Ability of Cotton to Compensate for Early-Season Fruit Loss and Impact on Yield and Lint Quality

Tommy Doederlein[1], David Kerns[2], Brant Baugh[3] and Dustin Patman[4]

Texas AgriLife Extension Service

[1]Dawson/Lynn Co., [3]Lubbock Co., [4]Crosby/Floyd Co.

[2]Texas AgriLife Research and Extension Center, Lubbock, TX

Introduction

Wind blown sand, sustained cloudy weather and insects often cause the loss of squares in pre-bloom cotton grown in the Texas High Plains. Among the insects, the cotton fleahopper, *Pseudatomoscelis seriatus* (Reuter), is a common pest that feeds on small squares causing them to abort. In recent years, extensive research has been conducted demonstrating the extraordinary capability of cotton to compensate for pre-bloom square loss. However, full compensation is questionable when cotton is planted late or cold late-season temperatures result in a shortened season. Additionally, the lint quality of compensated fruit may be compromised.

Blasted square caused by cotton fleahopper feeding

Objectives

1. To determine the impact of pre-bloom square loss on the yield of late-planted cotton.
2. If compensation occurs, to determine where compensation occurs on the plant.
3. To determine the impact of pre-bloom square loss on lint quality of late-planted cotton.

Materials and Methods

This test was conducted at the Texas AgriLife Research and Extension Center in Lubbock, TX. The cotton variety, 'Phytogen 375 WRF', was planted on 1 June 2010 on 40-inch rows and was irrigated as needed using furrow run irrigation. Plots were 1 row wide x 14-feet long. The test was a randomized complete block design with 4 replicates.

Plots were evenly thinned to 28 plants per plot (26,136 plants per acre) on 13 July 2010. All abnormally small or deformed plants were removed leaving a uniform plant population.

Treatments consisted of 0, 20, 40, 60, 80 and 100% manual square removal on pre-bloom cotton. On 13 July 2010, all of the squares in each plot were counted and numbered. The numbered squares from each plot were then randomized and removed based on the treatment percentage. Squares slated for removal were removed using fine forceps on 13 July 2010.

Materials and Methods (continued)

At that time the plants were approximately 18 days into squaring and averaged 13.7 nodes across all treatments.

At harvest on 10 November 2010, 10 plants from each plot were plant mapped and the entire plot was hand harvested. Samples were ginned at the Texas AgriLife Ginning Facility in Lubbock. Lint samples were submitted to the International Textile Center at Texas Tech University for HVI analysis, and USDA Commodity Credit Corporation (CCC) loan values were determined for each treatment by plot.

All count data were analyzed using PROC GLM and the means were separated using an F protected LSD ($P \leq 0.05$). Relationships were determined by using linear regression models.

Results and Discussion

Impact on Yield

The 2010 growing season in Lubbock was marked by wet weather in June and July, dry conditions in August, and a prolonged warm fall that facilitated cotton maturation. Thus, the possibility of achieving full compensation for yield and fiber maturity were high during this test. Consequently, we could not detect any differences in yield among the treatments. This suggests that even the 100% square removal treatment was able to compensate (Figure 1).

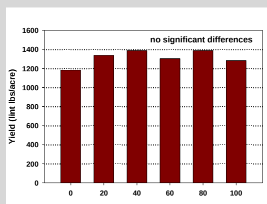

Figure 1. Impact of pre-bloom square removal on yield; no significant differences among treatments based on an F protected LSD ($P > 0.05$).

Impact on Bolls and Node Quantity

Although plots had as much as 100% of their early squares removed, there were no significant differences among treatments in the total number of bolls produced or the number of fruiting nodes per plant (Figures 2A & B). Thus, it appears that compensation in yield was primarily from adding bolls to replace missing fruit rather than increasing the size or quantity of the surviving fruit.

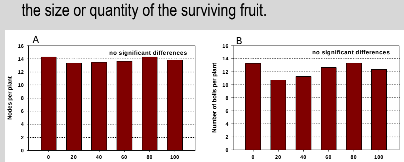

Figure 2 A) Impact of pre-bloom square removal on the number of nodes per plant and B) bolls per plant; no significant differences among treatments based on an F protected LSD ($P > 0.05$).

Results and Discussion (continued)

Impact on Fruiting Pattern

Plants in the 20, 40 and 100% square removal treatments had fewer bolls on the lower portion of the plant (nodes 11+) than plants where there were no squares removed (Figure 3A). This would be expected since we physically removed squares from this area. However, if the plant compensated by adding second and third position squares, primarily in this area, one would expect there to be no differences. Additionally, there were no differences among treatments in the ratio of lower bolls to upper bolls, which further supports the conclusion that replacement fruit was uniformly distributed from top to bottom (Figure 3B).

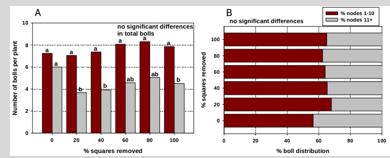

Figure 3 A) Number of bolls in the upper (nodes 1-10) and lower (nodes 11+) portions of the plant and B) vertical distribution as % of bolls within the top and bottom portions of the plant; similar colored bars capped by the same letter are not different based on an F protected LSD ($P > 0.05$).

There were more first position bolls where no squares were removed, no differences in second position squares, and it appeared that third position squares increased relative to the number of squares removed (Figure 4A). This is also evident when comparing boll distribution relative to total bolls per plant (Figure 4B). Thus, it appears that the compensated fruit were third position bolls and, based on vertical distribution (Figure 3A & B), were uniformly distributed from top to bottom.

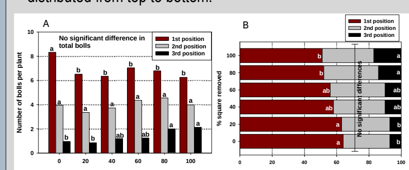

Figure 4 A) Number of bolls in the upper (nodes 1-10) and lower (nodes 11+) portions of the plant and B) vertical distribution as % of bolls within the top and bottom portions of the plant; similar colored bars capped by the same letter are not different based on an F protected LSD ($P > 0.05$).

Impact on Lint Quality

Significant differences in qualitative parameters among the square removal treatments were not detected based on GLM ($P > 0.05$), but trends were observed. Compensated bolls tended to have lower micronaire and higher fiber strength qualities (Figures 5A and B).

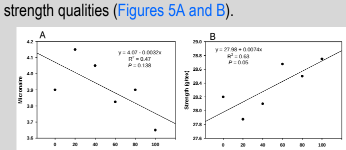

Figure 5. Linear relationships between % of squares removed and fiber A) micronaire and B) strength.

Results and Discussion (continued)

Impact on Lint Quality (continued)

Lower micronaire is indicative of immature cotton fibers and suggests that compensated bolls did not have sufficient time to mature. This is not uncommon for cotton with a truncated growing season, especially for fruit produced later in the season (i.e. third position bolls).

The trend detected for increased fiber strength with more square removal is a function of micronaire (Figure 5B). Increased strength is commonly associated with decreasing micronaire.

A trend was also detected for the degree of yellowness (+b) (Figure 6). Yellowness increased with increasing early square removal. Similar to low micronaire, increased yellowness is indicative of immature cotton fibers. Thus, further supporting the premise that compensated bolls are more likely to suffer qualitatively.

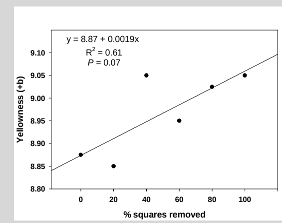

Figure 6. Linear relationship between % of squares removed and fiber yellowness.

Although we detected trends in reduced lint quality with regard to increasing square removal (Figures 5 & 6), it did not significantly impact loan value based on GLM ($P > 0.05$) (Figure 7). Thus, even 100% pre-bloom square removal did not significantly affect yield or overall quality as it relates to loan values. However, keep in mind that these data are representative of the Lubbock area during a year with a prolonged growing season. In coolers climates or in situations favoring a shorter growing season, the impact on lint maturity and/or yield may be adversely affected.

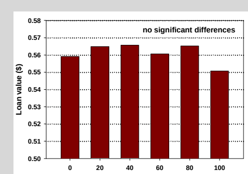

Figure 7. Impact of early square removal on loan values; no significant differences among treatments based on an F protected LSD ($P > 0.05$).

Acknowledgements

This project was funded in part by Plains Cotton Growers, Inc.