A SQUARE ABSCISSION-NODE GROWTH BALANCE RATIO FOR EARLY-SEASON DECISIONS ABOUT COTTON PLANT GROW, SQUARE SHED, PLANT GROWTH REGULATORS AND UTILITY OF COTMAN

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Abstract

COTMAN is a cotton crop information system that records changes in the fruiting dynamics of the cotton plant as well as plant growth parameters that are useful as a prompter of timely management decisions. This research reports on methods of detecting stress early in order to allow timely management inputs. Treatments of low, medium and high density, with and without insect damage (hand square removal) were compared in a field study. The retention growth balance was calculated from COTMAN data and used to detect stress as well as to schedule plant growth regulator application. The patterns of each growth curve compared to the target development curve show clear early evidence that we can detect stress due to plant density. The research also confirmed that the cotton crop can tolerate a high rate of square shed without undue yield loss. The study also clearly demonstrated that the *Aggregate change* in the *Retention-Growth Balance* is a very sensitive indicator of stress, and can be exploited in timely management decisions.

Introduction

COTMAN is a cotton crop information system that records changes in the fruiting dynamics of the cotton plant as well as in plant growth parameters that are useful as a prompter of timely management decisions. The utility of COTMAN in describing the progress of a cotton crop will not be fully realized until such information improves decision making. We hypothesize that such decisions often will require consideration of the balance between square abscission and plant growth, but questions remain about our ability to measure this balance and to effectively use the information.

The purpose of this research was to evaluate methods: 1) for detecting shifts in the balance between square abscission and plant growth, and 2) to determine if detection of the shifts could be used to improve management decisions. This is the second year of this study.

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Materials and Methods

In attempts to vary the balance between square abscission and plant growth, we used management practices available to the grower, i.e., control levels of square protection, use of plant growth regulators (PGRs) or by varying plant stand density. Irrigation also is an important factor involved in varying the balance between fruit numbers and size, but irrigation was held constant in this experiment by furrow irrigation of all treatments.

Treatments consisted of simulated insect damage, three plant densities, and two PGRs. The split-split plot experiment was designed to provide varying levels and types of plant stress. There were four replications.

Main plot treatments were two levels of square abscission: protected as needed with insecticides versus damaged squares. Sub plot treatments were: three levels of PGRs applied 1 July & 7 July, and no regulators versus mepiquat chloride (Pix) 8 oz./acre/date and PGR-IV 8 oz./acre/date. Sub-sub plot treatments were 3 levels of plant stand density: 15,187, 37,255 and 95,526 plant/acre.

The cultivar SureGrow 125 was planted 13 May 1999 at the University of Arkansas Cotton Branch Experiment Station in Marianna in northwest Arkansas. Sub-sub plots were 4 rows wide and 33 ft long.

Calculating the "Retention/Growth Balance (RGB)

The equation used was: RGB = (X2*Y2 - X1*Y1) / (X2-X1), where X1 and X2 were the number of squaring nodes at two consecutive sampling dates, and Y1 and Y2 were the square shed rate at two consecutive sampling dates.

Results and Discussion

Changes in the balance between square abscission and cotton plant growth were caused by levels of square protection (and hand removal), PGRs, and plant stand density. The changes were easily recorded and clearly indicated by COTMAN (Fig. 1). The change in square abscissions per new sympodial node (value "RGB") was evident (Table 1). The impact was similar to results shown in 1998 (Oosterhuis et al., 1998). The larger number for "RGB" may be viewed as an early indication of impending stress resistance, because of the strong strain induced by boll loading. Reduction of the strain by removal of squares should also imply an increased likelihood of a later resurgence of growth, including sympodial nodes. Conditions influencing growth and its resurgence are many, but we limited our observations to the three treatments of square loss, PGRs and stand density. The influence on growth associated with stand density in 1998 (Figure 1) was less apparent in 1999, although the trend was the same for both years as shown by the number of days required to reach cutout (Table 2).

The mepiquat chloride (Pix) treatment also had an influence on growth as in 1998, although the impact was less (Table 3).

Conclusions

COTMAN indices reflect shifts in plant stress and strain indications, but the tolerance levels for stress are yet to be defined in relation to these indices. The RGB index was shown to be a potentially sensitive indicator of change in plant stress that can be exploited for timely management decisions. Evaluation of combinations of management practices to avoid cotton plant stress seem possible with these standardized indices and will be the focus of future research.

Literature Cited

Oosterhuis, D. M., N.P. Tugwell, T. G. Teague, and D. M. Danforth. 1999. Early-season decisions about cotton plant growth, square shed, plant growth regulators and utility of COTMAN. 1999 Proceeding Beltwide Cotton Conf. Orlando, FL. Vol. 1:628-629.

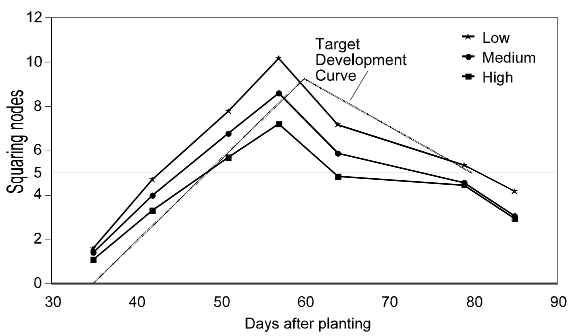

Figure 1. The nodal development curve from COTMAN to show plant stress associated with low, medium, and high stand densities in 1998.

Table 1. Value of "RGB" associated with changes in square loss per new sympodial node.

Mean % Square Abscission*	Value "RGB"*
6.2 a	0.13 a
20.6 b	0.56 b

*Means within column significant, Pr. > F < 0.05;LSD.05 = 5.1 & 0.16, respectively.

Table 2. Influence associated with plant stand density on days to cutout.

Mean Plant Stand Density/Acre	Mean Day to Cutout in 1999
15,187	77.7 b*
37,255	77.3 b
95,526	75.7 a

* Means followed by same letter are not significant at 0.05; LSD.05 = 0.569

Table 3. Influence associated with mepiquat chloride on days to cutout.

Plant Growth Regulator Treatments	Mean Days to Cutout
None	77.6 b*
Mepiquat chloride (Pix)	75.3 a
PGR-IV	77.7 b

*Means followed by same letter are not significant; LSD.05 = 0.438

Table 4. The plant structure and pattern of fruiting associated with plant stand densities.

Treatmenton plants/Acre	Total yield lbs. lint/Acre	Total bolls 000/Acre	% Total bolls veg.branches
15,187	1,062	345	33.7
37,255	1,081	381	11.1
95,526	1,053	562	1.5