TIME AND RATE OF RYZUP APPLICATION IN SOUTH TEXAS

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Abstract

The effects of early-season foliar applications of the gibberellic acid-based plant growth regulator Ryzup on growth and yield of upland cotton were evaluated in Corpus Christi and Uvalde, Texas during 1996 and 1997. Ryzup was applied at a rate of 4 oz/acre broadcast as follows: once at the 3rd to 5th true leaf stage, once at the 5th to 7th true leaf stage, and twice at the 3rd to 5th and at the 5th to 7th true leaf stages. Growth and yield responses to Ryzup varied between years and locations within a range of ±20% of UTC. Mixed results did not indicate any best treatment of Ryzup regarding timing or number of applications. Growth responses to Ryzup application appeared to be inversely related to cumulative atmospheric water demand during the 30 days following treatment.

Introduction

RyzUp is a gibberellic acid-based plant growth regulator for cotton. Effects of gibberellic acid treatment in plants are well known (Wareing and Phillips, 1981) which include promotion of internode elongation and leaf growth. Evaluation studies of Ryzup applications in cotton have shown improvement of early season vigor, increase of plant height, increase of leaf area (Hansen et al., 1996; Larson et al. 1997).

The objective of this study was to determine the effects of early-season foliar applications of Ryzup on growth and yield of upland cotton.

Materials and Methods

The experiments were conducted at the Texas A&M University Agricultural Research and Extension Centers in Corpus Christi and Uvalde, TX, during the 1996 and 1997 seasons. The soils at the experimental sites are a Victoria clay-Orelia fine sandy clay loam complex in Corpus Christi and a Uvalde silty clay loam in Uvalde. Triple superphosphate at a rate of 60 units of P_2O_5 per acre was applied broadcast before planting. Yellow herbicides were broadcasted and incorporated before planting at both locations. Pre-emergence herbicides were also applied at both locations. A deep furrow irrigation was applied three weeks before planting in Uvalde to provide adequate soil moisture content for germination and growth during early season. Nitrogen was applied broadcast at a rate of 90 lbs/acre and incorporated to the beds with rodweeder immediately before planting in Uvalde. In Corpus Christi, 120 lbs/acre of N was applied pre-planting and an additional 17 lbs/acre was applied side-dress. Upland cotton (cv. Deltapine 5409 in 1996 and NewCot 33b in 1997) was planted to a plant population of about 40,500 plants per acre in 38-inch rows in mid March in Corpus Christi and early April in Uvalde. Insect pests were controlled by aerial or ground applications of insecticides as needed.

In-season irrigation was provided using a drip system in Corpus Christi, while in Uvalde furrow irrigation was used in 1996 and a low-pressure overhead sprinkler irrigation system was used in 1997.

Ryzup was applied at a rate of 4 oz/acre broadcast (or 2 oz/acre banded) as follows: once at the 3rd to 5th true leaf stage, once at the 5th to 7th true leaf stage, and twice at the 3rd to 5th and at the 5th to 7th true leaf stages. Treatments (including untreated control) were arranged in a randomized complete block design with 4 replications.

Vegetative growth was assessed by measuring plant height (from the cotyledonar node to the newest unfolded main-stem leaf), number of main-stem nodes, and number of branch nodes -the latter provides a measurement of fruiting potential- and area of main-stem leaves that were rapidly expanding at the time of Ryzup application.

Plant height and area of main-stem leaves were made 10 days after completion of treatments. These measurements were made in 10 consecutive plants in each plot. Each time a treated plot was measured the untreated control was also measured.

Prior to harvesting and after plants were completely defoliated, 5-plant samples (5-out-of-7 plants) were taken from the second or fifth row of each plot for plant mapping and determination of bolls per plant and average boll weight.

Yield measurements were made from two central rows in each plot. In Corpus Christi, plots were hand-picked, while in Uvalde plots were machine-harvested with a JD299 picker modified for computerized recording of seedcotton yield.

Results and Discussion

Plant Height, Area of Main-stem Leaves, and Number of Main-stem Nodes

In 1996, plant height was reduced 6% by the single application at the 3-5 leaf stage in Corpus Christi, but was not affected by any of the treatments in Uvalde (Figure 1). In 1997, however, the single application at the 3-5 leaf stage increased plant height 9% in Corpus Christi. Plant height

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tended to be 3% greater also with the single application of Ryzup at the 5-7 leaf stage in Uvalde (Figure 2).

The number of main-stem nodes and area of main-stem leaves in Ryzup-treated plots were not significantly different from the untreated control at both locations in any of both years.

Number of Fruiting Positions

The total number of fruiting positions (i.e., number of nodes in sympodial branches) is an important growth parameter highly related to the plant's production potential. In 1996, the number of fruiting positions tended to decrease with the single applications of Ryzup in Corpus Christi. Similarly, in Uvalde, the number of fruiting positions tended to decrease with the single application at the 3-5 leaf stage, and significantly decreased with the application at the 5-7 leaf stage (Figure 3). In 1997, opposite effects were observed at both locations (Figure 4). In Corpus Christi, the number of fruiting positions tended to increase with single the application at the 5-7 leaf stage and the double application, while in Uvalde tended to increase only with the double application of Ryzup.

Square and Fruit Set

Percent fruit retention was not affected by Ryzup at both locations in any of both years (Figures 5 and6).

In 1996, the number of squares and bolls per plant was not affected by any of the Ryzup treatments in Corpus Christi, while it was decreased about 20% by both single applications in Uvalde (Figure 7). In 1997, however, the number of squares and bolls per plant was increased 5% to 20% at both locations (Figure 8). In Corpus Christi, the number of squares and bolls per plant was increased by the single application of Ryzup at the 3-5 leaf stage. In Uvalde, the number of squares and bolls per plant was higher in the single application at the 5-7 leaf stage and tended to be also higher in the treatment with double application of Ryzup.

Lint Yield

In 1996, the single application of Ryzup at the 5-7 leaf stage decreased yield about 15% in Uvalde, while the double application decreased yield about 10% in Corpus Christi and about 15% in Uvalde (Figure 9). In 1997, however, lint yield was not affected by any of the treatments in Corpus Christi, while in Uvalde lint yield tended to be about 7% higher with the single application at the 5-7 leaf stage (Figure 10).

Environmental Dependency of Effects

The relationships of plant height and number of fruiting positions to the post-treatment environment were analyzed in an attempt to bring some light to clarify the apparent lack of consistency in the responses of cotton to Ryzup applications. Two parameters describing the environment of the 30-day period following each of the single applications of Ryzup were chosen because of their well known relationship to plant growth. One of these parameters was the cumulative degree days over 60°F. Expansive growth in plants increases curvilinearly with temperature over a minimum threshold (60°F) (Mauney, 1986). The second parameter was the cumulative potential evapotranspiration (PET) calculated using the Penman equation (Penman, 1963). This method to estimate PET integrates various environmental factors affecting the drying power of the atmosphere. The greater this drying power the higher the chances for inhibition of expansive growth in plants through deterioration of plant water status. Unlike the more continuous influence of temperature on plant growth, the effect of plant water status is more discrete like an on/off switch depending whether the plant water status is above or below a threshold. Two years, two locations, and two single application treatments provided eight points for determining these relationships between growth and environment.

The relationship between plant height and the number of fruiting positions to cumulative degree days over 60°F was broadly dispersed without indication of tendencies (Figures 11 and 12). The relationship between plant height and the number of fruiting positions to cumulative PET, on the other hand, showed a well defined trend with positive effects of Ryzup applications associated to low cumulative PET and negative effects associated to high cumulative PET (Figures 13 and 14).

The practical implications of this finding would point towards possible fine-tuning the management of Ryzup application depending on prevailing or near-future weather conditions. Several consecutive days of rainy and/or cloudy weather would certainly decrease PET and, therefore, increase the possibility of attaining positive growth effects of Ryzup application.

This analysis of the environmental dependency of growth responses to Ryzup applications is only preliminary and more research is needed to draw firmer conclusions.

Conclusions

Growth and yield responses to Ryzup varied between years and locations within a range of ±20% of UTC.

Mixed results did not indicate any best treatment of Ryzup regarding timing or number of applications.

Growth responses to Ryzup application appeared to be inversely related to cumulative atmospheric water demand during the 30 days following treatment.

Acknowledgment

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References

Hansen, J., C. Black-Schaefer, W. Shafer. L. Larson, and M. Adair. 1996. Effects of RyzUp on the growth and development of early season cotton. *In* Proceedings of 1996 Beltwide Cotton Conferences, Vol. 1, 38-40.

Larson, L., C. Black-Schaefer, and M. Adair, and J. Conley. 1997. RYZUP on cotton: Reports on trials, 1994-96. *In* Proceedings of 1997 Beltwide Cotton Conferences, Vol. 2, 1474-1475.

Mauney, J.R. 1986. Vegetative growth and development of fruiting sites. In J.R. Mauney and J. McD. Stewart Cotton physiology. The Cotton Foundation Publisher. Memphis, TN.

Penman, H.L. 1963. Vegetation and hidrology. Technical Communication No. 53. Commonwealth Agricultural Bureaux. Bucks. England.

Wareing, P.F. and I.D.J. Phillips. 1981. Growth and differentiation in plants. Pergamon Press Inc. Elmsford, NY.

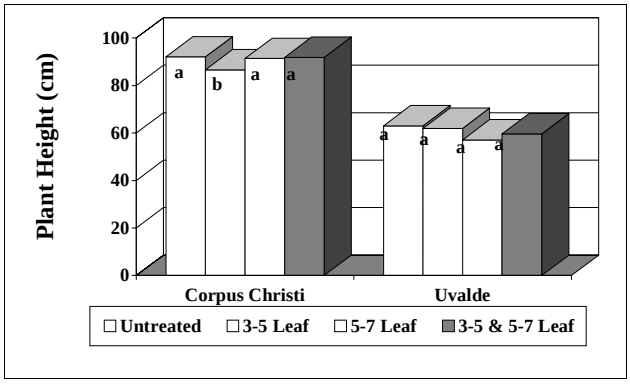

Figure 1. Effects early-season applications of Ryzup on height of cotton plants in Corpus Christi and Uvalde in 1996.

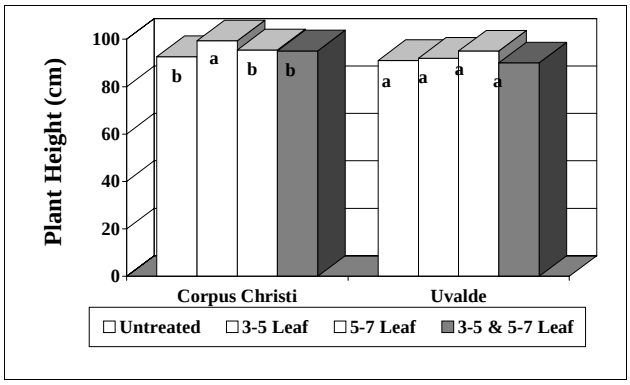

Figure 2. Effects early-season applications of Ryzup on height of cotton plants in Corpus Christi and Uvalde in 1997.

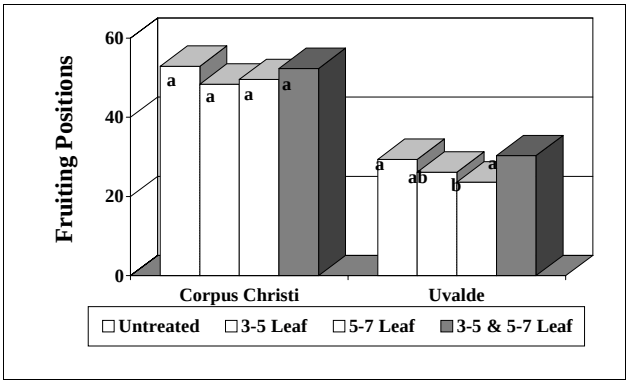

Figure 3. Effects early-season applications of Ryzup on number of fruiting positions in cotton plants in Corpus Christi and Uvalde in 1996.

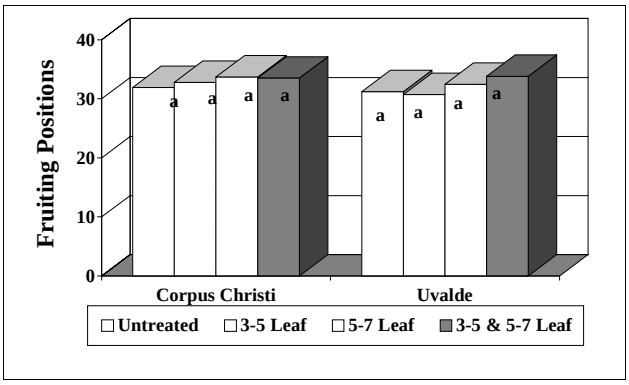

Figure 4. Effects early-season applications of Ryzup on number of fruiting positions in cotton plants in Corpus Christi and Uvalde in 1997.

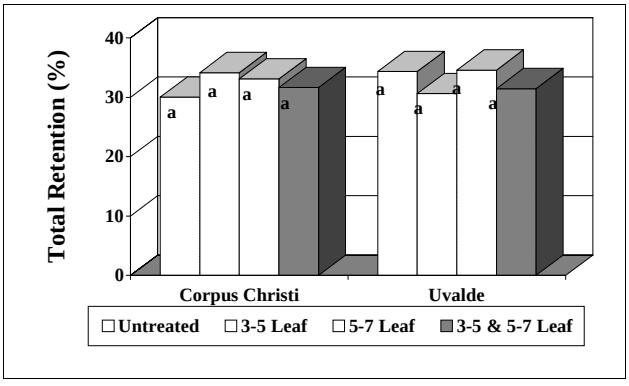

Figure 5. Effects early-season applications of Ryzup on % retention of bolls in cotton plants in Corpus Christi and Uvalde in 1996.

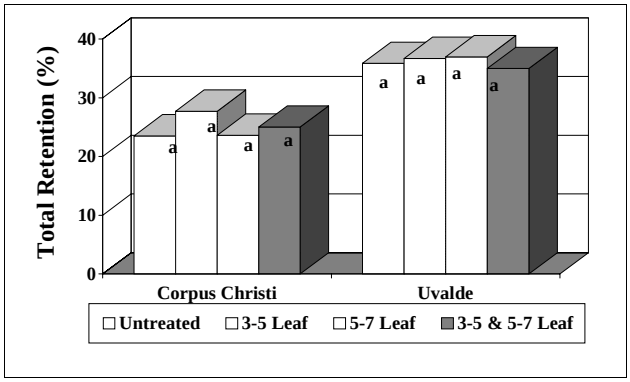

Figure 6. Effects early-season applications of Ryzup on % retention of bolls in cotton plants in Corpus Christi and Uvalde in 1997.

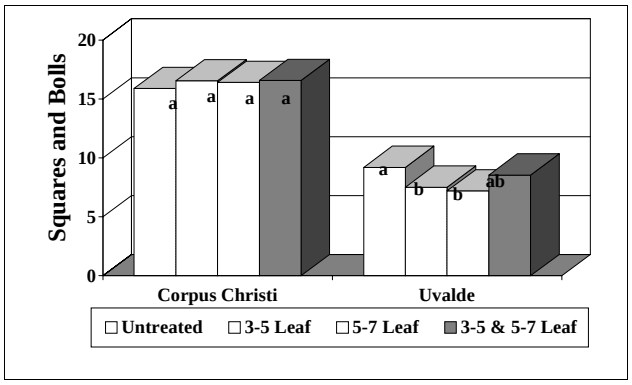

Figure 7. Effects early-season applications of Ryzup on number of squares and bolls in cotton plants in Corpus Christi and Uvalde in 1996.

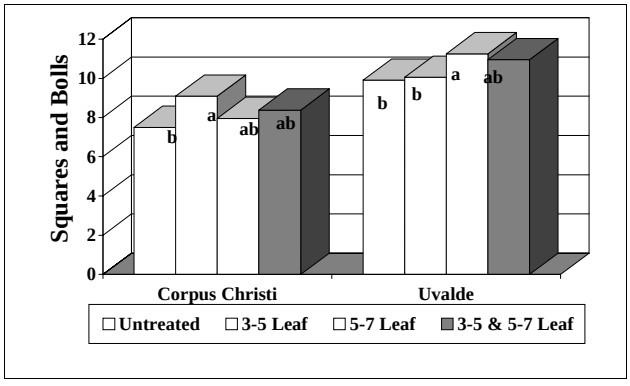

Figure 8. Effects early-season applications of Ryzup on number of squares and bolls in cotton plants in Corpus Christi and Uvalde in 1997.

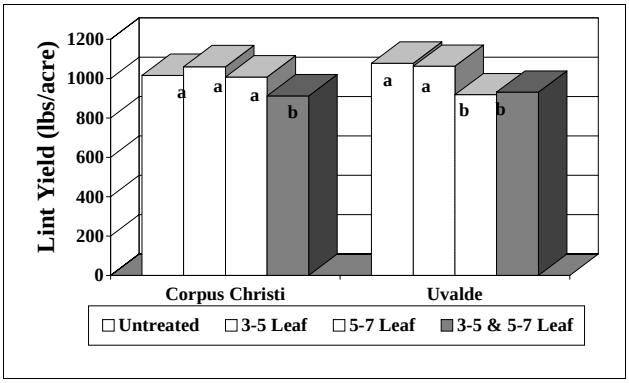

Figure 9. Effects early-season applications of Ryzup on lint yield of cotton in Corpus Christi and Uvalde in 1996.

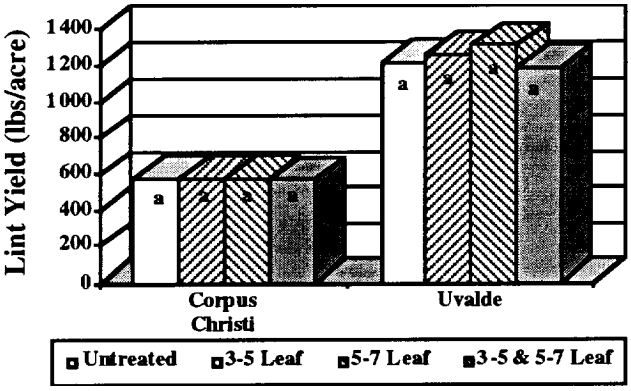

Figure 10. Effects early-season applications of Ryzup on lint yield of cotton in Corpus Christi and Uvalde in 1997.

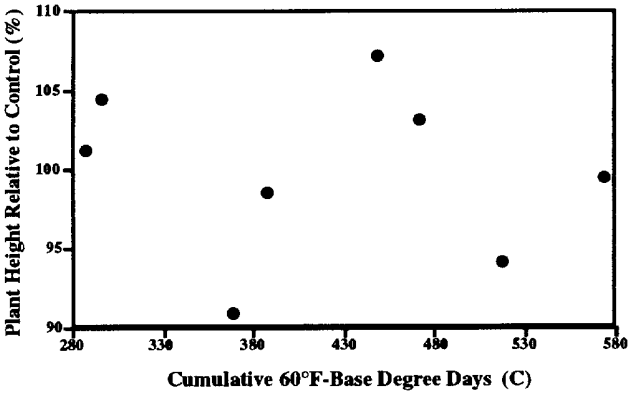

Figure 11. Relationship between height of cotton plants under single applications of Ryzup and the 30-day post-treatment cumulative degree-days over 60°F. The number of fruiting positions is given relative to that of untreated control. Paired data points correspond to single applications of Ryzup at 3-5 and 5-7 leaf stages in Corpus Christi and Uvalde in 1996 and 1997.

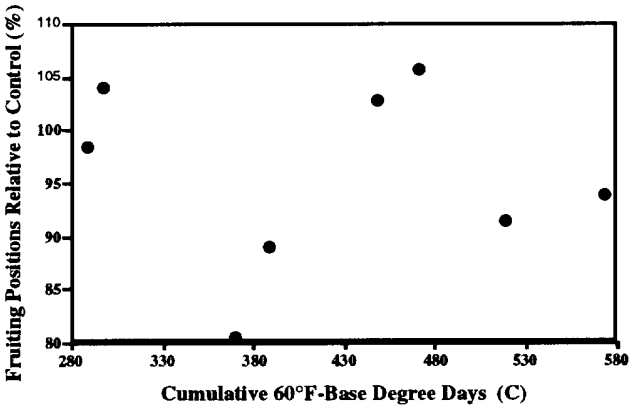

Figure 12. Relationship between the number of fruiting position in cotton plants under single applications of Ryzup and the 30-day post-treatment cumulative degree-days over 60°F. The number of fruiting positions is given relative to that of untreated control. Paired data points correspond to single applications of Ryzup at 3-5 and 5-7 leaf stages in Corpus Christi and Uvalde in 1996 and 1997.

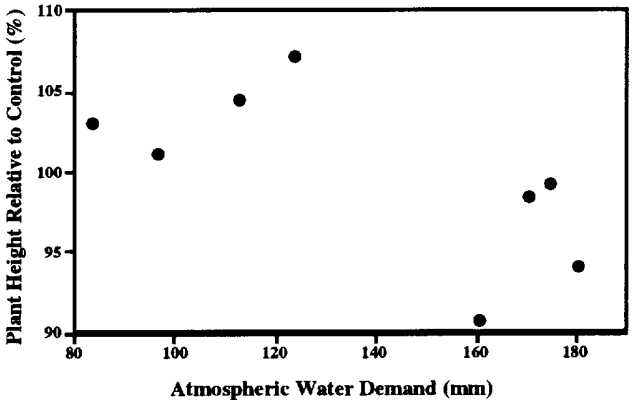

Figure 13. Relationship between height of cotton plants under single applications of Ryzup and the 30-day post-treatment cumulative potential evapotranspiration. Plant height is given relative to that of untreated control. Paired data points correspond to single applications of Ryzup at 3-5 and 5-7 leaf stages in Corpus Christi and Uvalde in 1996 and 1997.

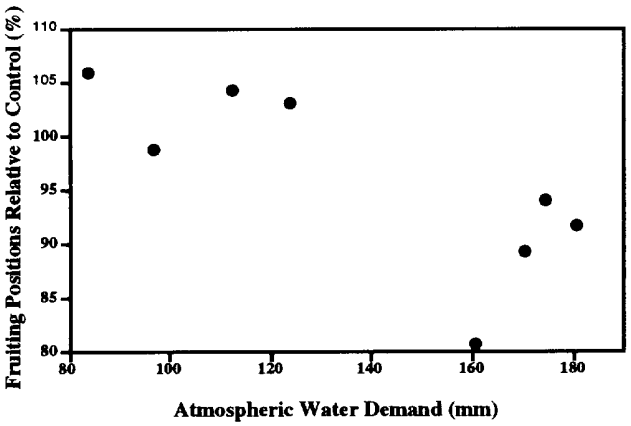

Figure 14. Relationship between the number of fruiting position in cotton plants under single applications of Ryzup and the 30-day post-treatment cumulative potential evapotranspiration. The number of fruiting positions is given relative to that of untreated control. Paired data points correspond to single applications of Ryzup at 3-5 and 5-7 leaf stages in Corpus Christi and Uvalde in 1996 and 1997.