Investigations into Timing and Frequency of Insecticide Applications for Cotton Fleahopper

C.G. Sansone, R.R. Minzenmayer and Dale Mott
Extension Entomologist, Extension Agent-IPM-Ballinger and Extension Agent-IPM-Georgetown, respectively
Texas Cooperative Extension

Summary:

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. Since cotton fleahoppers migrate continuously between wild hosts, 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 extremely low in 2006. Fleahopper numbers were significantly different in the treatment regimes only after the second application in the Southern Blacklands and after the third application in the Southern Rolling Plains. Numbers of squares per 10 plants and percent square sets were not significantly different in any of the treatment regimes in either region. Yields were not significantly different across the trials in either region.

Objectives:

Cotton fleahoppers caused a loss of 32,913 bales in Texas in 2005 at a cost of $9,056,717 (Williams 2006). 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 cotton 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 FM 960 BR in the Southern Blacklands and D&PL 488 BR in the Southern Rolling Plains. Cotton was managed conventionally in the trial except for cotton fleahoppers. The experiment was conducted in the eastern part of the state in Williamson County, Texas south of Taylor and in the central part of the state in Tom Green County, Texas east of Wall. 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 18) in Williamson County and July 5 in Tom Green County, with treatments following approximately 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 Tom Green County. Applications were made with a self-propelled CO_2 sprayer equipped with two TX-6 hollow cone nozzles per row calibrated to deliver 5 GPA total volume at 30 psi. Intruder® (1.0 oz/ac or 0.044 lbs. ai/ac of acetamiprid) 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. Data were analyzed with ANOVA and Fisher’s LSD.

Results and Discussion:

The number of cotton fleahoppers (combination of nymphs and adults) for the Williamson County trial is in Table 1. Cotton fleahopper numbers stayed below the economic threshold so the number of threshold treatments was the same as the three automatic treatments. However, numbers were lower in 2006 than in previous years.

Table 1. Comparison of cotton fleahopper numbers (average per 20 plants) following insecticide treatments, Jaecks Farm, Williamson County, Texas 2006.

	Mean Number of Cotton Fleahoppers/20 Plants					
Treatment[1]	May 18	May 22	May 26	May 29	June 1	June 5
1 Automatic	0.50a	0.50a	0.50a	0.00b	1.25a	1.00a
2 Automatic	0.50a	0.25a	0.75a	0.00b	0.50a	0.75a
3 Automatic	1.00a	0.25a	0.25a	0.00b	0.75a	0.00a
Threshold	0.75a	0.00a	0.50a	1.00a	1.00a	1.00a
Untreated	0.50a	0.00a	0.75a	1.00a	2.00a	1.50a
LSD (P=0.05)	NS	NS	NS	0.563	NS	NS
P>F	0.6272	0.4449	0.7854	0.0013	0.3824	0.4044

1. Treatments occurred May 18, May 26 and June 1

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

The number of cotton fleahoppers (combination of nymphs and adults) for the Tom Green County trial is in Table 2. Cotton fleahopper numbers went above the economic threshold but it was not until after the third application so the threshold treatment was the same as the untreated treatment. However, numbers were lower in 2006 than in previous years.

Table 2. Comparison of cotton fleahopper numbers (average per 20 plants) following insecticide treatments, Ripple Farm, Tom Green County, Texas 2006.

	Mean Number of Cotton Fleahoppers/20 Plants				
Treatment[1]	July 5	July 12	July 14	July 18	July 24
1 Automatic	0.00a	0.00a	0.75a	3.00a	7.25a
2 Automatic	0.20a	0.25a	0.75a	0.75a	2.00c
3 Automatic	0.30a	0.00a	0.25a	2.00a	0.75c
Threshold	0.15a	0.50a	3.25a	1.50a	5.75ab
Untreated	0.20a	0.75a	1.50a	2.00a	2.75bc
LSD (P=0.05)	NS	NS	NS	NS	3.689
P>F	0.7129	0.1283	0.0625	0.4563	0.0122

1. Treatments occurred July 5, July 13 and July 19
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 and none of the treatments had significantly more squares than the untreated control (Tables 3 and 4). No significant differences occurred for the first fruiting branch or for the height of the plant. No significant differences in yields were evident in the trial.

Table 3. Comparison of average number of squares per 20 plants, percent square set and yield following insecticide treatments, Jaecks Farm, Williamson County, Texas 2006.

	May 26		June 1		June 14		
Treatment[1]	Total Squares/10 plants	% Square Set	Total Squares/10 plants	% Square Set	Total Squares/10 plants	% Square Set	Yield (lbs lint/acre)
1 Automatic	69.25a	95.8	88.50a	96.9	134.25a	90.6	536.33a
2 Automatic	64.75a	95.1	82.75a	95.5	133.00a	91.4	544.33a
3 Automatic	55.75a	95.7	84.25a	98.3	130.50a	92.9	525.85a
Threshold	49.50a	96.4	90.75a	96.1	133.50a	88.7	516.78a
Untreated	57.00a	93.4	91.25a	95.2	139.00a	87.8	534.93a
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
P>F	0.1582	0.6111	0.4102	0.1440	0.7896	0.2046	0.9870

1. Treatments occurred May 18, May 26 and June 1
Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05; LSD).
Percent Square Sets were transformed before analysis. Data are non-transformed for presentation

Table 4. Comparison of average number of squares per 10 plants, percent square set and yield following insecticide treatments, Ripple Farm, Tom Green County, Texas 2006.

Treatment[1]	July 13		July 18		August 2		
	Total Squares/10 plants	% Square Set	Total Squares/10 plants	% Square Set	Total Squares/10 plants	% Square Set	Yield (lbs lint/acre)
1 Automatic	78.5a	94.3	83.3a	90.7	117.8a	94.3	1815.8a
2 Automatic	74.5a	90.0	86.5a	90.2	115.3a	91.6	2069.3a
3 Automatic	73.8a	88.7	82.8a	91.0	112.8a	92.6	1966.0a
Threshold	76.5a	90.9	87.8a	89.0	124.8a	92.6	1996.5a
Untreated	77.0a	92.8	88.3a	90.9	113.5a	88.4	1962.3a
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS
P>F	0.9221	0.5027	0.2461	0.8716	0.7896	0.3064	0.7485

1. Treatments occurred July 5, July 13 and July 19
Means in a column followed by the same letter are not significantly different by ANOVA (P=0.05; LSD).
Percent Square Sets were transformed before analysis. Data are non-transformed for write up purposes

Table 5 provides a summary of the yields for the two years of the trial. Even with the wide variability between the years (above average rainfall in 2005 compared to below average in 2006), no significant differences are evident in the data.

Table 5. Comparison of yield following insecticide treatments in Tom Green and Williamson County, Texas 2005-2006.

Treatment[1]	Williamson County			Tom Green County		
	Yield (lbs lint/acre) 2005	Yield (lbs lint/acre) 2006	Avg. Yield (lbs lint/acre)	Yield (lbs lint/acre) 2005	Yield (lbs lint/acre) 2006	Avg. Yield (lbs lint/acre)
1 Automatic	724.50a	536.33a	630.41	649.71a	1815.8a	1232.75
2 Automatic	769.50a	544.33a	656.91	619.32a	2069.3a	1344.31
3 Automatic	769.50a	525.85a	647.67	679.16a	1966.0a	1322.58
Threshold	783.00a	516.78a	649.89	617.42a	1996.5a	1306.96
Untreated	775.75a	534.93a	655.34	627.87a	1962.3a	1295.08
LSD (P=0.05)	NS	NS		NS	NS	
P>F	0.9500	0.9870		0.9952	0.7485	

1. Tom Green County yield in 2006 were irrigated

Conclusions:

Although the untreated and IPM plots had a general trend for higher cotton fleahopper numbers, final yields do not show any significant differences. Although weather conditions were not ideal for the Williamson County, the plot did receive rainfall during the early bloom stage. The Tom Green County plot was under center pivot irrigation. Drought can impact final yields and may mask any differences gained in early season insect control (Parker 1999). The trial in 2006 was conducted on different varieties (FM 960 BR and D&PL 488 BGRR) compared to 2005 (D&PL 444 BGRR) and 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, both varieties have many characteristics (trichome density, etc.) that are available in many of the common varieties currently planted by producers.

The trial indicates 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.

Acknowledgments:

The authors would like to thank the Texas State Support Committee, Cotton Incorporated, Blacklands Cotton and Grain Producers Association and the Southern Rolling Plains Cotton Growers for their financial support of the project. The authors would also like to thank Jay Jaecks and James and Rodney Ripple for their cooperation in conducting the trial.

References:

Baugh, B., J. F. Leser, R. Boman and T. Doederlein. 2003. Plant response to different levels of pre-bloom square removal and its relevance to plant bug management. Pp. 1131-1137. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council, Memphis, TN.

Minzenmayer, R. R., C. T. Allen and W. L. Multer. 1988. Management of cotton fleahopper in West Texas. Pp. 290-292. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council, Memphis, TN.

Parker, R. D, R. L. Huffman and M. R. Walmsley. 1986. Effects of cotton fleahopper feeding on earliness, yield and quality of cotton in South Texas. Pp. 217-218. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council, Memphis, TN.

Parker, R. D. 1999. New insecticides for control of cotton fleahopper and impact of drought on production. Pp. 1055-1057. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council, Memphis, TN.

Parker, R. D, E. D. Bethke III and D. D. Fromme. 2000. Significance of the cotton fleahopper as a pest of Texas Coastal Bend cotton. Pp. 1370-1372. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council, Memphis, TN.

Ring, D. R., J. H. Benedict, M. L. Walmsley and M. F. Treacy. 1993. Cotton yield response to cotton fleahopper (Hemiptera: Miridae) infestations on the Lower Gulf Coast of Texas. J. Econ. Entomol. 86: 1811-1819.

Sterling, W. L. and A. Hartstack. 1988. Economics of early-season fleahopper control in Texas. Pp. 374-379. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council, Memphis, TN.

Walker, J. K. and G. A. Niles. 1984. Primordial square formation in cotton and the cotton fleahopper. Southwest. Entomol. 9: 104-108.

Williams, M. R. 2005. Cotton insect losses-2005. Pp. 1151-1204. *In* Proceedings Beltwide Cotton Conferences, National Cotton Council, Memphis, TN.