

**EVALUATION OF SEED APPLIED PLANT
GROWTH REGULATORS ON COTTON
GERMINATION, EMERGENCE, AND GROWTH**

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Abstract

Timely, consistent, and vigorous cotton seedling establishment is critical in establishing yield potential in cotton production. In many areas, including West Texas, unfavorable environmental conditions often exist during the optimum planting and early season growth periods. Thus, management practices which would enhance seedling establishment and early season growth would be beneficial to profitable cotton production. This study was conducted to evaluate the effects of seed applied Plant Growth Regulators (PGRs) on cotton germination, emergence, and 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. No significant increases in germination or emergence were noted due to the PGR treatments when compared to the control. Ryzup provided significant increases in plant height in the growth chamber at all three rates, when measured at 15 days after planting. Ryzup also increased plant height in the field at the 1.0x and 2.0x rates, when measured at 14 days after planting.

Introduction

Timely and consistent cotton seedling emergence and establishment are critical in establishing yield potential in cotton production. Timeliness is important in order to utilize the maximum amount of heat units available during the growing season. Consistency in stand establishment is important from field to field and from year to year. Vigorous early season growth is also important in establishing final yield potential. In many areas, including West Texas, unfavorable environmental conditions exist during the optimum planting and early season growth periods. Thus, management practices which would enhance seedling establishment and early season growth, specifically during periods of environmental stress, would be beneficial to cotton production.

Studies by Locke et al. (1994), Oosterhuis and Zhao (1994), and Weir et al. (1994) report positive effects from in furrow applications of PGR-IV on early season growth of cotton. However, little information is available on the effects of seed applied Plant Growth Regulators (PGRs) on early season growth. The objective of this study was to evaluate the effects of several seed applied PGR's on germination, emergence and growth of cotton using 0.5x, 1.0x, and 2.0x the recommended rates.

Materials and Methods

The cotton cultivar used in this study was Paymaster HS 200. Treatments 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.

Treatments were evaluated in three environments: (1) laboratory (2) growth chamber and (3) field. In the laboratory a Warm Germination Test (WGT), a Cool Germination Test (CGT), and the combination of these tests to calculate a Cool Warm Vigor Index (CWVI) were performed. These tests were performed using 3 replications of 100 seed per treatment rolled in germination towels. The WGT was run at alternating temperatures of 68^oF for 16 hours and 86^oF for 8 hours. Counts were taken after four days in which normal seedlings 1.5 inches or longer were counted. A final 7 day count was also taken to determine percent germination. The CGT was run at a constant 64^oF and counted after 7 days using the same criteria as the WGT. The CWVI ratings were calculated by adding the WGT after 4 days and the CGT values. In the growth chamber, 3 replications of 50 seeds per treatment were planted (1.5 inches deep) in sand filled plastic containers. Temperature was maintained at a constant 64^oF. Measurements taken included stand establishment (a measure of the percentage of seeds planted resulting in established plants 21 days after planting) and seedling height (height of seedlings from the sand surface to stem tip 15 days after planting). In the field three replications of the 28 treatments were planted on May 16, 1996. Field parameter measurements included stand establishment at 28 days after planting and seedling height (height of seedlings from the soil surface to stem tip at 14 days after planting).

Results and Discussion

Results from the Warm Germination Test counted at 7 days and the Cool Warm Vigor Index rating showed no significant differences among the PGR treatments when

compared to the control (Figures 1 and 2, respectively). Results from the Warm Germination Test (4 Day) showed significantly lower germination in the 0.5x Arise treatment and the 1.0x and 2.0x Maxon treatments (data not shown). Results from the growth chamber (21 days after planting) and field (28 days after planting) showed no significant differences in stand establishment among the PGR treatments when compared to the control (Figures 3 and 4, respectively). Significant ($P \leq 0.05$) differences in seedling height were observed both in the growth chamber and the field when measured at 15 and 14 days after planting, respectively (Figures 5 and 6). Ryzup at 0.5x, 1.0x, and 2.0x rates increased seedling height in the chamber study. In the field study Ryzup increased seedling height at the 1.0x and 2.0x rates.

These results, based on one year's data, did not indicate that significant germination and emergence enhancement could be expected by the application of these PGR's to the seed. The seedling height measurements taken in the field and the chamber showed significant height increases can be obtained by the application of Ryzup to the seed. As indicated by the CWVI, high quality seed were used for this study. Further studies will investigate the effects of PGRs when lower quality seed must be used and include the effects of PGR's on root growth.

Acknowledgments

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References

Locke, D. H., J. A. Landivar, and D. Moseley. 1994. The effect of PGR-IV and soil insecticides on early-season growth, square retention and lint yield. Proc. of Beltwide Cotton Conf. pp. 1272-1273.

Oosterhuis, D. M. and D. Zhao. 1994. Increased root length and branching by soil application of the plant growth regulator PGR-IV. Plant and Soil 167:51-56.

Weir, B. L., D. Munk, S. Wright, and B. Roberts. 1994. Responses to PGR IV of Upland and Pima cottons in the San Joaquin Valley of California. Proc. of Beltwide Cotton Conf. pp. 1267-1268.

Table 1. Summary of Plant Growth Regulators and Recommended Rates.

<u>Plant Growth Regulator</u>	<u>Recommended Rates</u>
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
Triggr - Trg	4 oz/ 100wt

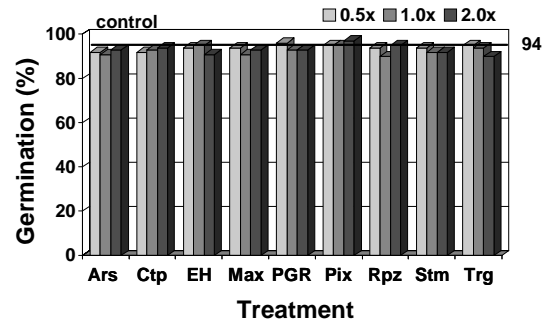


Figure 1. Effect of Pgrs on Warm Germination, 7 day.

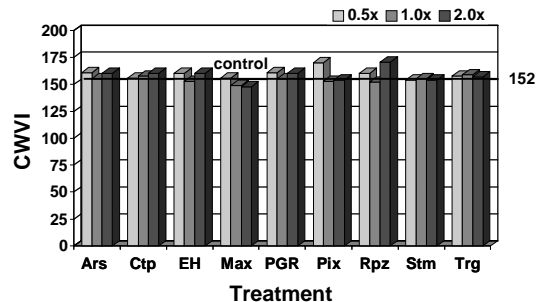


Figure 2 Effect of PGRs on CWVI.

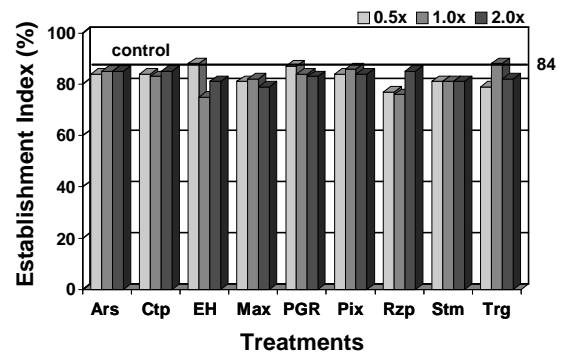


Figure 3. Effect of PGRs on stand establishment, 15 days after planting in growth chamber.

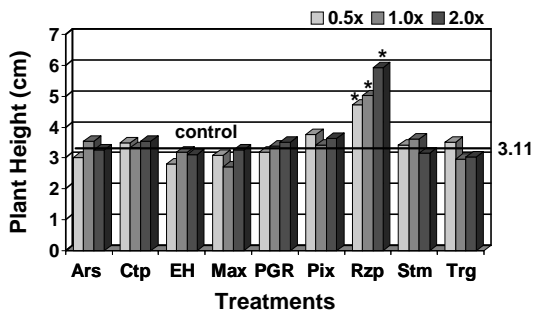


Figure 4. Effect of PGRs on plant height, chamber evaluation.

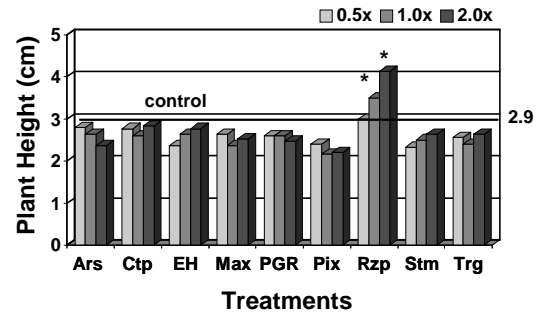


Figure 6. Effect of PGRs on plant height, 14 days after planting in field.

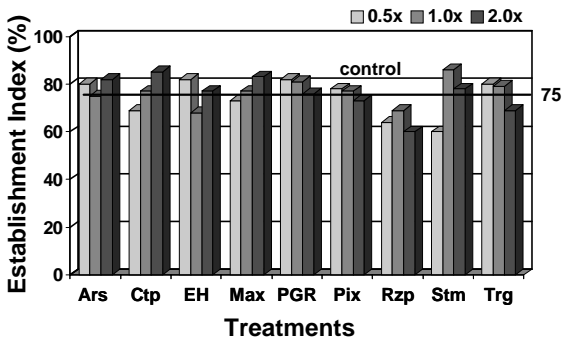


Figure 5. Effect of PGRs on stand establishment 28 days after planting in field.