# DEFINING OPTIMAL PGR MANAGEMENT STRATEGIES & PLANT POPULATIONS FOR NEW COTTON VARIETIES IN GEORGIA

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## Introduction

Prior to 2010, approximately 85 percent of the Georgia cotton acreage was planted to DP 555 BR. Due to the expiration of the EPA registration for the Bollgard™ technology, only an approximate 25 percent of the Georgia cotton acreage was planted to DP 555 BR in 2010, with the remaining 75 percent planted to relatively new varieties. In 2011, 100 percent of the Georgia cotton acreage will be planted to varieties other than DP 555 BR. The 2011 acreage, and beyond, will likely be comprised of a diverse group of varieties, as a single predominate replacement for DP 555 BR is unlikely in the near future.

Some of the most popular new varieties often exhibit vastly different fruiting characteristics than that of DP 555 BR (Figure 1). Most of these varieties tend to set more fruit on lower nodes and less fruit on upper nodes compared to DP 555 BR, and many do not appear to exhibit the excessive vegetative growth characteristics exhibited by DP 555 BR. Therefore, many of the newer varieties may require less aggressive plant growth regulator (PGR) management in order to maximize boll set and lint yields. Additionally, some of the newer varieties appear to have “columnar-type” fruiting and branching characteristics, thereby raising the question of whether or not plant populations for these varieties need to be adjusted in order to maximize yield potential.

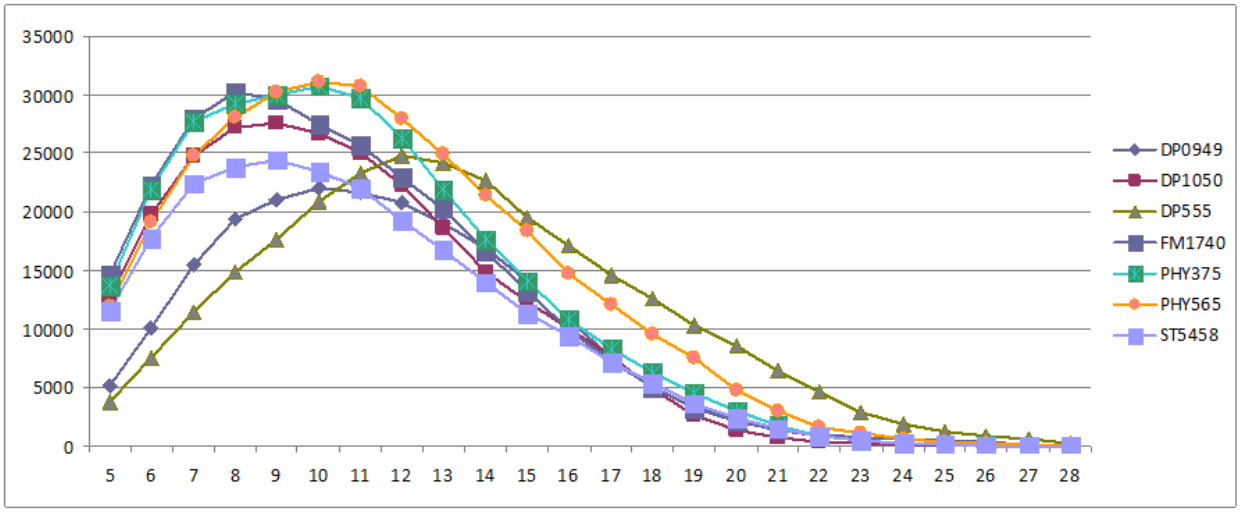


Figure 1. Distribution of total bolls per acre by node for several new varieties

## Methods

A series of experiments was conducted in 2010 in Tifton, GA and in Midville, GA, to investigate the response of several of the newer varieties to various PGR management strategies and plant populations. These trials were conducted using a randomized complete block design containing four replications. All PGR treatments were applied using a $CO_2$-pressurized backpack sprayer calibrated to deliver 15 GPA using regular flat-fan nozzles.

The objective of Experiment #1 was to quantify the response of 10 new varieties to an aggressive PGR treatment consisting of Mepiquat Chloride (MC) applied at a rate of 12 oz/A to 9-10 leaf(lf) cotton, followed by (fb) 16 oz/A MC at early bloom (EB), fb 16 oz/A MC at EB+2weeks (wk), fb 16 oz/A MC at EB+4wk. This PGR treatment was representative of a commonly used approach to adequately suppress plant height for DP 555 BR, especially in well-watered environments. The varieties included in Experiment #1 included DP 555 BR, DP 1050 B2RF, DP 1048 B2RF, DP 0949 B2RF, PHY 565 WRF, PHY 375 WRF, PHY 485 WRF, ST 4288 B2F, ST 5458 B2F, and FM 1740 B2F, evaluated in both irrigated and dryland conditions.

The objective of Experiment #2 was to determine if a pre-bloom MC application was necessary to adequately suppress plant height for some of the new varieties, which included DP 555 BR, DP 0949 B2RF, DP 0912 B2RF, and FM 1740 B2F. PGR treatments used in Experiment #2 included a non-treated control; an aggressive treatment consisting of 12 oz/A MC applied to 9-10 lf cotton fb 12 oz/A MC at EB fb 16 oz/a MC at EB+2wk; a mild treatment consisting of 12 oz/A MC at EB fb 16 oz/a MC at EB+2wk; and a non-aggressive treatment consisting of a single application of 16 oz/A MC at EB+2wk.

The objective of Experiment #3 was to determine if Stance™ (ST) (usually resulting in milder, or more forgiving, plant height suppression) is a more appropriately used PGR if a pre-bloom application is justified for an earlier maturing variety. Varieties included in Experiment #3 included DP 1050 B2RF and FM 1740 B2F and PGR treatments included a non-treated control; 2 oz/A ST applied to 9-10 lf cotton fb 3 oz/A ST at EB; 2 oz/A ST applied to 9-10 lf cotton fb 16 oz/A MC at EB; 3 oz/A ST applied to 9-10 lf cotton fb 16 oz/A MC at EB; 8 oz/A MC applied to 9-10 lf cotton fb 16 oz/A MC at EB; and 12 oz/A MC applied to 9-10 lf cotton fb 16 oz/A MC at EB.

The objective of Experiment #4 was to determine if ST should be used to manage growth throughout the season for some of the earlier maturing varieties. Varieties included in Experiment #4 were DP 555 BR and FM 1740 B2F and PGR treatments included a non-treated control; 2 oz/A ST applied to 9-10 lf cotton fb 2 oz/A ST at EB fb 2 oz/A ST at EB+2wk; 3 oz/A ST applied to 9-10 lf cotton fb 3 oz/A ST at EB fb 3 oz/A ST at EB+2wk; 4 oz/A ST applied to 9-10 lf cotton fb 4 oz/A ST at EB fb 4 oz/A ST at EB+2wk; 8 oz/A MC applied to 9-10 lf cotton fb 8 oz/A MC at EB fb 8 oz/A MC at EB+2wk; and 12 oz/A MC applied to 9-10 lf cotton fb 12 oz/A MC at EB fb 12 oz/A MC at EB+2wk.

The objective of Experiment #5 was to determine if higher plant populations are required for some of the columnar-type varieties to reach maximum yield potential. Varieties included in Experiment #5 were DP 555 BR, DP 0949 B2RF, PHY 375 WRF, and FM 1740 B2F, and plant populations included 0.5 plants foot$^{-1}$, 1 plant foot$^{-1}$, 2.5 plants foot$^{-1}$, and 4.5 plants foot$^{-1}$.

**Results and Discussion**

Results from Experiment #1 indicated that newer varieties differ in their responses to an aggressive PGR treatment which was previously required to manage growth of DP 555 BR, and thus differed with regard to growth potential. The greatest reduction when comparing the relative rank of varieties of non-treated cotton versus the sum of treated and non-treated cotton in the dryland trial occurred with PHY 565 (Figure 2). PHY 485 WRF appeared to exhibit greater growth potential in dryland environments than some of the other varieties. The greatest reduction when comparing the relative rank of varieties of non-treated cotton versus the sum of treated and non-treated cotton in the irrigated trial occurred with PHY 565 WRF (Figure 3). Most of the other varieties ranked according to their maturity as predicted. DP 1050 B2RF and DP 1048 B2RF held a lower rank on overall growth potential in the irrigated trial than they did in the dryland trial, indicating that some of the other varieties are likely less drought tolerant.

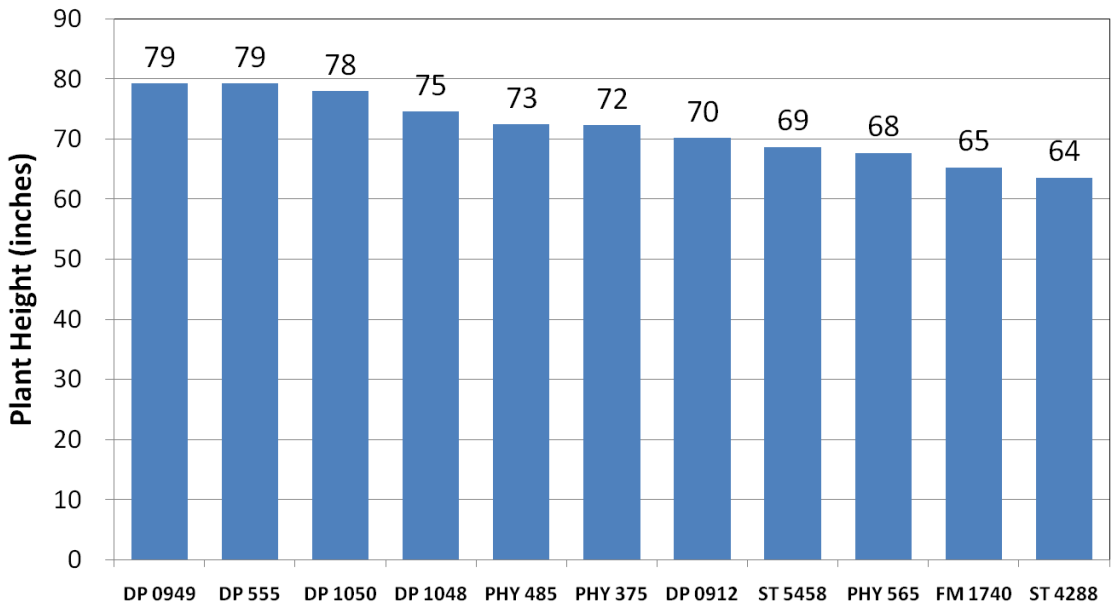


Figure 2. Sum of MC-treated and non-treated plant height as a measurement of growth potential for new varieties in dryland environments.

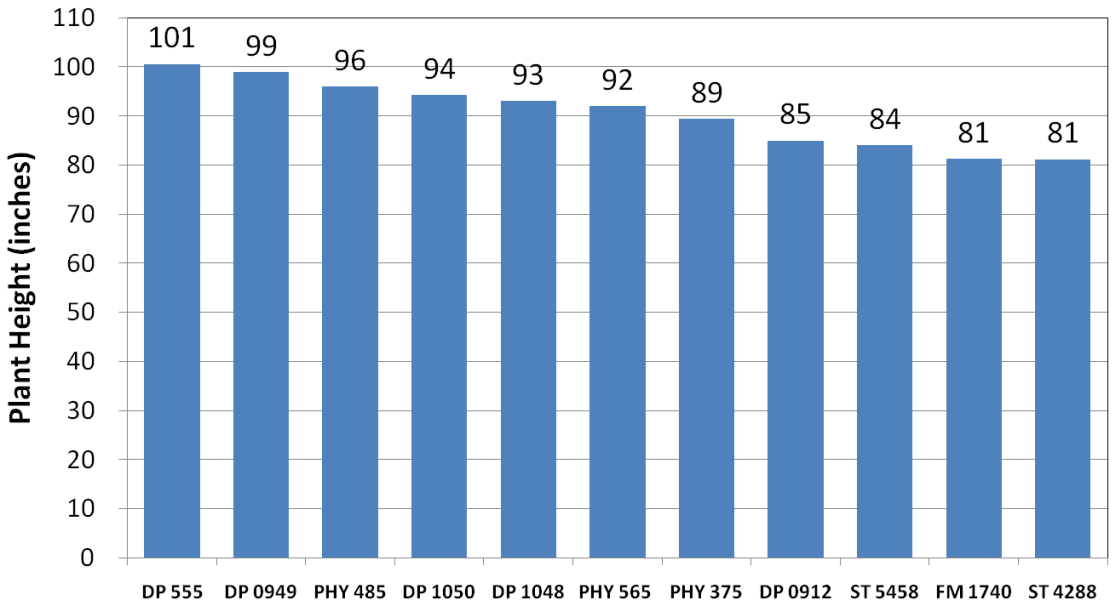


Figure 3. Sum of MC-treated and non-treated plant height as a measurement of growth potential for new varieties in irrigated environments.

Results from Experiment #2 indicated that a pre-bloom PGR application was necessary to achieve optimal plant height (38 to 45 inches) for DP 555 BR and DP 0949 B2RF in these irrigated conditions, however the pre-bloom application resulted in less-than-optimal final plant height for the two early maturing varieties; DP 0912 B2RF and FM 1740 B2F. Especially in the case of FM 1740 B2F, optimal plant height was achieved when PGRs were applied at EB or thereafter.

Results from Experiment #3 suggest that 2 oz/A ST applied to 9-10 lf cotton fb 3 oz/A ST at EB resulted in taller plants compared to 12 oz/A MC applied to 9-10 lf fb 16 oz/A MC at EB for DP 1050 B2RF, however plant height was similar between these two PGR treatments when applied to FM 1740 B2F, suggesting that Stance™ may adequately suppress plant height for FM 1740 B2F whereas MC may be more appropriate for DP 1050 B2RF, when used during the prebloom period.

Results from Experiment #4 indicated that 12 oz/A MC applied thrice resulted in significantly different plant height between DP 555 BR and FM 1740 B2F, however these two varieties responded similarly to all other PGR treatments. These results also indicated that 8 oz/A MC applied thrice to DP 555 BR resulted in similar plant height to that of 2 oz/A ST applied thrice to FM 1740 B2F, indicating that Stance™ may be more appropriate for PGR management of varieties exhibiting less growth potential.

Lastly, the results from Experiment #5 indicated that the three new varieties are somewhat earlier maturing than DP 555 BR at all plant populations. Additionally, there was a reduction in nodes above white flower noticed for DP 555 BR when plant

populations increased from 2.5 to 4.5 plants foot$^{-1}$ (Figure 4). This effect was not observed in other varieties. Yield responses to increasing plant populations varied among the varieties tested (Figure 5). DP 555 BR achieved maximum yield at 1 plant foot$^{-1}$, although yields were similar at 2.5 plants foot$^{-1}$. Maximum yields for FM 1740 B2F and DP 0949 B2RF were achieved at 2.5 plants foot$^{-1}$. Maximum yields for PHY 375 WRF were achieved at 4.5 plants foot$^{-1}$.

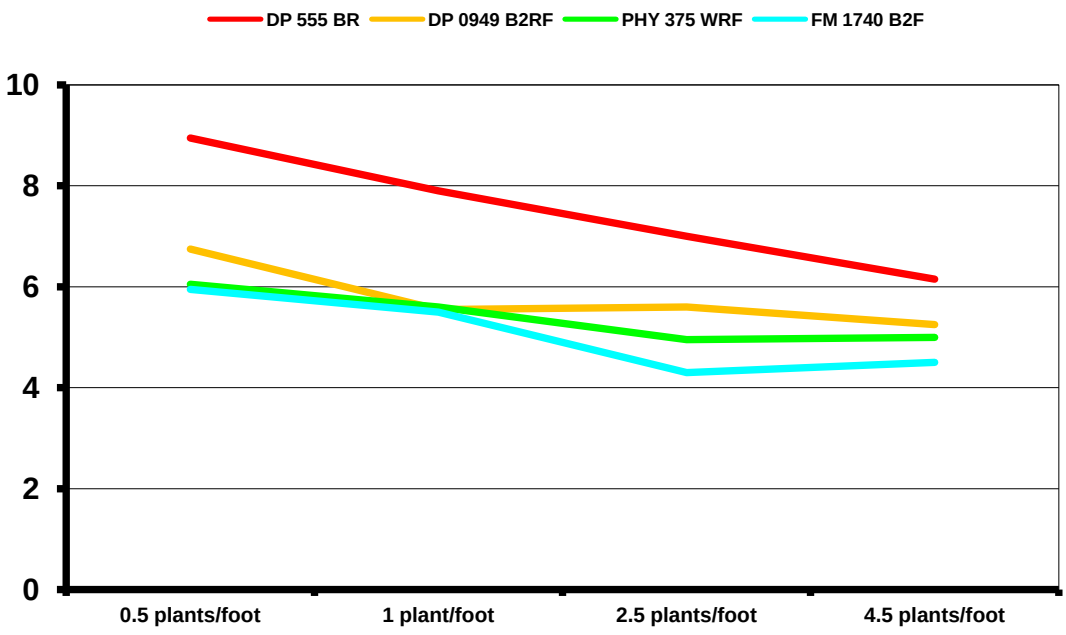


Figure 4. Plant population effects on nodes above white bloom of four varieties.

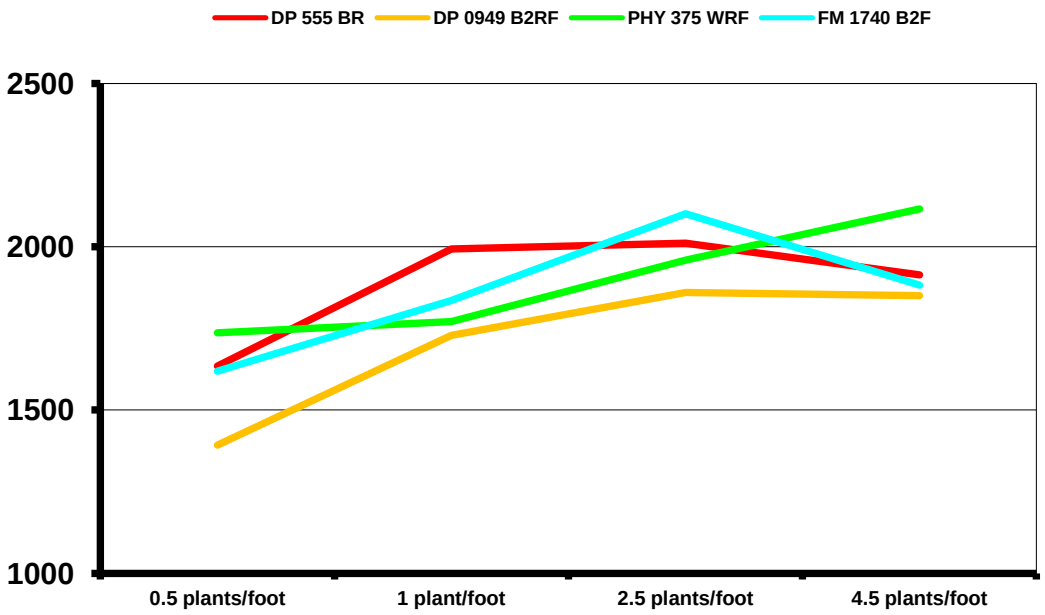


Figure 5. Plant population effects on lint yield (Lbs/A) of four varieties.

## Summary and Conclusions

In summary, results from these trials suggest that responses to PGR treatments vary among the varieties tested, and that an aggressive PGR strategy may result in suboptimal plant height for some varieties. For some of the earlier maturing varieties, a pre-bloom PGR application may not be necessary to adequately suppress plant height. Additionally, the use of Stance™ may be more appropriate than standard mepiquat-containing products for earlier maturing varieties in some environments. Lastly, the currently recommended 2.5 plants foot$^{-1}$ plant population appears to be appropriate for some of the newer columnar-type varieties to achieve maximum yields.

## Acknowldegement

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