IMPACT OF PRE-BLOOM SQUARE LOSS ON YIELD AND LINT QUALITY IN LOUISIANA COTTON CROPPING SYSTEMS

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Abstract

During the 2016 growing season, research was conducted at three locations in the state of Louisiana to evaluate the impact of pre-bloom square loss on cotton lint yield and fiber quality. Two cotton varieties, PHY 499 WRF and PHY 222 WRF were chosen to imitate early season square loss due to tarnished plant bug (*Lygus lineolaris*) feeding or unfavorable weather conditions. Thirty plants within each plot were selected and squares were counted. Squares were assigned numbers, and numbers were then randomized using a computerized number generator. To simulate intervals of minimum to maximum fruit loss, just prior to bloom, squares were removed at 0, 20, 40, 60, 80, and 100 percent. Throughout the growing season, weekly applications of insecticide were sprayed to keep plants insect free to avoid unwanted damage. At the end of the season, ten plants within the thirty plants previously chosen were plant mapped and each plot was hand harvested for lint yield and fiber quality. The impact of square loss (removal) on yield and lint quality was highly variable depending on location and variety. Under certain conditions in the Mid-South, high levels of pre-bloom square loss cannot be tolerated. In these situations, lint yield can be reduced when pre-bloom square retention is less than 70%.

Introduction

Fruit loss in cotton can occur following stresses such as lack of sunlight, water deficiencies, and insect damage (Jones, 1996). Each of these variables can cause extensive injury to cotton plants throughout the growing season. Depending on the growth stage in which injury occurs, the plant may or may not be able to overcome and/or compensate for that injury. Compensation for lost fruit or plant injury can be dependent on many factors such as soil fertilization, age of fruit, cotton cultivars, density of planting, planting date fluctuations, amount of fruiting branches, and severity of injury (Stewart et al., 2001 and Bi et al., 1991). Kerns et al. (2015) conducted a study within the Texas high plains on cotton's capability of compensating for pre-bloom square loss due to weather, such as hail damage, and square feeding insects, such as the cotton fleahopper. They concluded that these factors have little or no influence on yield. Although the outcome of this research indicates little to no yield loss in that particular region, other regions, such as the Mid-South, may display different results from the same experiment. With this information in mind, research must be performed in other geographical areas to discover whether or not the same outcomes will occur with different variables affecting plant growth during the growing season.

Materials/Methods

Cotton compensation trials were planted in three different locations within Louisiana: Macon Ridge Research Station (Winnsboro, La.), Northeast Research Station (St. Joseph, La.), Dean Lee Research Station (Alexandria, La.). The two cotton varieties used in this trial were PHY 499 WRF and PHY 222 WRF. Six levels of square removal (0%, 20%, 40%, 60%, 80%, and 100%) were used to simulate intervals of minimum to maximum square removal due to insect pests or climatic stresses that may occur during a growing season. The experimental design used was a 2x6 factorial (2 varieties x 6 levels of square removal) with 4 replications. Plot sizes consisted of 4 rows by 40 ft in length. In each plot, a sub-plot was created, which consisted of one 14 ft row or 1/1000th of an acre that was designated as the research area for square removal and data collection. Each sub-plot was thinned to 30 healthy and intact plants at approximately the 5 true leaf stage. Within each sub-plot, squares were counted and each square assigned a number. From these numbers, the percentage of squares to be removed were randomly assigned. Designated square removal took place when cotton plants reached 12-14 nodes (just prior to bloom) and was accomplished using fine nosed forceps. After squares were removed, insect pests were controlled on a weekly basis. Mepiquat chloride applications for height control were made throughout the season. Nodes above white flower were recorded on 10 plants, 14 days prior to defoliation. Just before harvest, 10 plants/plot were plant mapped to determine if and where fruit compensation occurred. Linear and non-linear regressions using GraphPad Prism version 7.00 (2016), Sigma Plot version 13, and Sysstat Software (2014) was used to statistically analyze the information shown below. Plots were hand harvested and seed cotton was ginned at the Dean Lee Research Station to determine lint yield and gin turnout. Fiber samples were sent to the LSU cotton fiber laboratory for HIV analysis.

Results

At the Alexandria location, PHY 499 WRF demonstrated the ability to compensate or overcompensate for square loss. Based on a curvilinear regression, yield tended to increase from 0% to 20% square removal and then declined, which suggests some overcompensation (Figure 1). PHY 222 WRF at the Alexandria location produced yields that remained relatively flat until 60% square loss, which suggests significant compensation (Figure 2). Micronaire values for PHY 499 WRF at the Alexandria location decreased as square removal increased (Figure 3), while micronaire increased for PHY 222 WRF as square removal increased (Figure 4). At St. Joseph, PHY 499 WRF lint yields were reduced by 300 pounds for the 20%-80% square loss and a 400 pounds for the 100% square removal (Figure 5). PHY 222 WRF at St. Joseph produced a linear response, for every 1% loss in squares, a 3.8% loss in yield was observed (Figure 6). At Winnsboro, PHY 499 WRF demonstrated a varied response to pre-bloom square loss with a 2.23% reduction in yield for every 1% of square loss, which indicates that significant compensation was not evident (Figure 7). There was a highly variable response to pre-bloom square loss for PHY 222 WRF at Winnsboro with yields improving with increasing square loss (Figure 8). The reasons for this response are not clear, but this location experienced a great amount of precipitation, boll rot and hard lock and bolls. Boll age and susceptibility to environmentally induced loss of lint yield from rainfall may have been advantageous for the high square removal treatments which delayed maturity and suffered less boll damage.

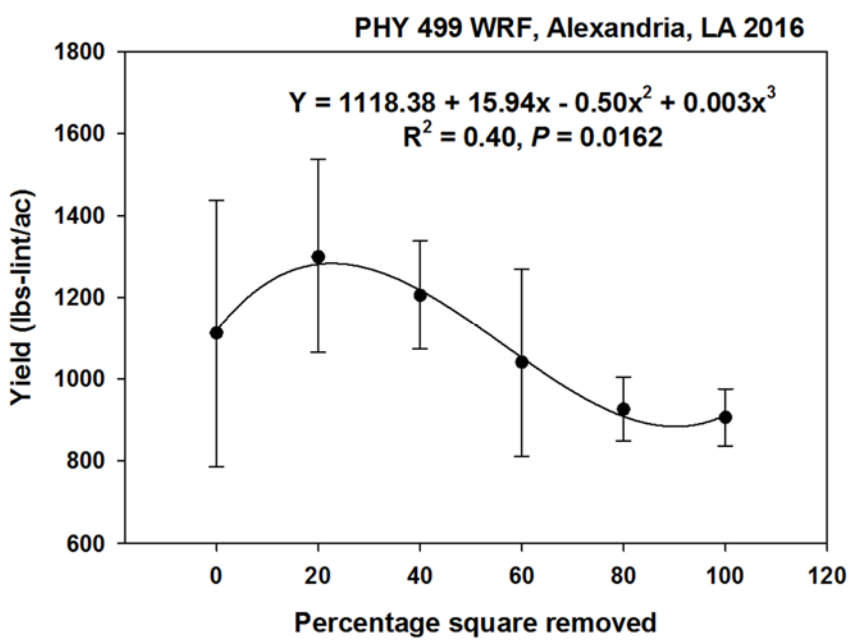

Figure 1. Yield response to different levels of pre-bloom square removal in Alexandria, La with PHY 499 WRF.

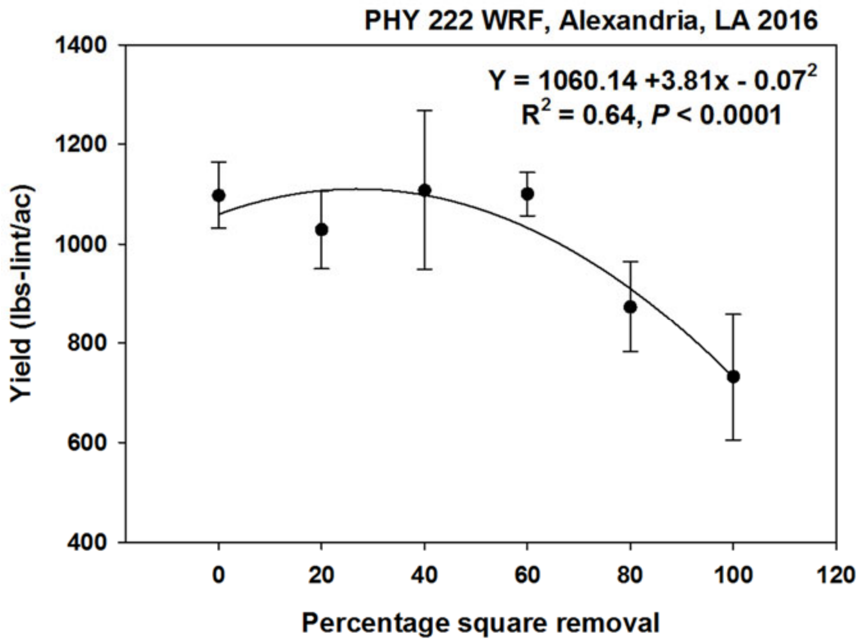

Figure 2. Yield response to different levels of pre-bloom square removal in Alexandria, La with PHY 222 WRF.

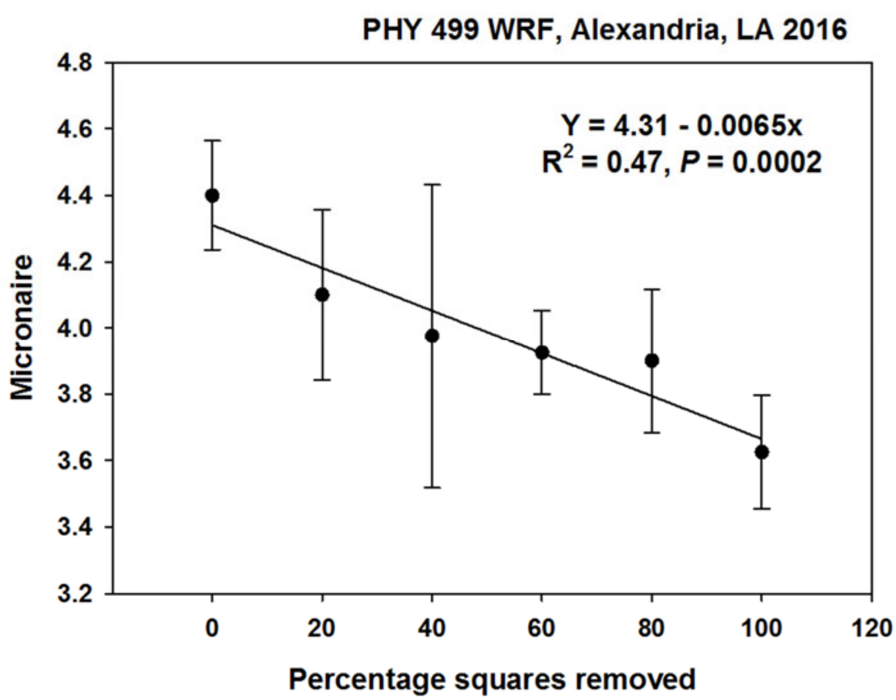

Figure 3. Micronaire response to different levels of pre-bloom square removal in Alexandria, La with PHY 499 WRF.

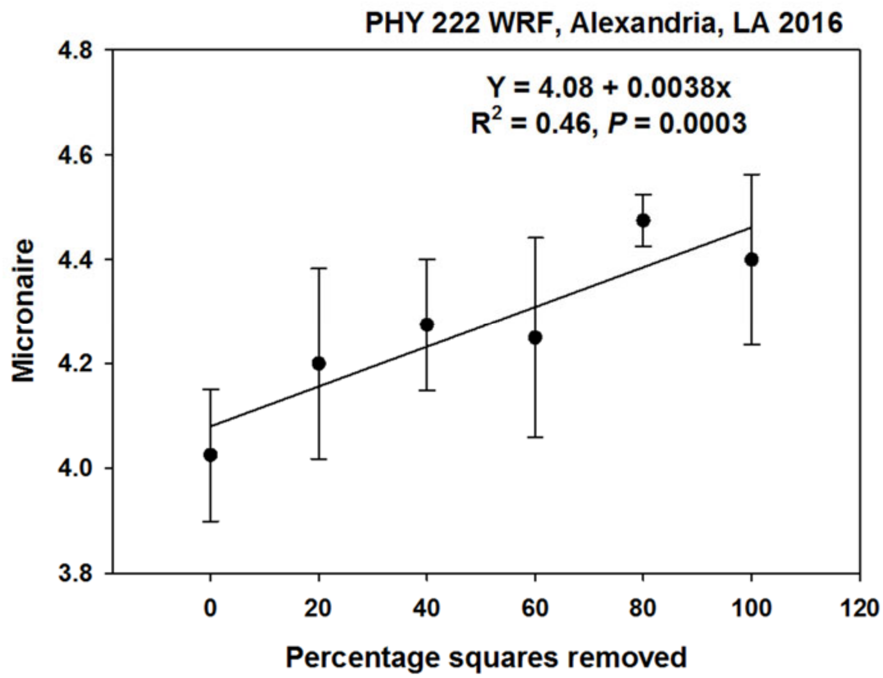

Figure 4. Micronaire response to different levels of pre-bloom square removal in Alexandria, La with PHY 222 WRF.

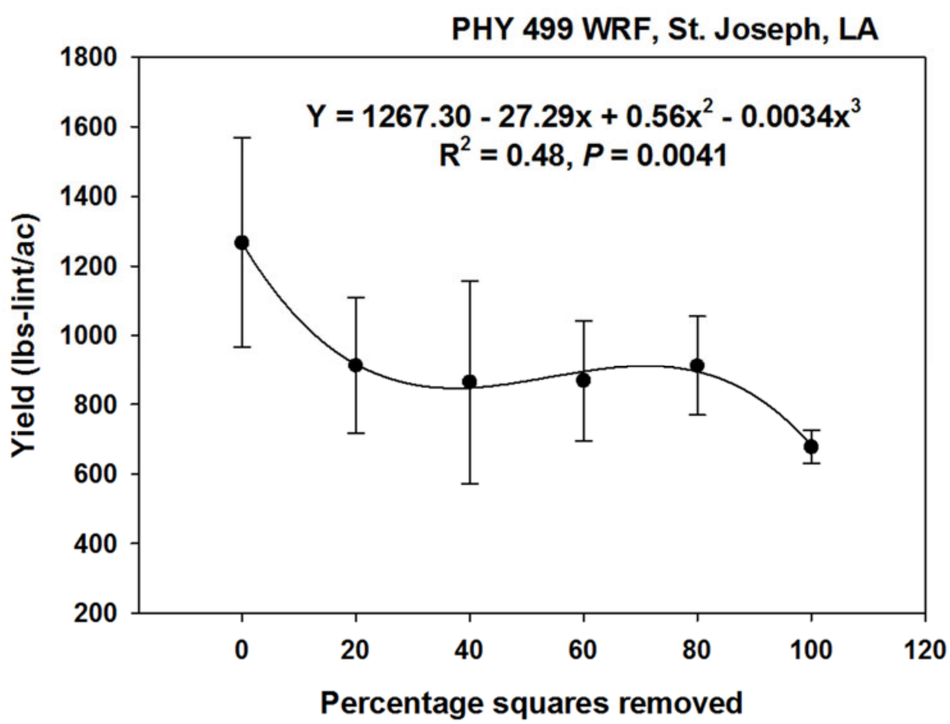

Figure 5. Yield response to different levels of pre-bloom square removal in St. Joseph, La with PHY 499 WRF.

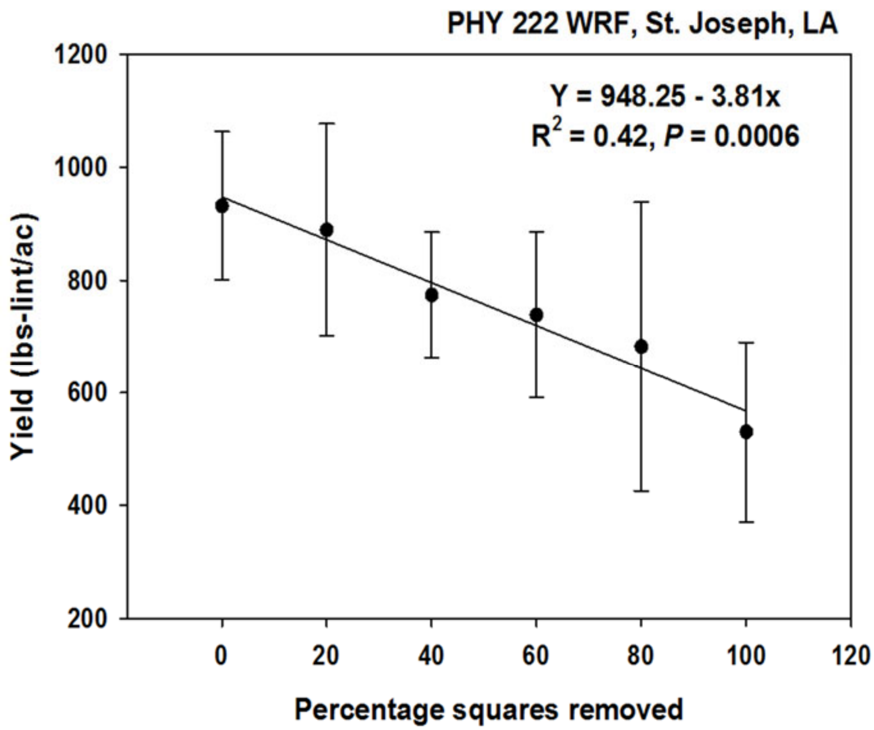

Figure 6. Yield response to different levels of pre-bloom square removal in St. Joseph, La with PHY 222 WRF.

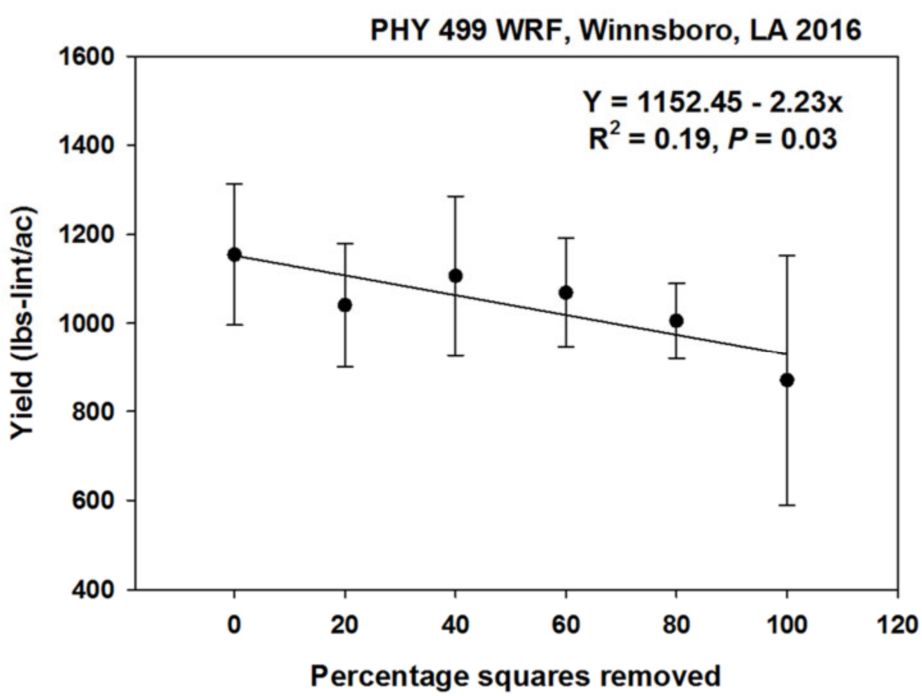

Figure 7. Yield response to different levels of pre-bloom square removal in Winnsboro, La with PHY 499 WRF.

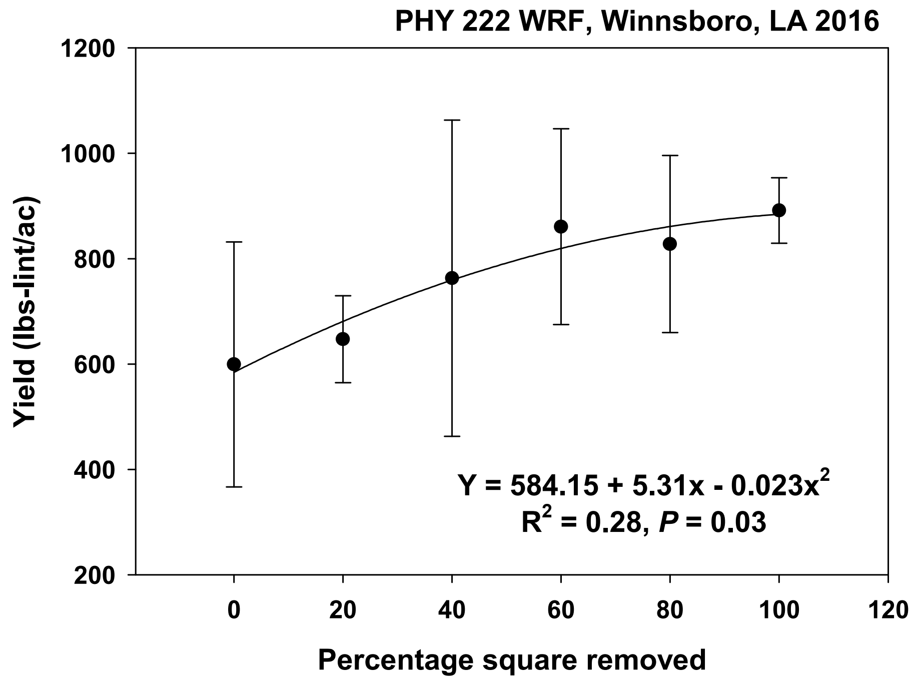

Figure 8. Yield response to different levels of pre-bloom square removal in Winnsboro, La with PHY 222 WRF.

Summary

The impact of square loss (removal) on yield and lint quality was highly variable depending on location and variety as influenced by environmental conditions. Under certain conditions in the Mid-South, high levels of pre-bloom square loss cannot be tolerated. In these situations, lint yield can be reduced when pre-bloom square retention is less than 70%.

References

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