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INVESTIGATIONS INTO TIMING AND FREQUENCY OF INSECTICIDE APPLICATIONS FOR COTTON FLEAHOPPER

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Abstract

The cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter), is considered a key pest in the eastern part of Texas. Both adults and nymphs feed on new growth, including small squares. Squares up to pinhead size are susceptible to damage and the plant is most susceptible during the first three weeks of fruiting. Cotton fleahopper numbers increase in wild hosts and move into cotton fields prior to squaring. In the Southern Blacklands, the population dynamics are consistent through years and vary only in numbers. As a result, cotton fleahoppers migrate continuously between wild hosts and cotton in this production region averages two insecticide applications for cotton fleahoppers, with a range of one to four applications depending on the populations.

The situation changes in the western part of the state, including the Rolling Plains. In the western part of the state, the cotton fleahopper may increase to damaging populations occasionally. In the Southern Rolling Plains, wild host availability is limited by rainfall and cotton fleahopper populations usually remain at low levels. Cotton in this production region rarely averages more than one insecticide application for cotton fleahoppers.

Recent research, performed with mechanical removal of squares which cannot duplicate the physiological impacts of insect feeding, has again shown that the newer cotton varieties have the ability to compensate for early square loss (including square losses in the second and third week of fruiting) if square removal ended after the third week.

This study was initiated to evaluate cotton fleahopper control strategies in two different production regions in Texas in light of new research. Cotton fleahopper numbers were lower than normal in 2005. All treatment regimes numerically lowered numbers compared to the untreated control with significant differences in the Southern Blacklands six days after the second application. Differences in total squares per plant occurred with two automatic treatments having significantly higher numbers than the untreated control. No significant differences were seen in any of the parameters measured in the Southern Rolling Plains trial. Yields were not significantly different in either trial.

Introduction

Cotton fleahoppers caused a loss of 34,489 bales in Texas in 2004 at a cost of $9,932,832 (Williams 2005). The cotton plant can rapidly produce up to 12 squares per row foot per week during that first three weeks of squaring (Walker and Niles 1984). These squares are considered vulnerable to attack by both adults and nymphs of the cotton fleahopper.

Cotton fleahoppers are managed differently in Texas depending on the production area. In the eastern region of the state, cotton fleahoppers are considered a key pest and thresholds range from 10-15 cotton fleahoppers per 100 plants. Parker et al. (2000) combined data from five experiments conducted in the Texas Coastal Bend in 1993, 1995 and 1998-1999. They showed that yields significantly increased in insecticide treated cotton by 77.3 lbs. lint per acre. In contrast, Minzenmayer et al. (1988) compared four trials in West Texas. Three of the trials had no statistical differences in yields and one trial showed significant differences only in late planted cotton.

Interest in cotton fleahopper management has increased with the increased adoption of transgenic and the success of boll weevil eradication. Producers will often include an insecticide for cotton fleahoppers while making glyphosate applications early in the season. However, numerous studies have indicated that cotton can compensate for early season square losses. Sterling and Hartstack (1988) used field data and computer models to indicate that no loss in profits would occur for cotton where squares were removed for 30 days although a significant delay in harvest would occur. More recently, studies conducted in the High Plains indicate that yields are not adversely affected when squares are removed manually from the first position of the first nine fruiting nodes (Baugh et al. 2003).

This trial was set up to evaluate timing of insecticides and frequency for cotton fleahopper management. Similar studies in Texas indicate an impact on earliness but overall yields are not significantly different (Parker et al. 1986). The interest in this trial is with the new transgenic varieties that have higher yield potential than the varieties tested in previous trials.

Materials and Methods

The variety used in the trial was D&PL 444 BG/RR in both regions. Cotton was managed conventionally in both trials except for cotton fleahoppers. The experiment was conducted in the eastern part of the state in Williamson County, Texas east of Taylor and in the western part of the state in Runnels County, Texas northwest of Ballinger. Plots were 4 rows X 50 ft with four replications arranged in a randomized complete block design. Treatments included one, two or three automatic insecticide applications, an economic threshold and an untreated. Automatic treatments were made beginning at pinhead square stage (May 24) in Williamson County and June 22 in Runnels County with treatments following every seven days. The economic threshold used was 10 cotton fleahoppers per 100 plants in Williamson County and 25 cotton fleahoppers per 100 plants in Runnels County. Applications were made with a self-propelled CO_2 sprayer equipped with two TX-6 hollow cone nozzles per row calibrated to deliver 6 GPA total volume at 30 psi. Intruder® (1.0 oz/ac or 0.044 lbs. ai/ac) was used to manage cotton fleahoppers.

Cotton fleahoppers were sampled beginning when plants had 5-6 true leaves and repeated every 7 days for a total of 5 sample dates. On each sample date, 20 plants were selected at random (without bias) and the terminal area visually inspected for cotton fleahopper adults and nymphs. Number of adults and nymphs per plant were recorded.

Square sampling was started when plants have 4-6 true leaves. The first week of squaring begins when the majority of the plants first have at least one visible square (pin head-match head) on the branch below the terminal. The first branch below the terminal was determined to be the branch which has a fully expanded leaf (at least as large as a quarter). Fruiting positions will be mapped on 20 plants selected at random (without bias) after the first, second and fourth week of squaring. Fruit sites on the first two branch positions will be mapped. Plants were pulled from the ground so a careful examination was possible to see all of the fruiting sites. The center two rows were sampled. Also, the number of plants with “split” terminals due to CFH injury to growing point will be recorded.

Treatment yield was measured by hand harvesting one row length of 1/1000th acre. A sequential harvest was conducted in Runnels County to measure any delay in fruiting. Data were analyzed with ANOVA and Fisher’s LSD.

Results and Discussion

Williamson County

The number of cotton fleahoppers (combination of nymphs and adults) for the Williamson County trial is in Table 1. Cotton fleahopper numbers stayed above the economic threshold so the number of threshold treatments was the same as the three automatic treatments. However, numbers were lower in 2005 than in previous years.

Table 1. Comparison of cotton fleahopper numbers (average per plant) following insecticide treatments, Bohls Farm, Williamson County, Texas 2005.

	Mean Number of Cotton Fleahoppers/Plant				
Treatment[1]	May 24	May 25	May 30	June 6	June 13
1 Automatic	0.11a	0.00a	0.10a	0.35a	0.21a
2 Automatic	0.10a	0.00a	0.11a	0.16b	0.17a
3 Automatic	0.09a	0.00a	0.10a	0.11b	0.06a
Threshold	0.10a	0.00a	0.09a	0.14b	0.06a
Untreated	0.13a	0.01a	0.11a	0.40a	0.20a
LSD (P=0.05)	NS	NS	NS	0.145	NS
P>F	0.6011	0.4449	0.9929	0.0023	0.4740

1. Treatments occurred May 24, May 31 and June 7

Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05; LSD).

Square set data was taken for first and second position squares at three times early in the season. All treatments were similar except on June 18 when the two automatic insecticide applications had significantly more squares than the one automatic treatment and the untreated control (Table 2). No significant differences occurred for the first fruiting branch or for the height of the plant. Sequential harvest was not taken in Williamson County. No significant differences in yields were evident in the trial.

Table 2. Comparison of average number of squares per plant at the first and second position, percent square set and yield following insecticide treatments, Bohls Farm, Williamson County, Texas 2005.

	May 30		June 6		June 18		
Treatment[1]	Total Squares/plant	% Square Set	Total Squares/plant	% Square Set	Total Squares/plant	% Square Set	Yield (lbs lint/acre)
1 Automatic	5.35a	93.8	8.42a	85.1	9.93c	77.4	724.50a
2 Automatic	6.18a	92.2	10.33a	91.3	15.05a	93.5	769.50a
3 Automatic	4.38a	89.4	9.14a	88.5	13.18ab	92.2	769.50a
Threshold	5.10a	95.4	9.67a	91.4	13.33ab	92.9	783.00a
Untreated	4.68a	92.3	8.64a	74.9	11.17bc	75.2	775.75a
LSD (P=0.05)	NS		NS		2.281		NS
P>F	0.2835		0.4102		0.0032		0.9500

1. Treatments occurred May 24, May 31 and June 7
Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05; LSD).

Runnels County

The number of cotton fleahoppers (combination of nymphs and adults) for the Runnels County trial is in Table 3. Cotton fleahopper numbers never reached the economic threshold so the threshold treatment was never treated. In comparison to Williamson County, the cotton fleahopper numbers are almost a magnitude lower.

Table 3. Comparison of cotton fleahopper numbers (average per plant) following insecticide treatments, Byler Farm, Runnels County, Texas 2005.

	Mean Number of Cotton Fleahoppers/Plant			
Treatment[1]	June 22	June 23	June 29	July 6
1 Automatic	0.06a	0.01a	0.03a	0.03a
2 Automatic	0.10a	0.00a	0.09a	0.04a
3 Automatic	0.09a	0.01a	0.08a	0.03a
Threshold	0.13a	0.04a	0.09a	0.05a
Untreated	0.13a	0.06a	0.15a	0.05a
LSD (P=0.05)	NS	NS	NS	NS
P>F	0.0554	0.0982	0.2999	0.7676

1. Treatments occurred June 22, June 29 and July 6. Treatments occurred after counts were made.
Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05; LSD).

Square set data was taken for first and second position squares at three times early in the season. All treatments were similar (Table 4). No significant differences occurred for the first fruiting branch or for the height of the plant. Initial percent square sets were low in this trial because growing conditions early in the season were extremely dry. The plots came up to a good stand but did not receive any subsequent moisture until late in July. Sequential harvest was taken in Runnels County. No significant differences in yields were evident in the trial but there was a numerical trend for a greater percentage at the first harvest for the insecticide treated plots (Table 5).

Table 4. Comparison of average number of squares per plant at the first and second position and percent square set following insecticide treatments, Byler Farm, Runnels County, Texas 2005.

Treatment[1]	June 29		July 7		July 20	
	Total Squares/plant	% Square Set	Total Squares/plant	% Square Set	Total Squares/plant	% Square Set
1 Automatic	5.05a	69.9	8.15a	83.6	11.50a	83.0
2 Automatic	4.85a	69.3	7.80a	88.9	11.88a	85.6
3 Automatic	5.28a	73.1	8.60a	75.3	11.08a	82.5
Threshold	4.18a	63.5	7.90a	81.4	10.90a	75.3
Untreated	5.28a	72.1	8.13a	76.5	11.10a	78.3
LSD (P=0.05)	NS		NS		NS	
P>F	0.8607		0.8619		0.9166	

1. Treatments occurred June 22, June 29 and July 6. Treatments occurred after counts were made.
Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05; LSD).

Table 5. Comparison of average yields (pounds seed cotton per acre) following insecticide treatments, Byler Farms, Runnels County, Texas 2005.

Treatment[1]	Yield (lbs seed cotton per acre)		
	September 13	October 4	Total
1 Automatic	1338.47a	630.37a	1968.84a
2 Automatic	1213.25a	663.47a	1876.73a
3 Automatic	1339.90a	718.16a	2058.06a
Threshold	1164.32a	706.65a	1870.97a
Untreated	1072.21a	830.42a	1902.63a
LSD (P=0.05)	NS	NS	NS
P>F	0.8563	0.9567a	0.9952

1. Treatments occurred June 22, June 29 and July 6. Treatments occurred after counts were made.
Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05; LSD).

Conclusions

Although general trends can be seen in the two trials to favor insecticide applications, final yields do not show any significant differences. Both of these trials went through prolonged periods of dry weather. Drought can impact final yields and may mask any differences gained in early season insect control (Parker 1999). The trials were also conducted on only one variety of cotton. Different characteristics in cotton varieties can impact how a plant responds to insect damage and can dramatically impact response to cotton fleahoppers (Ring et al. 1993). However, D&PL 444 BG/RR has many characteristics (trichome density, etc.) that are available in many of the common varieties currently planted by producers.

The trials do indicate that producers and crop managers need to consider multiple factors when using current economic thresholds. Although numerous tests have shown the utility of the current thresholds, the thresholds do not consider all the dynamics of crop production such as weather, disease, continuous insect infestations, simultaneous infestations of more than one arthropod or the role of natural enemies (Ring et al. 1993). The introduction of transgenic cotton that is tolerant of herbicides has resulted in producers treating their weeds early in the growing season when cotton fleahoppers are also present. Many producers are now adding an insecticide with the herbicide to save a trip across the field. This trial shows that such insecticide use is not always needed. With increasing production costs, growers may be able to reduce input costs by better management of early season insects.

Cotton has the ability to compensate for early square loss without much delay in the harvest season. Producers should be able to take advantage of this in managing cotton fleahoppers and other plant bugs. These same tests need to occur over multiple years to determine how the plant responds to higher cotton fleahopper numbers and in more favorable moisture conditions.

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