

Evaluation of Two Plant Growth Regulators from LT Biosyn

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Abstract

A single field study was conducted during the 2004 cotton growing season at the University of Arizona Safford Agricultural Center to evaluate the effect of two plant growth regulators (PGRs) manufactured by LT Biosyn Inc. on the growth, development, yield, and fiber quality of cotton grown in the southeastern region of the state. This test was designed as a follow up study to work that was performed in 2003 on a grower cooperater site that demonstrated positive lint yield responses to the use of one of the PGRs used in this project. This was an eight treatment test involving the application of two PGRs, HappyGro™ (HG) and MegaGro™ (MG). The two formulations are intended to have different effects on plant growth and development. The HG formulation is a kinetin based product designed to enhance cell division and differentiation. The MG formulation is designed to enhance root growth early in the season. Several treatment combinations were designed to investigate varying scenarios of application of these two products alone and in conjunction with each other. The test included a control and each treatment was replicated four times in a randomized complete block design. Plant measurements were collected throughout the season to look for differences in plant growth and development. Lint yield was estimated by harvesting the entire plot and weighing the seedcotton with a weigh wagon equipped with load cells. Sub samples were collected for fiber quality and percent lint determinations. Plant measurements revealed extremely high fruit retention levels throughout the entire season with end of season levels near 75%. This high fruit retention resulted in very low vigor. Under these conditions, while lint yield was extremely high for this region (1300-1600 lbs. lint per acre), no statistical differences were observed among treatments. Fiber quality measurements also revealed no significant differences.

Introduction

Cotton grown in the deserts of the southwestern cotton belt are intensively managed crops with high levels of input and high yields. Among those inputs are both water and fertilizer nitrogen (N) which are two of the most well recognized growth stimulants for any crop. With high levels of both water and N, maintaining a proper balance between the reproductive and vegetative components of the crop is sometimes difficult to accomplish. Increased production of vegetative components (stems and leaves) at the expense of the reproductive component (squares, flowers, and bolls) can lead to decreased yield. Maintenance of a proper vegetative to reproductive ratio is often difficult due to the dynamic nature of the cotton plant. The tendency of the cotton plant to abort fruiting forms in response to environmental cues, may result in the disruption of a vegetative/reproductive balance that is favorable to high yields. The loss of these carbohydrate sinks (fruiting forms) results in rapid proliferation of the mainstem and other vegetative components of the crop. However, the cotton plant also has the ability to compensate for that loss under favorable environmental conditions through rapid initiation and retention of new fruiting forms. This ability of the cotton plant to shed fruit and then also to compensate based upon environmental cues necessitates crop monitoring to properly manage the vegetative/reproductive ratio of the crop.

There are many plant hormones involved in the production of both vegetative and reproductive dry matter. These hormones act as signals in many of the plant processes such as fruit abortion, fruit initiation, cell division, and cell elongation. There have been many products introduced commercially that contain different formulations of these plant hormones with the idea of increasing the levels of the plant hormones available to the plant to enhance growth and development in different areas such as root or shoot growth. The ultimate idea behind these products is to increase lint yield and improve fiber quality and thus provide the grower with significant returns on the investment in the PGR.

The two products used in this evaluation are manufactured by LT Biosyn, Inc. who specializes in the manufacture and marketing of PGRs for many different crop production systems. The two products evaluated in this project are HappyGro™ (HG) and MegaGro™ (MG). Kinetin, the active ingredient in HappyGro™, is a plant growth hormone occurring naturally in plants. It is proprietary formulation that is designed to increase cell division, cell differentiation and cell growth. The second PGR, MegaGro™ contains two plant growth regulators (PGRs) that are designed to synergistically stimulate early root development.

The objective of this project was to evaluate several different timing and combination scenarios with these two PGRs on the subsequent growth, development, and ultimately yield and fiber quality of cotton grown in the southeastern region of Arizona. The study is a follow-up to work done during the 2003 cotton season on a grower-cooperator site that demonstrated positive results to the use of HG on final lint yield. Results obtained in 2003 came from two different areas of a field. One area the average yield was 1400 lbs lint/acre. The second area where this trial was conducted had an average lint yield of 800 lbs lint/acre. Differences among treatments were much larger in the weaker area of the field (993 treated vs. 724 untreated lbs lint/acre). Differences among treatments in the high yielding area were much less (1490 treated vs. 1344 untreated lbs. lint yield/acre). The treatment on the 2003 plots consisted of one application of HG near first bloom.

Materials and Methods

A single field study was established to investigate the effects of the two PGRs on cotton by establishing 8 treatments including a control. Table 1 shows application dates and rates for each of the eight treatments utilizing the two PGRs. All treatments applications were made with a JD HiCycle model 6000. The carrier rate for each application was 20 gallons per acre at 40 pounds per square inch pressure. Applications were made on calm days to avoid any potential drift contamination across plots. The treatments were arranged in four, 36" row plots that extended the full length of the irrigation run of approximately 220 feet. Each treatment was replicated four times in a randomized complete block design. General agronomic information for the field is found in Table 2. Plant measurements were collected over the course of the growing season to evaluate crop growth and development. These measurements included; plant height, number of mainstem nodes, position of the first fruiting branch, number of retained fruiting structures on the first two positions of each fruiting branch, and number of nodes above the top, first position, fresh bloom.

Plant measurement data was summarized by calculating percent fruit retention for the first two positions on each fruiting branch and calculating a height to node ratio vigor index. Lint yield estimates were made by harvesting each entire experimental plot and weighing the resultant seedcotton with a cotton weigh wagon equipped with load cells. Sub samples were collected from each experimental unit that were subsequently cleaned and ginned at the University of Arizona Maricopa Agricultural Center ginning facility. Lint samples were then submitted to the USDA Phoenix Classing Office for HVI analysis to obtain fiber quality estimates. All yield and fiber quality data were analyzed according to procedures outlined by the SAS Institute (2002) including analysis of variance and means separation.

Results

Results from the plant measurements collected over the course of the season are shown in Figures 1 and 2. Several interesting items should be noted from these Figures. Figure 1 show percent fruit retention levels for all eight treatments plotted against long-term averages collected over 15 years of Arizona cotton production. No significant differences in fruit retention levels were observed among treatments. Levels of fruit retention remained very high during the course of the season, particularly early in the season. Fruit retention levels near the end of the season remained as high as 75% which is uncommonly high. End of season fruit retention levels are typically near 40-50%. The effect of the high fruit load on this crop is evidenced in Figure 2. Figure 2 shows height to node ratio levels for each of the eight treatments, again

plotted against long-term averages for Arizona grown cotton. Height to node ratio levels remained very depressed over the course of the entire season. Due to the high fruit load, energy produced by the plant was invested in maintaining the fruit load at the expense of vegetative structure.

The high fruit load on this crop contributed to the high yields observed in this project. Table 3 lists lint yield and fiber quality characteristics for all eight of the PGR treatments in this study. Lint yields ranged from just under 1400 to just under 1600 pounds of lint per acre. For the elevation of the Safford Agriculture Center these are high yields. No statistically significant differences were observed among any of the treatments with respect to lint yield (Table 3). Fiber quality differences were also not observed for any of the fiber quality parameters measured (Table 3). Under conditions of lower fruit load and higher vigor a response from the PGRs used in this study would have been more likely. One idea as to why a response was not observed this year is that conditions for this crop were optimum throughout the season providing no opportunity for enhanced growth due to the application of a PGR. The results from the 2003 season are consistent with the results observed in 2004. Differences among treatments in the high yielding area in 2003 were very small. Yields in 2004 were 100 lbs. lint/acre higher than in 2003.

Literature Cited

SAS Institute. 2002. SAS procedures guide. Version 9. SAS Inst., Cary, NC.

Table 1. Application rate and combination information for each of the eight treatments in the PGR evaluation study, Safford Agricultural Center, Safford, AZ, 2004.

Application Date	Treatment							
	1	2	3	4	5	6	7	8
24 May	---	2 oz. MG*	---	2 oz. MG	---	2 oz. MG	---	2 oz. MG
16 June	---	---	2 oz. MG	2 oz. MG	---	---	2 oz. MG	2 oz. MG
20 July	---	---	---	---	3 oz. HG**	3 oz. HG	3 oz. HG	3 oz. HG

*Mega Grow™

**Happy Grow™

Table 2. General agronomic information concerning the field where the PGR evaluation was conducted, Safford Agricultural Center, Safford, AZ, 2004.

Field Identification	I1 and I2
Planting Date	20 April 2004
Variety	Deltapine DP555BR
Total Water Applied	48 inches
Total Fertilizer Applied	96 lbs. N/acre
Final Irrigation Date	16 September 2004
Defoliation Date	25 October 2004
Harvest Date	13 November 2004

Table 3. Lint yield and fiber quality data with associated analysis of variance information for each of the eight treatments in the PGR evaluation, Safford Agricultural Center, Safford, AZ, 2004.

Treatment	Yield lbs. lint/acre	Percent Lint	Micronaire	Fiber Length (100ths)	Staple Length (32nds)	Fiber Strength (g/tex)	Uniformity Index	Leaf Grade
1	1584.2 a*	38.6 a	3.9 a	108.5 a	35 a	28.9 a	78.0 a	2.5 a
2	1417.5 a	37.9 a	3.8 a	106.5 a	34 a	27.2 a	77.5 a	2.5 a
3	1512.9 a	38.4 a	4.1 a	106.5 a	35 a	27.7 a	78.5 a	3.0 a
4	1393.0 a	37.6 a	3.8 a	105.0 a	34 a	27.3 a	78.0 a	3.0 a
5	1527.7 a	37.4 a	3.8 a	108.0 a	35 a	28.3 a	78.5 a	3.0 a
6	1487.2 a	37.7 a	3.9 a	108.5 a	35 a	27.2 a	78.5 a	2.5 a
7	1443.6 a	38.0 a	3.9 a	105.0 a	34 a	28.2 a	79.5 a	3.0 a
8	1390.2 a	37.8 a	3.9 a	105.5 a	34 a	27.8 a	78.0 a	3.0 a
§LSD	NS	NS	NS	NS	NS	NS	NS	NS
†CV	6.4	1.5	2.7	1.8	1.8	4.0	1.2	16.1
‡OSL	0.0776	0.1402	0.1059	0.4205	0.2240	0.7333	0.6324	0.7067

*Means followed by the same letter are not statistically different according to a Fisher's LSD means separation test.

§Least Significant Difference

†Coefficient of Variation

‡Observed Significance Level

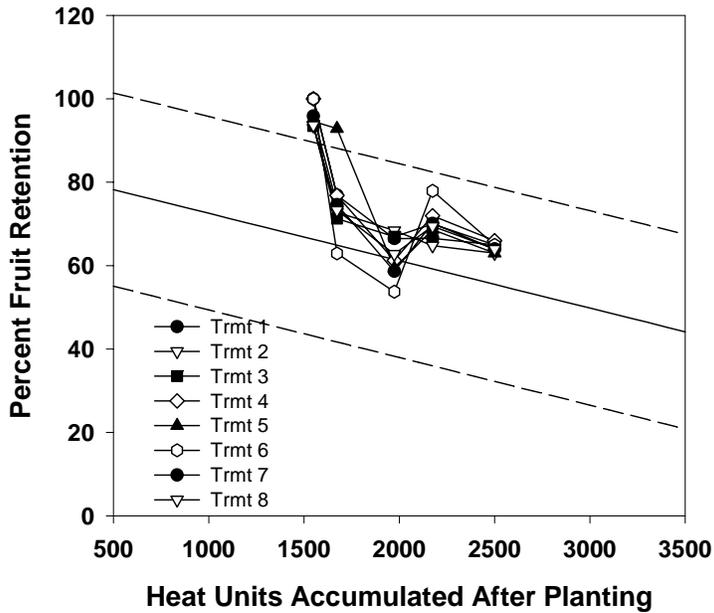


Figure 1. Percent fruit retention levels for each of the eight treatments in the PGR evaluation, Safford Agricultural Center, Safford, AZ, 2004.

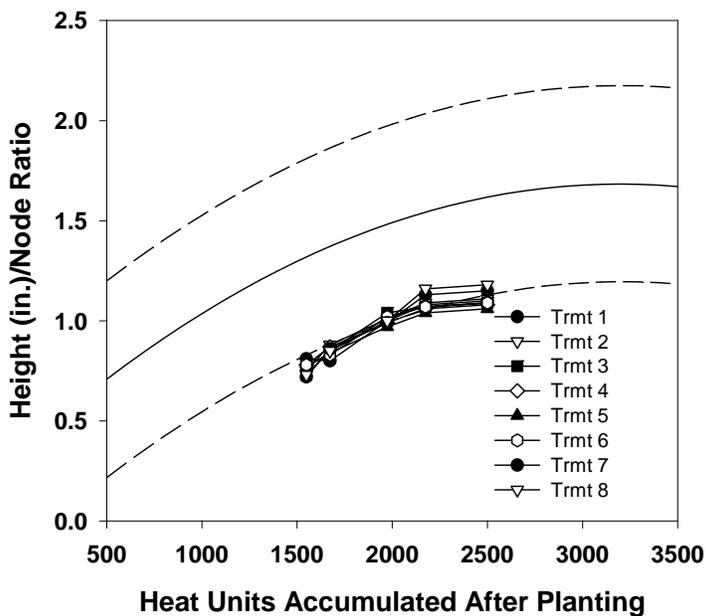


Figure 2. Height to node ratio levels for each of the eight treatments in the PGR evaluation, Safford Agricultural Center, Safford, AZ, 2004.