

RESPONSE OF COTTON TO FLEAHOPPER CONTROL BASED ON GROWING CONDITIONS: USING THE FLEAHOPPER TO ADJUST FRUIT LOAD

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Abstract

Response of cotton fruiting to fleahopper control and subsequent lint production is greatly influenced by growing conditions especially as it relates to water availability. In dryland production systems very high retention of fruit on the earliest positions (1st squaring week) achieved through fleahopper control resulted in no yield increase compared with delaying treatment until the 2nd squaring week, and evidence suggested that under season-long dry soil conditions there was even a reduction in yield when insecticide was applied for fleahopper which resulted in a high square retention rate on the first few fruiting sites. On the other hand, lack of timely control of cotton fleahopper following the 1st squaring week and with adequate rainfall to maintain plant growth, losses from the insect were shown to exceed 200 lb lint/acre.

Herein, plant mapping was used to show some of the relationships of how cotton responds to fruit loss caused by the fleahopper. This paper proposes that timing of treatments for the cotton fleahopper might be used to manipulate cotton fruiting rates and position of fruit on plants as a mechanism to maximize yield and profit. Factors affecting the change in fleahopper management tactics from that of a decade ago possibly include growing of longer season cotton varieties, more effective control tactics for other insect pests, and lack of boll weevils in the production system.

Introduction

Lint yield response to control of cotton fleahopper under similar infestation levels varied from no yield increase (trend toward a negative response) to more than 200 lb/acre increase in 18 field studies conducted from 1993 - 2008 in the Coastal Bend of Texas. In the 18 field studies over the 16-year period, treated cotton averaged 50 lb/acre more than nontreated. This report provides possible explanation of field conditions which affect response of the cotton plant to fleahopper control.

In a previous study (Parker and Buehring 2006) no differences were observed in lint production, and all but one treatment numerically had less yield compared with the nontreated cotton. In this case fleahopper numbers averaged 33.9 per 100 plants during late squaring and early bloom period. Very dry soil conditions occurred at the study site during early season and the fleahopper was suspected to have had a beneficial affect in that early fruit removal by the insect allowed plants to develop a larger root system and plant size, subsequently delaying cutout and taking advantage of maturing bolls under more favorable soil moisture conditions. However, in cases where soil moisture was adequate for favorable plant growth, fleahopper control resulted in yield increases exceeding 200 lint pounds/acre (Parker 1996, Parker et al. 2004, and Parker and Chilcutt 2008).

Materials and Methods

Experiments conducted in the Coastal Bend of Texas in 2007 (previously reported by Parker and Chilcutt 2008) and 2008 were selected for this analysis. Transgenic-Bt cotton varieties were used in both studies. Plots were 8 rows wide and the center 4 rows were treated with insecticide. Tests were arranged in a randomized complete block design with 4 replications of each treatment. Insecticide was applied through 4X hollow cone nozzles at a pressure of 40 psi in spray volumes ranging from 5.5 - 7.0 gpa (depending upon test year). Centric 40WG (2.0 or 1.25 ounces/acre in 2007 and 2008, respectively) insecticide was utilized in these treatment timing studies.

Treatments were assessed by counting fleahoppers on 20 plants from the center rows in plots before treatment and generally at 3 day intervals after treatment. The number of insecticide treatments made varied from 1 to 4. Six plants were selected in non-harvest rows for plant mapping using PMAP software (Landivar and Lawlor 1992). Cotton was harvested with an International Harvester 120A spindle picker. Seed cotton samples were ginned on a 10-saw Eagle laboratory machine and 30 gram lint samples were sent to the Fiber and Biopolymer Research

Institute, Texas Tech University, Lubbock, Texas for fiber analysis. The software program Agriculture Research Manager (ARM revision 6.1.13) was used to conduct analysis of variance, and means were separated by LSD for ease of presentation.

Results and Discussion

Fleahopper infestation levels in the 2007 study were manipulated by initiating treatments at various weeks during squaring and then calculating their average number over the duration of the study (Table 1). Significantly greater numbers of fleahoppers occurred in the nontreated cotton over that period and were 2.8 times above the listed treatment threshold (Parker et al. 2008). Pretreatment fleahopper counts averaged 31 per 100 plants in the test site. Fruit retention percentages for each of these treatment regimes was determined. Significantly greater fruit retention was generally observed in the first two fruiting positions where insecticide was applied in the 1st or 2nd week of squaring. Fleahoppers removed different amounts of fruit depending upon when treatments were initiated. Subsequently, effects were observed on plant height at harvest. Yield and dollar return for each treatment regime is shown in Fig. 1. All treatments where insecticide was applied resulted in substantial dollar increase over nontreated cotton, but no advantage was observed by treating cotton during the first squaring week.

Table 1. Effect of fleahopper insecticide treatment timing on number of fleahoppers, cotton plant fruit retention by position off the main stem and plant height, Texas AgriLife Research and Extension Center, Nueces County, TX, 2007.

Treatments by squaring week ^{1/}	Fleahopper ^{2/} post-treatment average/100 plants	% fruit retention by position at 4 th week bloom				Plant height at harvest
		1	2	3	4	
1, 2, 3, 4	7.5 ^c	86.7 ^a	77.1 ^a	68.7 ^a	55.7 ^a	44.0 ^b
2, 3, 4	10.8 ^c	79.5 ^{ab}	68.4 ^{ab}	75.8 ^a	67.4 ^a	46.9 ^b
3, 4	21.3 ^b	70.5 ^c	61.7 ^b	71.9 ^a	74.9 ^a	46.8 ^b
2, 4	10.8 ^c	78.2 ^b	66.1 ^b	67.7 ^a	63.6 ^a	45.2 ^b
Nontreated	42.1 ^a	61.0 ^d	33.0 ^c	34.4 ^b	54.5 ^a	57.3 ^a
LSD (P = 0.05)	7.57	7.46	9.40	10.12	NS	3.97
P > F	.0001	.0001	.0001	.0001	.2265	.0001

Means in a column followed by the same letter are not significantly different by ANOVA.

^{1/} Centric 40WG was applied at 2.0 oz/acre in indicated squaring weeks.

^{2/} Average of counts for 3 DAT-WK 1; 3, 6 DAT-WK 2; 2, 9 DAT-WK 3; 3, 8, 12 DAT-WK 4. (DAT-WK is days after treatment-week).

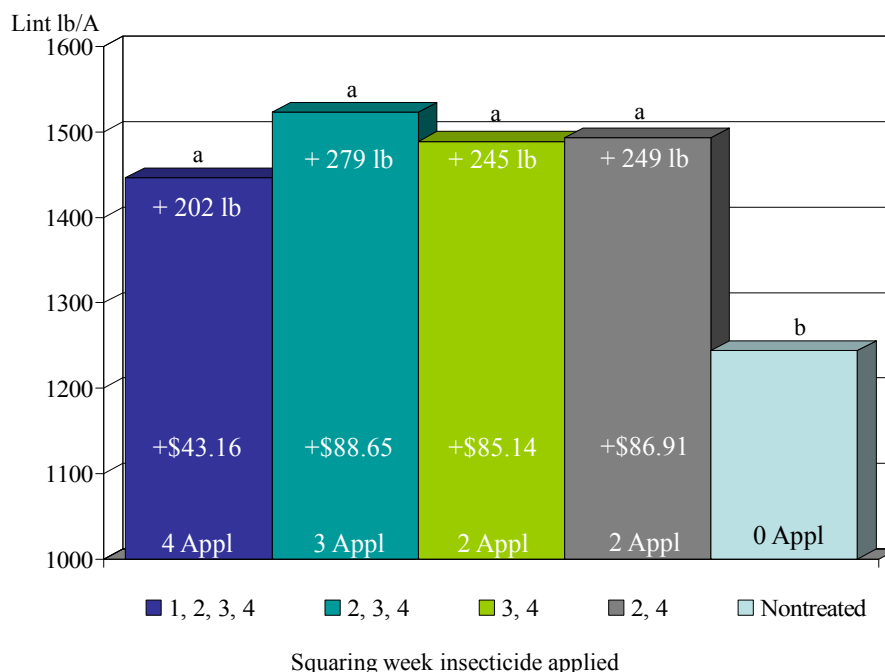


Figure 1. Effect of fleahopper insecticide and treatment timing on cotton yield and dollar return, Texas AgriLife Research & Extension Center, Nueces County, TX, 2007. Cotton value based on \$0.55/lb for lint and \$0.65/lb for seed using a factor of 1.56 times lint weight. Costs include Centric 40WG (\$4.50/oz), application (\$2.50/acre) and harvesting/hauling/ginning cost for extra lint above nontreated cotton (\$0.21/lint). LSD (P=0.05).

A second treatment timing study was conducted in 2008 in which no rainfall was received for the entire production period. Average plant height at harvest was only 18 inches. The average number of fleahoppers at various treatment timings for duration of the study were about the same in nontreated plots as measured the previous year (Table 2). Similar to the previous study, fruit retention was generally greater in cotton that was treated early. There were no differences in cotton lint yield; numerically less cotton lint was produced in the insecticide treatments (Fig. 2).

Conclusions

Lint yields can be dramatically increased where insecticide is applied for cotton fleahopper when soil moisture favors plant growth and fruit retention, but nothing is gained by protection of squares during the first production week. Under severe drought conditions no yield increases were observed by controlling fleahoppers, and there was a trend for less lint production with aggressive fleahopper control under the harsh drought conditions.

Reasons for the change in response of cotton to fleahopper control from a decade ago are possibly due to the combined effects of higher-yielding longer-season cotton varieties, transgenic Bt cotton varieties, improved insecticides for caterpillar control, and lack of boll weevils in the production system.

Additional studies need to be conducted to confirm these results and further measure the effects of fleahopper treatment timing on boll retention, location of fruit on plants, effect on harvest date, and boll weight. If the conclusions reported herein are correct there is no need to apply insecticide for fleahopper during the first squaring week, but treatments should begin in the second squaring week where numbers warrant and growing conditions are expected to be favorable. Under such conditions substantial yield increase from fleahopper control would be expected.

Table 2. Effect of fleahopper insecticide treatment timing on number of fleahoppers and on cotton plant fruit retention by position off the main stem, Joseph Respondek Farm, DeWitt County, TX, 2008.

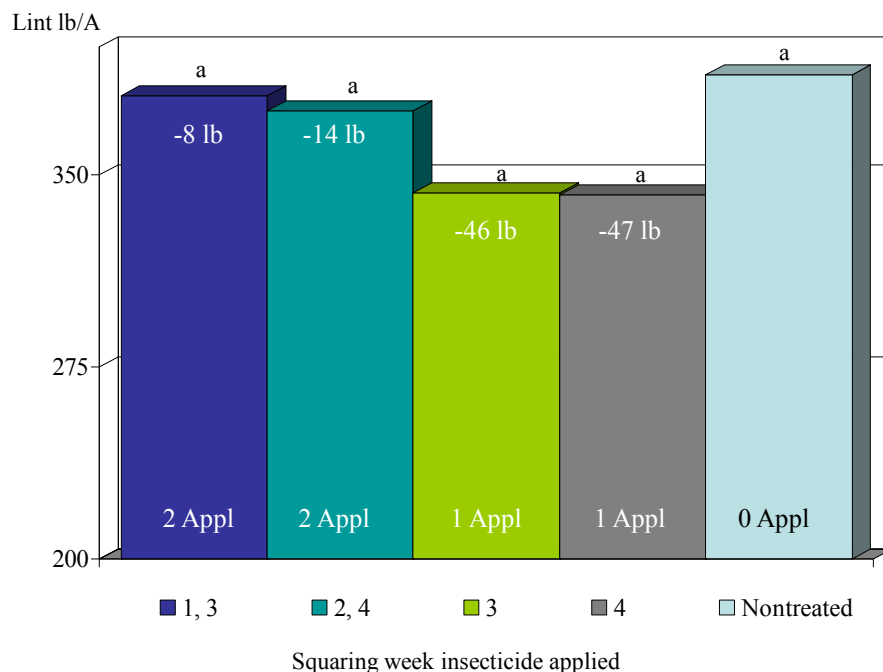
Treatment made in squaring week ^{1/}	Fleahopper ^{2/} post-treatment average/100 plants	% fruit retention by position at cutout ^{3/}			
		1	2	3	4
1, 3	5.9 ^d	74.2 ^a	43.8 ^a	71.3 ^a	25.0 ^a
2, 4	15.2 ^c	74.3 ^a	48.7 ^a	73.3 ^a	0.0 ^a
3	24.6 ^b	69.4 ^{ab}	44.1 ^a	57.9 ^a	75.0 ^a
4	38.6 ^a	59.9 ^c	38.6 ^a	36.3 ^a	25.0 ^a
Nontreated	35.5 ^a	65.6 ^{bc}	40.7 ^a	53.1 ^a	75.0 ^a
LSD (P = 0.05)	7.02	6.82	NS	NS	NS
P > F	.0001	.0026	.5602	.3238	.1471

Means in a column followed by the same letter are not significantly different by ANOVA.

^{1/} Centric 40WG was applied at 1.25 oz/acre in the indicated squaring weeks.

^{2/} Average of counts for 3 DAT-WK 1; 3, 6 DAT-WK 2; 2, 9 DAT-WK 3; 3, 8, 12 DAT-WK 4. (DAT-WK is days after treatment-week).

^{3/} Cutout was 4 nodes above white flower.



2008

Figure 2. Effect of fleahopper insecticide and treatment timing on cotton lint yield, Joseph Respondek Farm, DeWitt County, TX, 2008.

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