Impact of Early-Season Fruit Loss on Cotton Yield and Lint Quality

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

Texas AgriLife Extension Service

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

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

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Introduction

Environmental conditions and/or insects often result in the loss of squares in pre-bloom cotton grown in the Texas high plains. Among those 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 late-season cold temperatures result in a shortened growing season. Additionally, the lint quality of compensated fruit may be compromised.

Blasted square caused by cotton fleahopper feeding

Objectives

The objectives of this test were to assess the ability of cotton to compensate for early season square loss under a "normal" length growing season and an "early" terminated growing season and the impact compensated fruit may have on lint quality.

Materials and Methods

This test was conducted at the Texas AgriLife Research and Extension Center in Lubbock, TX. The field was planted June 16, 2011 on 40-inch rows and was irrigated as needed using furrow run irrigation. The variety was PhytoGen 375WRF. Plots were 1 row wide x 14-feet long. The test was a 2 × 6 factorial design with 4 replicates.

Plots were evenly thinned to ~30,000 plants per acre on July 21, 2011. All abnormally small or deformed plants were removed leaving as uniform a plant population as possible.

Treatments consisted of 0, 20, 40, 60, 80 and 100% manual square removal on pre-bloom cotton in both a "normal" length growing season and an "early" terminated growing season treatments. On July 28, 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 then removed using fine-nosed forceps. At the time of square removal, plants were approximately 18 days into squaring.

The "early" terminated plots were sprayed with Gramoxone at 25% open boll, October 10, and the "normal" terminated plots were sprayed with a boll opener, October 21, followed by Gramoxone at 80% open boll, October 27.

Materials and Methods (continued)

Ten plants from each plot were plant mapped and the entire plot was hand harvested. The "early" terminated plots were harvested on October 17 and the "normal" terminated plots were harvested on November 3. Samples were ginned at the Texas AgriLife Ginning Facility in Lubbock, Texas. Lint samples were submitted to the Fiber and Biopolymer Research Institute at Texas Tech University for HVI analysis, and USDA Commodity Credit Corporation (CCC) loan values were determined for each treatment by plot.

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. Sigma Plot 10.0.

Results and Discussion

Impact on Yield

The 2011 growing season in Lubbock was marked by extreme hot and dry weather conditions throughout the season, causing yields across the region to be substantially reduced by as much as 75%. Even though there was a prolonged warm fall that facilitated cotton maturation, the possibility of achieving full compensation for yield and fiber maturity was diminished due to the environment causing plants to obtain cutout at an increased rate. Consequently, we detected differences in yield between termination treatments (Figure 1) and among the percent square removal treatments in both termination treatments (Figures 2A and 2B). Regression analysis shows the importance of protecting the early fruit in a shortened growing season and that cotton tends to "overcompensate" up to 50% square loss with peak yields at about 27% square loss in "normal" terminated cotton (Figures 3A and 3B).

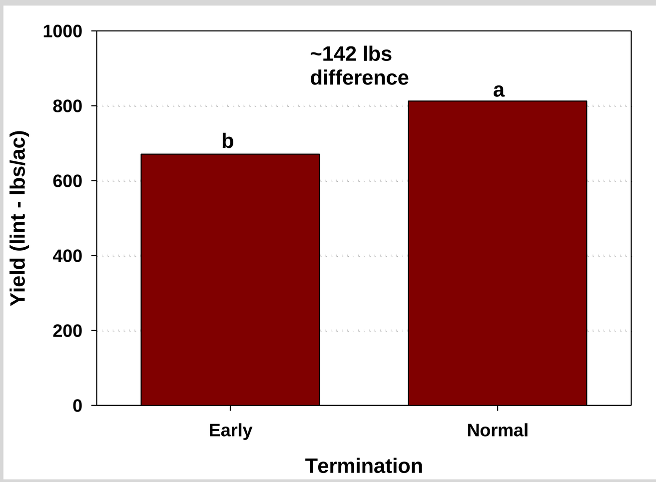

Figure 1. Impact on yield for different percent levels of pre-bloom square removal for two termination treatments; treatments differed significantly based on a F protected LSD ($P > 0.05$).

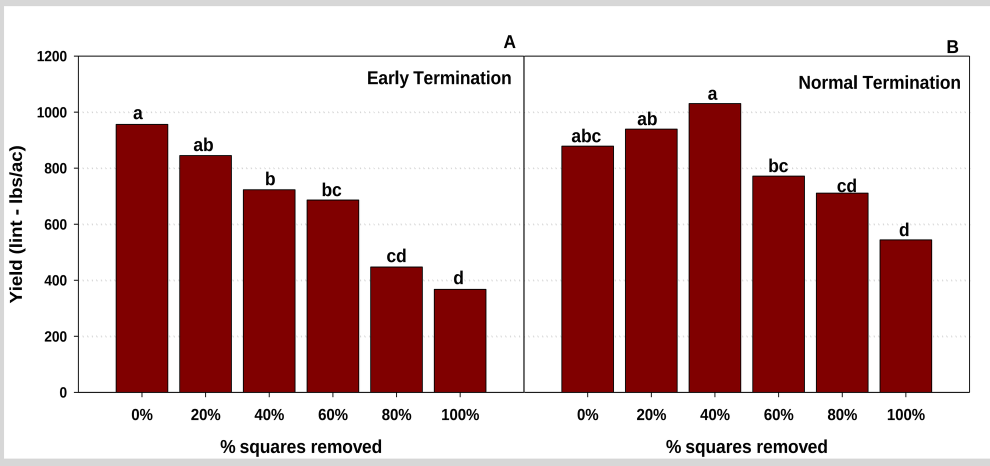

Figure 2. Impact of different percent levels pre-bloom square removal on yield in A) an "early" and B) a "normal" terminated crop; bars capped by the same letter are not significantly different based on a F protected LSD ($P > 0.05$).

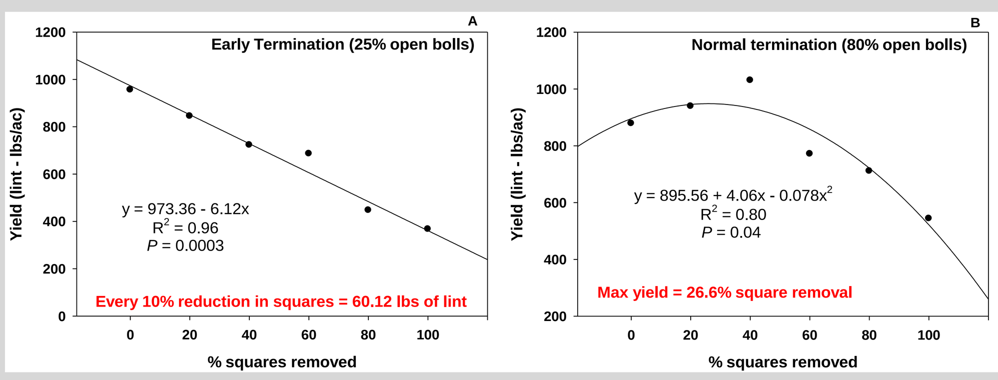

Figure 3. Linear relationship between % of squares removed and lint yield for two crop termination treatments.

Results and Discussion (continued)

Impact on Boll Quantity and Distribution

There were significant differences for total number of harvestable bolls per plant in the "early" terminated plots, while there were no significant differences in the "normal" terminated plots (data not presented).

Where the growing season was cut short and the crop was terminated early, the differences in yield appears to be determined by the contribution from the first position bolls from the lower nodes of the plant (Figures 4A and 4B).

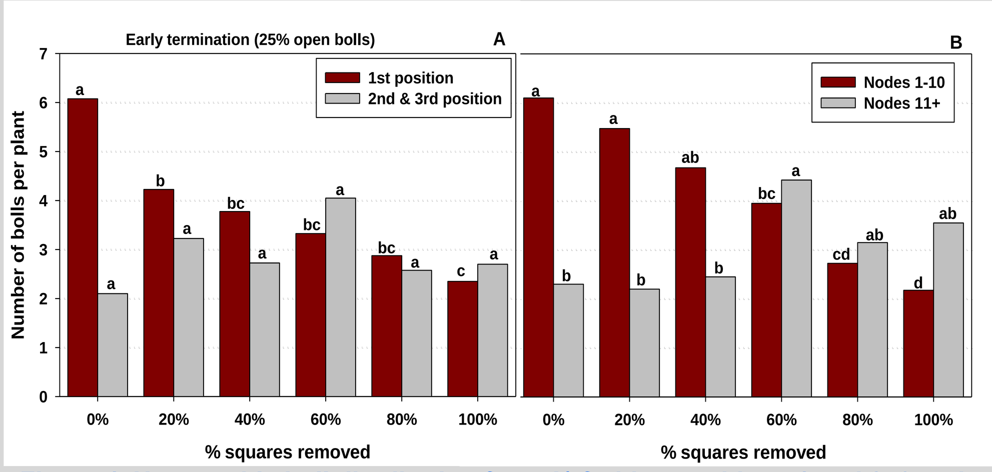

Figure 4. Harvestable boll distribution from A) fruiting positions 1 and 2+3 and B) the lower (nodes 1-10) and upper (nodes 11+) portions of the plant for different percent levels of pre-bloom square removal when the crop is terminated "early"; similar colored bars capped by the same letter are not different based on a F protected LSD ($P > 0.05$).

Conversely, where a crop has adequate time to mature, yield is compensated for with an increase in second and third position harvestable bolls from the upper nodes of the plant (Figures 5A and 5B).

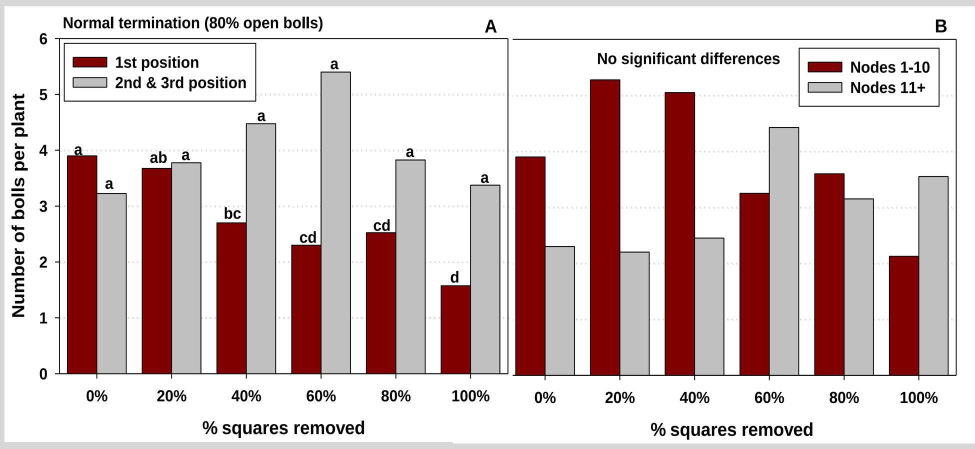

Figure 5. Harvestable boll distribution from A) fruiting positions 1 and 2+3 and B) the lower (nodes 1-10) and upper (nodes 11+) portions of the plant for different percent levels of pre-bloom square removal when the crop is terminated "normal"; similar colored bars capped by the same letter are not different based on a F protected LSD ($P > 0.05$).

Impact on Loan Value

Loan values averaged $0.5547 (ranging from $0.5730 to $0.4866) with the three highest values coming from the "early" terminated plots (Figures 6). Only the 100% square removal treatment from the "early" terminated plots were significantly different from all other treatments from both terminations. This demonstrates that under the environmental conditions experienced in 2011, where maturity was accelerated, the bolls that were harvestable reached maturity and therefore loan values were not affected.

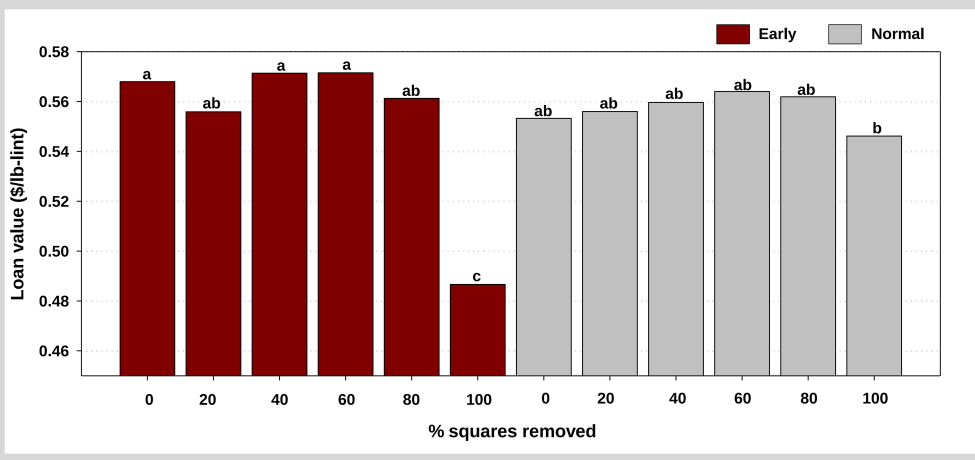

Figure 6. Loan values for different percent levels of pre-bloom square removal for two termination treatments; bars capped by the same letter are not different based on a F protected LSD ($P > 0.05$).

Results and Discussion (continued)

Impact on Quality

Lower micronaire is indicative of immature cotton fibers and suggests that bolls did not have sufficient time to fully 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). However, with the above normal heat unit accumulation in 2011, micronaire was not an issue for these late-season fruit (Figures 7). Only the 100% square removal from the "early" termination treatment had micronaire values in the "discount range. Conversely, where plants maintained their fruit load and had "normal" termination, they trended towards the High Micronaire Reading.

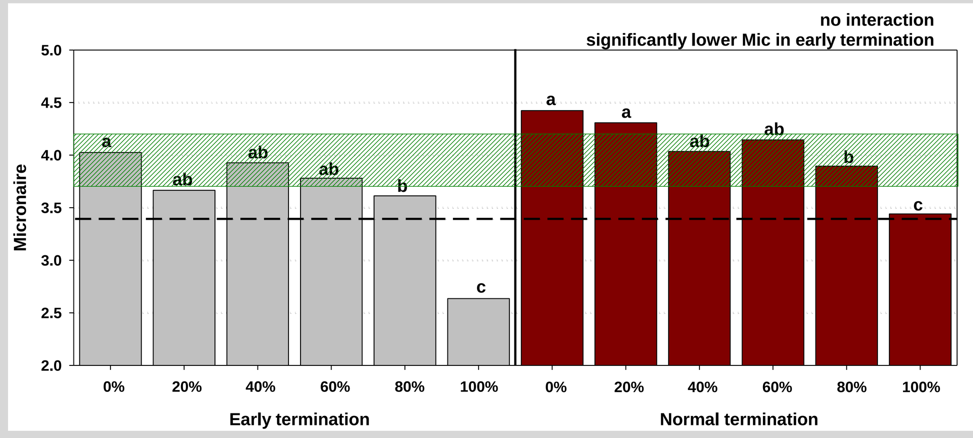

Figure 7. Micronaire readings for different percent levels of pre-bloom square removal for two termination treatments; bars capped by the same letter are not different based on a F protected LSD ($P > 0.05$).

There were no discounts assigned to any treatment for length, strength or length uniformity (data not presented). All "normal" termination treatments had a fiber length of 35/32nds, while fiber lengths from the "early" termination treatments were longer, 36's and 37's. There were a few scheduled premiums for fiber strength but no premiums for length uniformity. Color was all 11's and 21's.

Impact on Total Value

Total value per acre (lint lbs./acre X loan value/lb.) was influenced more by yield with loan values being statistically equal (Figures 8).

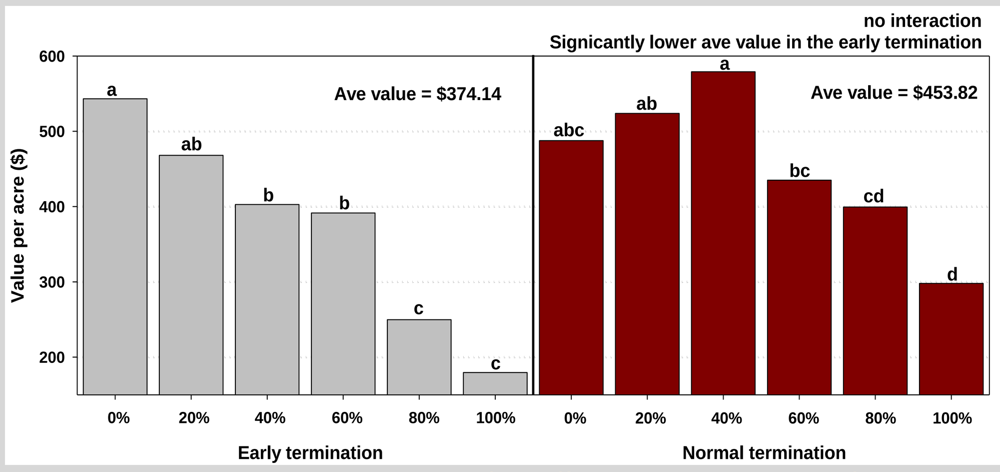

Figure 8. Total lint value per acre for different percent levels of pre-bloom square removal for two termination treatments; bars capped by the same letter are not different based on a F protected LSD ($P > 0.05$).

Summary

In cooler climates or in situations favoring a shorter growing season, the impact on lint maturity and/or yield is adversely affected. Whereas, when conditions favor a full growing season, cotton has the ability to compensate for substantial pre-bloom square loss.

Acknowledgements

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