GERMINATION, EMERGENCE AND ROOT GROWTH OF COTTON AS AFFECTED BY SEED APPLIED PLANT GROWTH REGULATORS

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Abstract

Uniform and vigorous seedling establishment and early season growth are critical in reaching the full yield potential of a cotton crop. Unfavorable environmental conditions often exist during the optimum planting and early season growth periods, resulting in reduced stands and stunted plants. Thus, management practices that would help insure adequate stand establishment and vigorous growth under less than optimum conditions would be beneficial for cotton production. This study was conducted to evaluate the effects of seed applied Plant Growth Regulators (PGRs) on cotton germination, emergence, and early season growth. Nine commercially available materials (Arise, Cytoplex, Early Harvest, Maxon, PGR-IV, Pix, Ryzup, Stimulate, and Triggrr) were applied to seed at 0.5x, 1.0x, and 2.0x the recommended rates. In the field study, no significant increases in stand establishment were noted due to the PGR treatments when compared to the control in either 1996 or 1997. Ryzup increased plant height at the 1.0x and 2.0x rates, when measured at 14 days after planting, in 1996. Plant height was not significantly increased by the PGRs treatments in 1997 when compared to the control. Yield was not significantly increased by the PGR treatments in 1997. In the greenhouse study (1996), no significant differences in total root length or root dry weights were observed when compared to the control.

Introduction

Uniform and vigorous seedling establishment and early season growth are critical in reaching the full yield potential of a cotton crop. The development of a healthy root system is an important part of this early season growth, providing for adequate water and nutrient adsorption. Unfavorable environmental conditions often exist during the optimum planting and early season growth periods resulting in reduced stands and stunted plants. Herbicides may also induce stress on establishing plants. As the cost of seed increases with technological advances, the economic consequences of a poor stand also increase. Thus, management practices, which would help, insure adequate stand establishment and vigorous growth under less than optimum conditions would prove beneficial for cotton production.

The effects of plant growth regulators (PGRs) on cotton continue to be studied in an effort to better manage or enhance growth. Studies by Locke et al. (1994) and Weir et al. (1994) report positive effects from in furrow applications of PGR-IV on early season growth of cotton. Studies by Egilla and Oosterhuis (1996) and Steger and Oosterhuis (1997) have shown improved germination and emergence with seed application of PGRs. Other studies have shown inconsistent or no beneficial responses to the application of in furrow or seed applied PGRs.

Objective

To evaluate the effects of several seed applied PGRs on germination, emergence, and early season growth of cotton using 0.5x, 1.0x, and 2.0x the recommended rates.

Materials and methods

Treatments

Paymaster HS 200 was used for this study in both 1996 and 1997. Treatments each year included (1) nine plant growth regulators applied at three rates, 0.5x, 1.0x, and 2.0x, the recommend rates, and (2) a control (Table 1). PGRs included in this study were Arise, Cytoplex, Early Harvest, Maxon, PGR-IV, Pix, Ryzup, Stimulate, and Triggrr. Each of the 28 treatments received a standard fungicide treatment of Captan, Vitavax PCNB, and Apron. All PGRs, except for Ryzup, were applied to the seed with the fungicide material. Ryzup was applied to the seed after the fungicide material was applied.

Evaluation

In the field, three replications of the 28 (9 PGRs x 3 rates + control) treatments were planted on May 16, 1996 and May 20, 1997 in a randomized block design. Each plot consisted of four rows 37 feet long. Field parameter measurements included stand establishment at 28 days after planting, seedling height (height of seedlings from the soil surface to stem tip at 14 days after planting in 1996 and 17 days after planting in 1997), and yield in 1997 (obtained by hand harvesting 13.1 feet from the center two rows of the plot).

In the greenhouse the 28 treatments were planted in tubes which were four inches in diameter and 12 inches long. Three replications were used in a completely randomized design. One seedling per tube was grown for 14 days. Plants were then harvested; including the root system, with measurements taken on root dry weights and total root length (obtained using digital imaging).

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Results and Discussion

Field

In the field study no significant ($P \leq 0.05$) differences in stand establishment were observed in 1996 (Figure 1). In 1997 Ryzup significantly decreased stand establishment at all three rates when compared to the control (Figure 2). Significant differences in seedling height were observed both in 1996 and 1997 (Figures 3 and 4, respectively). Ryzup increased seedling height at the 1.0x and 2.0x rates in 1996. In 1997 Cytoplex at 0.5x, Maxon at 0.5x and 1.0x, PGR-IV at 0.5x, and Pix at all three rates showed decreased height when compared to the control as well as Ryzup at 0.5x, Stimulate at 0.5x, 1.0x, and 2.0x and Triggrr at 2.0x. Ryzup at 2.0x, Stimulate at 1.0x, and Triggrr at 0.5x significantly decreased yields in 1997 as compared to the control (Figure 5).

Greenhouse

The greenhouse study showed no significant differences in total root length (Figure 6) or root dry weights (Figure 7) even though a relatively large range in numerical differences was observed.

Conclusions

These results do not indicate that significant stand establishment or root growth enhancement can be expected by the application of these PGRs to the seed.

Acknowledgments

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Table 1. Summary of treatments.

Plant Growth Regulator	Recommended Rates
Arise - Ars	23 oz/ 100wt
Cytoplex - Ctp	13.5 oz/ 100wt
Early Harvest - EH	2 oz/ 100wt
Maxon - Max	6 oz/ 100wt
PGR IV - PGR	6 oz/ 100wt
Pix - Pix	4 oz/ 100wt
Ryzup - Rzp	1 oz/ 100wt
Stimulate - Stm	5 oz/ 100wt
Triggrr - Trg	4 oz/ 100wt

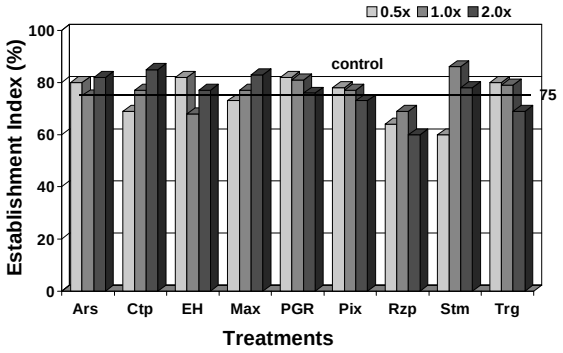

Figure 1. Effect of PGRs on stand establishment in 1996, 28 days after planting.

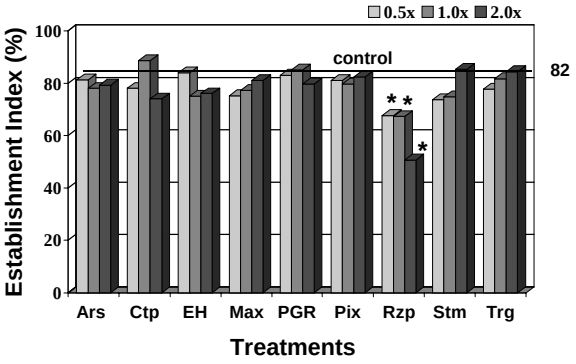

Figure 2. Effect of PGRs on stand establishment in 1997, 28 days after planting.

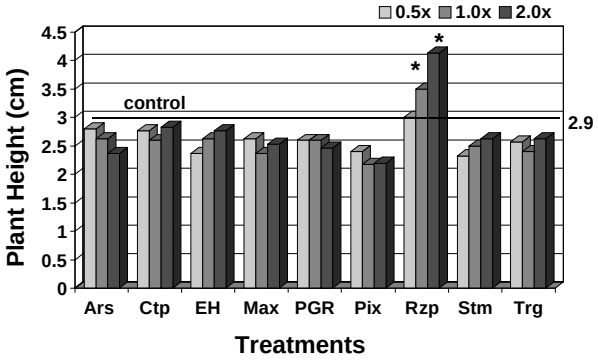

Figure 3. Effect of PGRs on plant height in 1996, 14 days after planting.

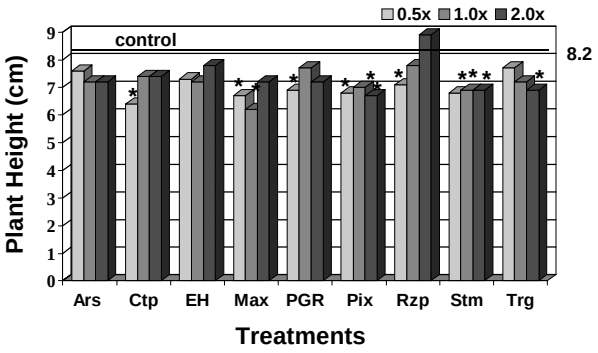

Figure 4. Effect of PGRs on plant height in 1997, 17 days after planting.

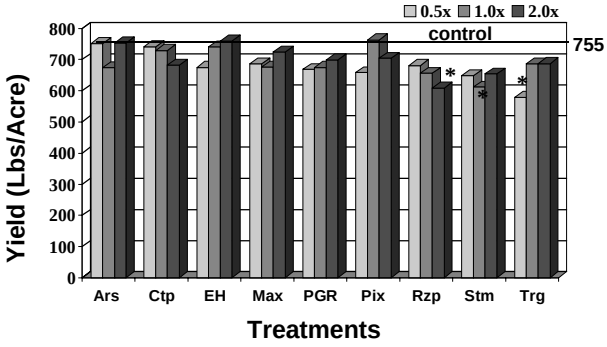

Figure 5. Effect of PGRs on yield in 1997.

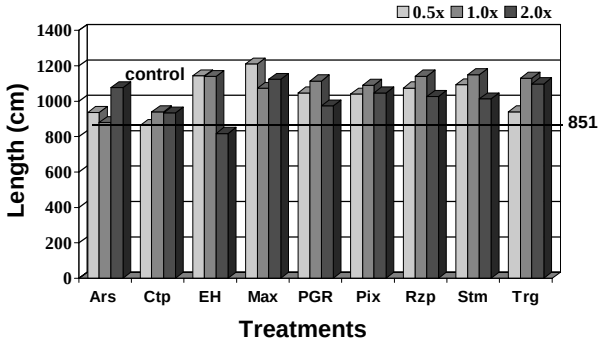

Figure 6. Effect of PGRs on total root length (1996).

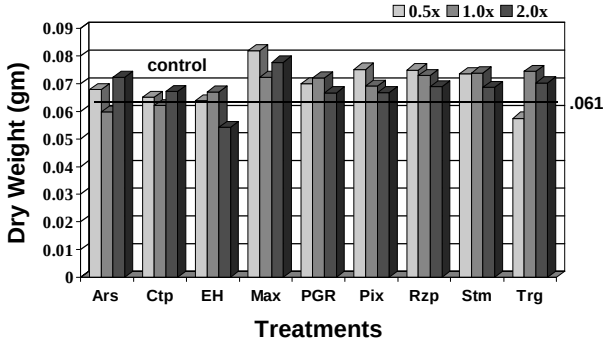

Figure 7. Effect of PGRs on root dry weights (1996).