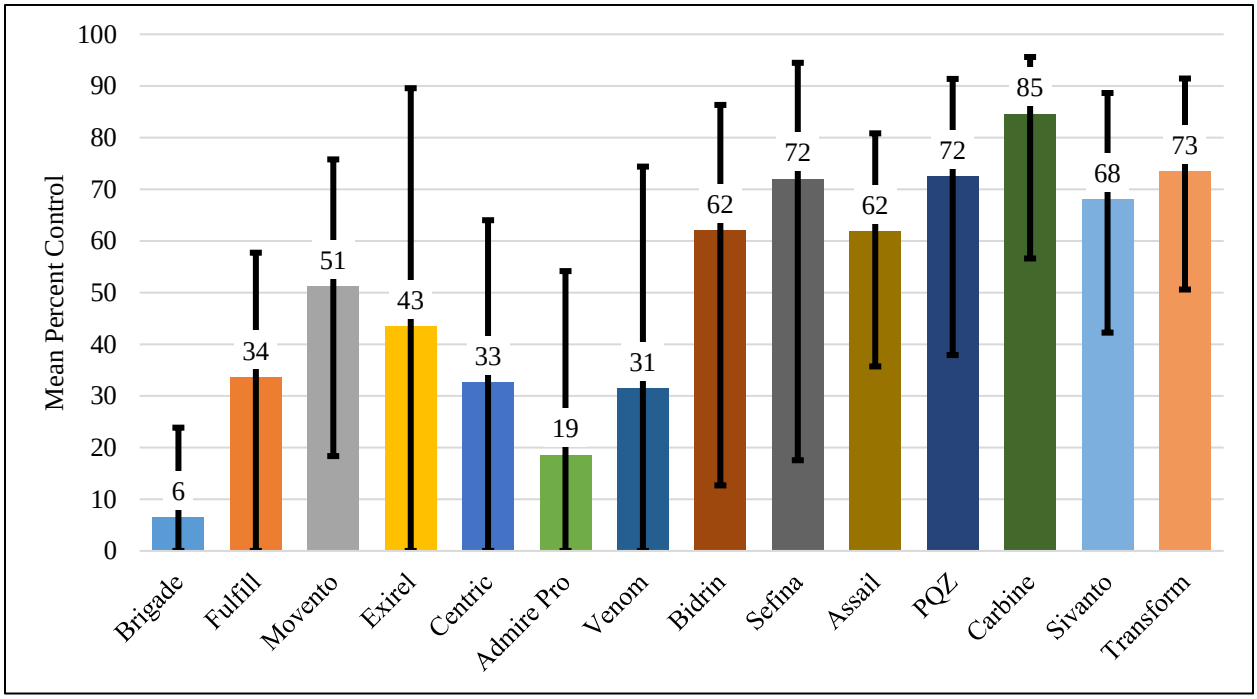

Figure 3. Mean percent aphid control at 7 DAT from GA, FL, NC, and AL trial locations. Error bars illustrate the range of aphid control observed in trials summarized.

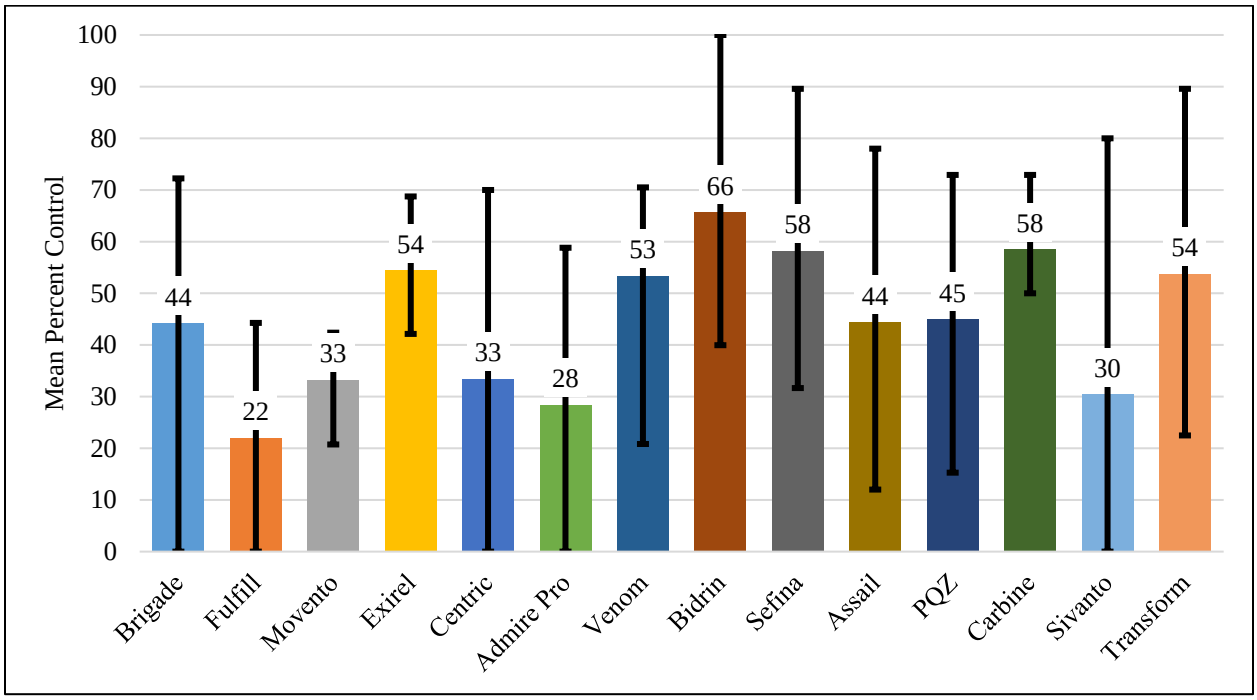

Figure 4. Mean percent aphid control at 14 DAT from GA, FL, NC, and AL trial locations. Error bars illustrate the range of aphid control observed in trials summarized.

Mean percent control of cotton aphids at 14 DAT was calculated for trials conducted in GA, FL, NC, and AL. Percent control at 14 DAT ranged from a low of 22 percent for Brigade to 66 percent for Carbine (Figure 4). Aphid populations had declined in most trial locations at 14 DAT.

Summary

Cotton aphid insecticide trials conducted in the Southeast during 2019 illustrated variable results by location. Differences in insecticide efficacy were likely due to differences in insecticide susceptibility for some insecticides by location and timing of application. In some trial locations, reinfestation of aphids following insecticide application contributed to poor performance. However, these trials summarized insecticide control for a wide range of insecticide classes across multiple environments and application timings providing insight into insecticide performance. It should be noted that no insecticide eliminated cotton aphid.

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