MULTIPLE PLANT GROWTH REGULATOR USE ON SHORT STAPLE COTTON

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Abstract

A field trial was conducted during the 1992 & 1993 growing seasons to evaluate the activity of Cytokin and Pix applied alone or in combination to short staple cotton. The Cytokin treatment significantly increased lint yield over the other treatments in 1992. There were no statistically significant seed cotton differences between the non-treated check and any treatment in 1993. Fruit retention remained high throughout 1992 and very high throughout the 1993 season. Under high fruiting conditions, use of a plant growth regulator would not normally be recommended.

Introduction

Cotton grown in the low desert region of Arizona can frequently become vegetative in the course of the growing season. To remedy this condition, growers often apply plant growth regulators (PGRs). However, PGRs are often applied on a scheduled basis instead of monitoring the fields and applying them on an as-needed basis, using information collected in-field (feedback approach).

The objective of this trial was to study the effects of Cytokin and Pix applied alone and in combination, on the growth and development of Upland cotton and to quantify conditions under which Cytokin applications would be beneficial. Objectives of applying PGRs under low desert growing conditions may be improved balance between reproductive and vegetative growth, suppression of undesirable late-season fruiting forms, and earlier maturity and harvesting (Cathey and Thomas, 1986).

Cytokinins are common plant hormones that in general promote cell division and organ formation. They also tend to promote lateral bud development in dicotomous plants, promote chloroplast development and chlorophyll synthesis as well as delay senescence and increase nutrient sink activities (Salisbury and Ross, 1986). Cytokin is a mixture of cytokinins that in cotton is promoted as improving root development and fruit retention, reducing stress, improving fiber characteristics, and promoting earlier maturity. Pix is a PGR designed to control height or limit excessive vegetative growth. It has also, in certain cases, promoted earliness.

Materials and Methods

This two-year field trial was conducted under grower conditions in the Parker Valley, Arizona in cooperation with Telles Ranch. The field in 1992 was planted to DPL 5415 on April 30 (1134 HU after Jan. 1). The 1992 field has a Gadsen clay loam over clay soil type. The 1993 trial field was planted April 18 (838 HU after Jan. 1) to DPL 5415 and has a Gadsen clay loam soil type. All treatment applications were performed with a ground rig boom sprayer with multiple nozzles per row. Treatment applications are listed in table 1. Each treatment in 1992 covered 12 (588') rows with four replications. Treatments in 1993 covered 12 (1140') rows with four applications. Plant measurements were taken throughout the course of each crop year on plant height, node development, and fruit retention. The fields were harvested October 21, 1992 and October 9, 1993 by picking eight rows per plot.

Results and Discussion

1992

Lint yield averaged over 81 pounds more for the Cytokin treatment than the check plots. The Pix treatment and the combination treatment each yielded less than the check plots (table 2). Fruit retention remained high throughout the season, following a normal retention pattern (table 3). Neither factor of height or height-to-node ratio were statistically significant among treatments at season end (table 4). Since there were no differences between treatments for harvestable fruit, but were differences in total fruiting forms; this may indicate the Cytokin treatment promoted improved fruit maturity. Guinn reported that cytokinins tended to promote the transport, accumulation, and retention of metabolites; and the ability of an organ to compete for metabolites (Guinn, 1986).

Some evidence existed in 1992 that the PGR treatments promoted earliness. No significant difference existed between treatments when measuring closed bolls of harvestable size one month prior to harvest. However, nodes above white bloom (NAWB) taken at three intervals did show some significance at the earliest sample date (table 5). This shows that all treatments cut-out by the end of July (using cut-out as NAWB $\leq$ 5 [Silvertooth, et.al, 1992]). At the July 27 sample date NAWB were significantly lower for all treatments compared to the un-treated check, and the combination treatment was significantly lower than the Cytokin treatment. As regrowth occurred, no significant differences existed between treatments.

1993

Seed cotton and lint yield were not statistically significant among treatments (table 6). Fruit retention levels remained above normal for all treatments throughout the season as was percent retention of harvestable bolls (table 7). Statistically significant yield differences experienced in 1992 were difficult to quantify since other measurements such as fruit retention were not significant factors. In an effort to determine the origin of those differences, boll weight data was gathered and analyzed. However, due to the nature of the 1993 growing season in which excellent growing conditions were experienced throughout, no significance in boll weight among treatments was found (table 8). The only significant factor in reference to boll weight was a difference between the first and second fruiting positions (table 9).

Summary

Growers must continue to refine and fine-tune their operations and inputs to remain competitive. Guidelines have been developed for the optimum use of Pix under low desert growing conditions (Husman, et.al. 1992; Silvertooth, et.al. 1990). This study may help to define the conditions under which Cytokin or Cytokin in combination with Pix will be beneficial. However, more research under differing conditions should be conducted to quantify plant responses to these PGRs and to develop guidelines for grower use. This research does indicate the need for inputs, such as PGRs, to be applied on an as needed basis (plant feedback approach). The very high fruit retention levels experienced in 1993 would have been an indication of a limited response to PGR application. Fields should be monitored closely as to fruit retention levels and height to node ratios and inputs be applied in response to established guidelines. It is likely that use of PGRs, such as those researched in this project, will be more beneficial under adverse conditions. Cotton crops growing under conditions of fruit loss and high vegetative growth will require more management and inputs such as PGRs.

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Table 1. Treatment applications (in ounces) for crop years 1992 and 1993.

	1992	
	July 7 1635 HUAP[1]	August 6 2461 HUAP
Check	-	-
Pix	8 oz	8 oz
Cytokin	8 oz	8 oz
Pix + Cytokin	8 oz + 8 oz	8 oz + 8 oz

		1993	
	June 19 1337 HUAP	July 12 1943 HUAP	July 31 2426 HUAP
Check	-	-	-
Pix	4 oz	4 oz	8 oz
Cytokin	4 oz	8 oz	8 oz
Pix + Cytokin	2 oz + 4 oz	4 oz + 8 oz	4 oz + 8 oz

[1]HUAP = Heat Units After Planting

Table 2. 1992 Lint yield as influenced by PGR treatments. Means followed by the same letter are not significantly different at the 5% level.

Treatment	# Lint/A*
Cytokin	1440.5 A
Check	1358.8 B
Cytokin-Pix	1347.0 B
Pix	1333.5 B
$SNK_{.05}$	*P = .0182

Table 3. Retention percentage on first two fruiting positions of each branch throughout the 1992 growing season. *Final sample date reflects percent retention of harvestable bolls and the only sample date statistically analyzed.

Treatment	% Fruit Retention				
	6/6	7/27	8/18	9/1	9/24*
Check	85.6	66.1	49.0	52.0	29.0 A
Pix	82.0	65.4	47.9	49.8	26.6 A
Cytokin	87.5	61.9	50.5	47.5	26.1 A
Cytokin-Pix	85.4	61.6	46.4	53.9	26.0 A

Table 4. Height-to-node ratios as influenced by PGR treatments in 1992. Means followed by the same letter within columns are not significantly different at the 5% level.

Treatment	Height	Ht:Node Ratio
Check	42.6 A	1.7 A
Pix	39.7 A	1.6 A
Cytokin	40.7 A	1.6 A
Cytokin-Pix	37.7 A	1.5 A

$SNK_{.05}$

Table 5. Nodes Above White Bloom (NAWB) for three sample dates (1992) as influenced by PGR treatments. Means followed by the same letter within columns are not significantly different at the 5% level.

Treatment		NAWB	
	7/27*	8/18	9/1
Check	4.95 A	4.60 A	5.84 A
Pix	4.15 BC	4.20 A	5.80 A
Cytokin	4.40 B	5.25 A	6.31 A
Cytokin + Pix	3.75 C	4.30 A	5.85 A

$SNK_{.05}$ *P=.0027

Table 6. Seed cotton and lint yield as influenced by PGR treatments in 1993. Means followed by the same letter within columns are not significantly different at
the 5% level.

Treatment	# Seed Cotton/A	Standard Deviation	# Lint/A
Check	5079.61 A	147.29	1752.42 A
Pix	5126.18 A	204.45	1820.10 A
Cytokin	4921.99 A	683.15	1732.22 A
Cytokin + Pix	5258.72 A	289.67	1798.98 A

$SNK_{.05}$

Table 7. 1993 Fruit retention levels for first two fruiting positions of each branch. *Final sample date reflects percent retention of harvestable bolls and the only sample date statistically analyzed ($SNK^{.05}$).

	6/17	7/14	7/25	8/13	8/24	9/20*
Check	86.5	83.5	81.8	61.0	57.5	31.2 A
Pix	82.5	83.5	79.3	58.0	56.3	35.0 A
Cytokin	89.5	85.5	83.5	57.3	59.3	34.8 A
Cytokin + Pix	83.0	85.3	78.0	59.8	56.8	30.9 A

Table 8. Weight (g) per 25 bolls (seed cotton) as influenced by PGR treatments in 1993.

Treatment	Wt (g)/25 Bolls
Check	105.4 A
Pix	101.6 A
Cytokin	102.1 A
Cytokin + Pix	104.0 A
	$SNK_{.05}$

Table 9. Average boll weight as influenced by fruiting position on 1993. Figures are an average weight (g) of 25 bolls of seed cotton.

Fruiting Position	Wt (g)/25 Bolls
1	113.8 A
2	92.7 B
	$SNK_{.05}$ P=.0024