RESPONSE OF COTTON VARIETIES TO VARYING PLANT GROWTH REGULATOR PROGRAMS IN SOUTH CAROLINA

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Introduction

The application of plant growth regulator (PGRs) chemicals has become common practice in cotton production across the cotton belt. Plant growth regulators appear to be important in stimulating early-season growth and in manipulating resources into harvestable yield. Proper use of PGRs often reduces plant height (Heilman, 1981), which may result in reduced yield losses caused by boll rots, hardlocks, and shading commonly associated with dense canopies (Snow et al., 1981). Although the physiological responses of cotton plants to PGRs have been fairly consistent throughout the Cotton Belt, reports on the yield response to PGR applications have been inconsistent. Some researchers have found yield increases (Briggs, 1980, Walter et al., 1980) with the application of PGRs, while others have found yield decreases or no yield effects (Crawford, 1981; Feaster et al., 1980, Thomas, 1975). Improved yields with the applications of PGRs have often been attributed to improved photosynthetic capacities (Gausman et al., 1979), more vigorous early-season growth (Oosterhuis and Zhao, 1994), higher boll retention (Kerby, 1985; Kerby et al., 1986), better light penetration (Reddy et al., 1990), improved earliness (Kerby, 1985), and increased root mass (Oosterhiuis and Zhao, 1994). However, it appears the proper rate and timing of PGRs depends upon many environmental factors, such as soil moisture, ambient air temperatures, and fertility (Cathey and Thomas, 1986). Yield responses appear to be related to environmental factors encountered by the plant throughout the growing season, with increased yields occurring under conditions that favor excessive vegetative growth (high N rates, excessive rainfall, thick stands, etc.) and yield decreases occurring under conditions that limit proper growth (excessive drought, high temperatures, N deficiency, etc.). The objective of this study was to compare and contrast yield performance and crop development of experimental and commercial cotton varieties in South Carolina in response to various plant growth regulator programs.

Materials and Methods

A replicated field study was conducted in 2008 at the Pee Dee Research & Education Center located in Florence, SC on a Norfolk loamy sand soil type. The plots were planted on May 20, 2008 with a JD 1700 vacuum planter at a rate of 4 seed per row foot. Plots consisted of 4 rows, spaced 38 inches apart and were 40 feet long. Three plant growth regulator programs and ten cotton varieties were arranged as split-plots in a randomized complete block design with four replications. The three plant growth regulator programs were in main plots, and the ten varieties were in sub-plots. Varieties consisted of five commercially released varieties (DPL 555BR, DPL 143BR, ST 4554B2RF, DPL 0924B2RF, and DPL 0935B2RF) and five experimental varieties (DPLX 07X440DF, DPL 0912 B2RF, DPL 0949 B2RF, MCS 0711B2RF, and MCS 0702B2RF). Plant growth regulator programs consisted of: 1) untreated, 2) a standard program, and 3) an aggressive program. The standard program consisted of Pentia sprayed at a rate of 8 oz/a on July 1, 2008 at the matchhead square stage followed by Pentia sprayed at a rate of 16 oz/a on July 10, 2008 at the early bloom growth stage. The aggressive program consisted of Pentia sprayed at a rate of 8 oz/a on June 20, 2008 at the 6 to 8 leaf stage, followed by Pentia sprayed at a rate of 16 oz/a on July1, 2008 at the matchhead square stage, followed by Pentia sprayed at a rate of 16 oz/a on July 10, 2008 at the early bloom growth stage.

Data collected included plant height and number of nodes at several times during the season, and a final plant map at the end of season (plant height, number of nodes, total fruiting sites, boll location on main stem nodes and sympodia). The middle two rows of each four row plots were machine-harvested at season's end. Seed cotton was ginned on a 10-saw gin and gin turnout calculated, and fiber quality determined by HVI analysis at Star Lab (Knoxville, TN). Data were evaluated by analysis of variance (SAS Institute Inc., Cary, NC).

Table 1. Lint yield, seed cotton, gin turnout and fiber quality of various cotton varieties (VAR) in response to three different plant growth regulator programs (PGR) at Florence, SC, in 2008.

Parameter	Lint Yield (lb/a)	Seed Cotton (lb/a)	Gin Turnout (%)	Micronaire	Fiber Length (in.)	Fiber Strength (g/tex)	Fiber Uniformity (%)
PGR Program							
Untreated	1560	3957	39.5	4.3	1.12	28.5	82.6
Standard†	1568	4040	38.8	4.2	1.14	28.9	82.6
Aggressive‡	1467	3869	37.9	4.1	1.14	28.5	82.4
LSD (0.05)	77	NS	0.6	0.1	0.01	NS	NS
Variety							
DPLX 07W505 DF	1630	4206	38.7	4.5	1.11	29.4	82.4
DPLX 07W514 DF	1577	4017	39.2	4.4	1.15	28.7	83.5
ST 4554 B2RF	1557	4101	37.9	4.2	1.12	29.1	82.9
DPLX 07X440 DF	1549	3739	41.4	4.0	1.12	25.4	82.2
MCS 0711B2RF	1547	4153	37.3	4.1	1.17	27.6	83.2
DPL 0935 B2RF	1546	3912	39.5	4.3	1.11	28.8	82.1
DPL 555 BR	1532	3736	41.0	4.2	1.11	29.3	80.9
MCS 0702 B2RF	1507	3969	38.0	4.2	1.12	29.4	83.3
DPL 0924 B2RF	1488	3938	37.8	4.5	1.11	29.2	82.7
DPL 143 B2RF	1386	3782	36.7	3.9	1.19	29.2	82.1
LSD (0.05)	NS	327	1.1	0.2	0.02	0.9	0.7
PGRxVAR	NS	*	NS	NS	NS	NS	NS

†Pentia sprayed at 8 oz/a on July 1, 2008 (matchhead square) and at 16 oz/a on July 10, 2008 (Early Bloom).

‡Pentia sprayed at 8 oz/a on June 20, 2008 (6 to 8 leaf stage), at 16 oz/a on July 1, 2008 (matchhead square), and at 16 oz/a on July 10, 2008 (Early Bloom).

Table 2. Seed cotton (lb/a) of various cotton varieties (VAR) in response to three different plant growth regulator programs (PGR) at Florence, SC, in 2008.

	PGR Program			
Variety	Untreated	Standard PGR Program†	Aggressive PGR Program‡	Variety Mean
	Seed cotton (lb/a)			
DPLX 07W505 DF	4686	4252	3680	4206
MCS 0711B2RF	4088	4123	4247	4153
ST 4554 B2RF	4037	4187	4080	4101
DPLX 07W514 DF	4252	3925	3873	4017
MCS 0702 B2RF	3985	4045	3878	3969
DPL 0924 B2RF	4024	3628	4161	3938
DPL 0935 B2RF	3693	4278	3766	3912
DPL 143 B2RF	3701	4140	3504	3782
DPLX 07X440 DF	3633	3783	3800	3739
DPL 555 BR	3469	4037	3701	3736
PGR Mean	3957	4040	3869	3955
LSD (0.05)	PGR=NS	VAR=327	PGRXVAR=567	
C.V. (%) = 9.2				

†Pentia sprayed at 8 oz/a on July 1, 2008 (matchhead square) and at 16 oz/a on July 10, 2008 (Early Bloom).

‡Pentia sprayed at 8 oz/a on June 20, 2008 (6 to 8 leaf stage), at 16 oz/a on July 1, 2008 (matchhead square), and at 16 oz/a on July 10, 2008 (Early Bloom).

Summary

Plant Growth Regulator Program Differences

Although weather conditions in SC in 2008 were optimal for cotton production (3 bale or greater lint yield), the aggressive PGR program (3 sprays of 40 oz/a total) reduced lint yield 6 to 7% (Table 1) compared to a more standard PGR program (2 sprays of 24 oz/a total) or the untreated (no PGRs applied).

PGR applications appeared to change the internal partitioning of dry matter within cotton bolls. The use of Pentia in this study reduced gin turnout and micronaire, and increased fiber length (Table 1).

The use of Pentia reduced plant height, the number of nodes, and the height: node ratio, decreased the first fruiting branch, and increased the number of bolls produced between nodes 6 and 10.

Variety Differences

Although not statistically significant, the lint yields of many of the new B2RF varieties evaluated in this study were greater than DPL 555BR. The yield potential of these new B2RF varieties is extremely promising to many SC cotton growers who have relied so heavily on DPL 555BR as their primary variety over the last five or six years. DPL 555BR will not be commercially available after 2010.

PGR Program x Variety Interactions

No PGR x variety interactions were found for any of the parameters measured in this study, with the exception of seed cotton (Table 2). Seed cotton production was reduced 21% with DPL 0912 B2RF by the aggressive use of PGRs during the growing season compared to the untreated plots. Likewise, seed cotton production was reduced 15% with DPL 143B2RF by the use of an aggressive PGR program compared to a more standard PGR program. Seed cotton production was increased 14% with DPL 555BR and DPL 0935B2RF by the use of a standard PGR program during the growing season compared to no PGRs applied at all (untreated).

Disclaimer

Entries listed as MCS or DPLX are experimental varieties, and not for sale. Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil, and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible.