Development of a System for Determining Relative Plant Growth Regulator Requirements for Cotton Varieties in Georgia

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INTRODUCTION:

Plant growth regulator (PGR) applications are often necessary in cotton to reduce vegetative growth and maintain a manageable crop in Georgia. However, making such decisions can be difficult because of the many factors that need to be considered (irrigation, soil fertility, temperature, soil moisture, growth stage, field history, etc.). Cotton variety also plays a role in making proper PGR decisions since some varieties need to be monitored closely and heavily managed while some are sensitive, and overuse may negatively impact growth and development, and ultimately yield. Because of potential differences in PGR requirement among varieties and due to frequent release of new commercial varieties, research is needed to help understand differences between varieties with regard to vegetative growth potential to develop proper PGR regimes for new cotton varieties.

METHODS:

This study consisted of total of seven trials, two in 2010, three in 2011, and two in 2012. In all trials, treatments consisted of a factorial arrangement of cotton varieties (similar within year, different set each year) and two PGR regimes. Varieties consisted of DP 0912 B2RF, DP 0949 B2RF, DP 1048 B2RF, DP 1050 B2RF, FM 1740 B2RF, PHY 375 WRF, PHY 565 WRF, ST 4288 B2RF and ST 5458 B2RF in 2010. In 2011 varieties consisted of entries from 2010 along with DP 1137 B2RF, FM 1773 LLB2, FM 1845 LLB2, and PHY 499 WRF. In 2012 varieties consisted of AM 1511 B2RF, DP 0912 B2RF, DP 1050 B2RF, DP 1137 B2RF, DP 1252 B2RF, PHY 499 WRF, FM 1740 B2RF and FM 1944 GLB2. PGR regimes included cotton which was not treated with PGR and cotton treated with mepiquat chloride three times (applied at initiation of squaring at 12 oz/A, at first bloom at 16 oz/A, and two weeks after first bloom at 16 oz/A).

Growth parameters, particularly end-season plant height, along with lint yield and fiber quality were used to assess the growth potential of a variety and document the impact a heavy PGR regime has on development and yield. Three sets of data were analyzed, information from the nine similar varieties in five locations during 2010 and 2011, information from all 14 varieties in three locations during 2011, and eight varieties in two locations during 2012. Data were subjected to ANOVA using the PROC MIXED procedure of SAS to reflect the factorial arrangement of treatments, location was treated as a random effect. Means for significant main effects and interactions were separated with Fisher's Protected LSD at $P \leq 0.1$.

Table 1. Plant height in 2011. Data averaged over PGR regime.[1]

Variety	Plant Height	
	(inches)	
DP 0949 B2RF	47.1	a
DP 1050 B2RF	46.2	ab
PHY 499 WRF	45.7	abc
DP 1048 B2RF	45.3	abc
DP 1137 B2RF	44.7	bcd
PHY 565 WRF	43.7	cd
ST 4145 LLB2	42.6	de
PHY 375 WRF	41.0	ef
FM 1773 LLB2	40.8	ef
ST 5458 B2RF	40.7	ef
DP 0912 B2RF	40.6	ef
FM 1845 LLB2	38.0	fg
ST 4288 B2RF	38.0	g
FM 1740 B2RF	37.6	g

[1] Means within a column followed same letter are not significantly different at P=0.1.

Table 2. Plant height in 2012.. Data averaged over PGR regime.

Variety	Plant Height	
	(inches)	
DP 1137 B2RF	48.1	a
DP 1252 B2RF	48.0	a
PHY 499 WRF	46.9	ab
DP 1050 B2RF	46.9	ab
AM 1511 B2RF	45.2	bc
DP 0912 B2RF	43.6	cd
FM 1740 B2RF	41.3	d
FM 1944 B2RF	41.2	e

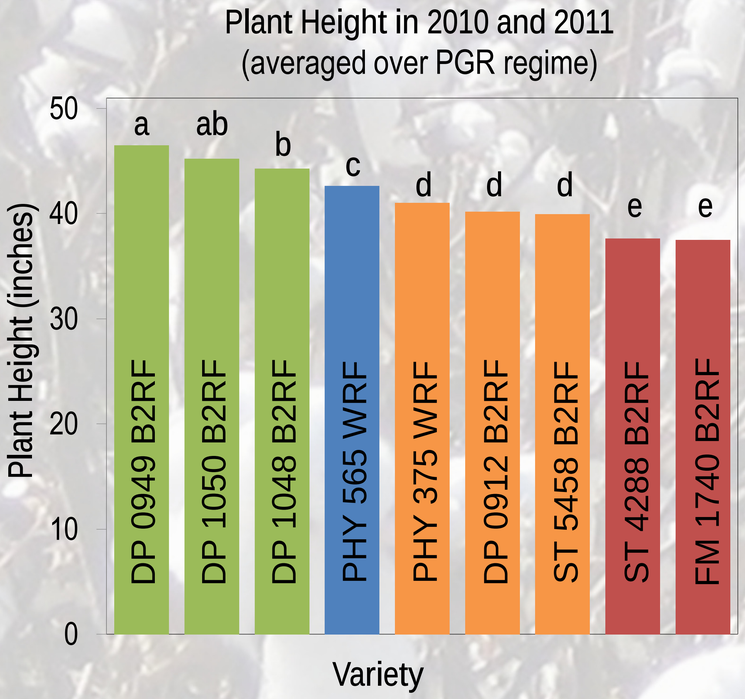
[1] Means within a column followed same letter are not significantly different at P=0.1.

RESULTS:

Analysis of 2010 and 2011 data indicated that plant height was affected by the main effect of variety and PGR regime. In general, plant height was reduced by PGRs, yet no variety by PGR regime was observed. Lint yield was only affected by variety. While recognizing that data did not indicate variety by PGR interactions, differences in plant height among varieties (averaged over PGR regime) were observed (Figure 1). The main effect of variety on plant height is a parameter which is equally based on vegetative growth potential of a variety as well as its response to PGRs. Both of these characteristics play a role in PGR decisions. Therefore, variety height (averaged over PGR regime), along with additional data for this and other studies, was used to identify four classes of variety responses. The first class contained varieties with the most vegetative growth potential, and would require PGR applications in almost all situations. The 2nd class contains varieties with similar vegetative growth potential of the 1st class, yet are more responsive to PGRs or may have earlier maturity. The 3rd class contains varieties which could require PGR applications, however initiation of PGR applications prior to bloom is not generally necessary and could result in premature cutout, especially in dryland conditions. The 4th class contains varieties which may need no PGR applications or in almost all cases not applied prior to bloom.

In 2011, five additional varieties were included to evaluate their growth and response to PGRs compared to the nine varieties evaluated in 2010 and 2011. These varieties were included in a PGR class based on comparing differences and similarities of each particular variety to varieties in each of the classes. In 2012, only eight varieties were evaluated and three of which were not evaluated in 2010 and 2012. One variety of each class was included as a check to ensure that new varieties evaluated could be properly included into PGR classes.

This grouping of varieties into classes was developed to simplify PGR decisions based on variety and help growers make more educated decisions when planting varieties for the first time. When a new variety is planted, PGR decisions could be based on its PGR classification due to being in the same class as a more familiar variety or because it is in a different class than a familiar variety. This system was also developed so that future investigations of PGR needs of new varieties can be more easily evaluated and quickly determined.



CONCLUSIONS:

Although this study focuses on variety influences on PGR management, it is important to recognize that many other factors can influence proper PGR decisions (irrigation, soil fertility, temperature, soil moisture, growth stage, field history, etc.). These factors can play a tremendous role in the effectiveness of a particular PGR strategy and should be carefully considered when making such decisions.

Table 3. Classification of cotton varieties with regards to relative PGR requirements.

Classification	Varieties			
1	DP 0949 WRF	DP 1050 B2RF	DP 1048 B2RF	PHY 499 WRF
	DP 1137 B2RF	DP 1252 B2RF		
2	PHY 565 WRF	ST 4145 LLB2		
3	AM 1511 B2RF	DP 0912 B2RF	FM 1773 LLB2	ST 5458 B2RF
4	FM 1740 B2RF	FM 1845 LLB2	FM 1944 B2RF	ST 4288 B2RF

Varieties in blue were included in 2011 and varieties in red were included in 2012.

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