EVALUATION OF MEPIQUAT CHLORID AND *BACILLUS CEREUS* IN SOUTH TEXAS

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Abstract

Bacillus cereus is the bacterial base for a new biochemical with plant growth regulating activity. The objective of this study was to determine the effects of multiple, early-season foliar applications of five formulations of *Bacillus cereus* and mepiquat chloride on growth and yield of upland cotton. Inhibiting effects of mepiquat chloride on expansive growth were maintained or enhanced with the addition of *Bacillus cereus*. The number of fruiting positions (number of nodes in sympodial branches) was decreased by formulations having 3 and 4% of mepiquat chloride, but this effect appeared to be somewhat counteracted by the addition of 2 g/gallon of *Bacillus cereus*. Yield responses to the addition of *Bacillus cereus* to mepiquat chloride were mixed between the two locations and the two years, and overall did not show a consistent improvement of the effects mepiquat chloride on yield of cotton.

Introduction

Bacillus cereus is the bacterial base for a new biochemical with plant growth regulating activity. Combinations of this biochemical with mepiquat chloride appeared to enhance the consistency of cotton yield improvement resulting from the application of this vegetative growth inhibitor (Parvis and Atkins, 1997).

The objective of this study was to determine the effects of multiple, early-season foliar applications of five formulations of *Bacillus cereus* and mepiquat chloride 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.

Five formulations were obtained by combining different % solutions of mepiquat chloride (MC) and g/gallon of *B. cereus* (BC).
Four sequential applications of 4 oz/acre of these formulations started at the 9th true leaf stage and continued at 9-day intervals.

MC:BC combinations:

- 2% MC : 2 g/gal BC
- 2% MC : 4 g/gal BC
- 4% MC : 2 g/gal BC
- 4% MC : 4 g/gal BC
- 4% MC : 0 g/gal BC

In 1997, the 4% MC : 4 g/gal BC formulation was replaced by 3% MC : 2 g/gal BC.

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.

Shortly before the first application, five consecutive plants satisfying the target plant population were identified and marked at two locations in each plot. Plant height and number of main-stem nodes were then measured in these same plants at the times of the first application and third application.

Prior to harvesting and after plants were completely defoliated, the two tagged 5-plant samples were mapped and the bolls harvested for boll weight determination.

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

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picker modified for computerized recording of seedcotton yield.

Results and Discussion

Plant Height and Number of Main-stem Nodes

Plant height was decreased by all formulations at both locations in both years (Figures 1 and 2). Height reduction increased with MC concentration. Addition of BC enhanced the height reduction effect of formulations with 4% MC.

The number of mainstem nodes was decreased equally by all formulations in 1996 in Corpus Christi, but decreased the most with formulations having high concentration of MC in Uvalde in 1997.

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 was decreased by formulations having high concentration of MC in Corpus Christi, except when the formulation had 2 g/gal of BC (Figure 5), while there were no significant differences among formulations in Uvalde. In 1997, there were no significant differences among treatments in Corpus Christi, while in Uvalde the number of fruiting positions was decreased by formulations having high concentration of MC (Figure 6), except that 2 g/gal of BC appeared to have counteracted effects of 3% MC.

Square and Fruit Set

Fruit retention was not significantly affected by any of the formulations but there was a tendency in Uvalde in 1997 to increase with MC concentration (Figures 7 and 8).

There were no significant differences in numbers of bolls per plant among treatments at both locations and both years (Figures 9 and 10)

Lint Yield

In 1996, the addition of 4 g/gallon of BC enhanced the yield-increasing effect of MC in Corpus Christi, but the opposite was observed in Uvalde (Figure 11). The formulation 4% MC : 4 g/gal BC increased yield 20% in Corpus Christi, but decreased it 20% in Uvalde.

In 1997, lint yield was significantly decreased only by the 2% MC : 4 g/gal BC formulation in Corpus Christi, and by the MC-alone formulation in Uvalde (Figure 12).

Conclusions

- Inhibiting effects of mepiquat chloride on expansive growth were maintained or enhanced with the addition of *Bacillus cereus*.
- The number of fruiting positions (number of nodes in sympodial branches) was decreased by formulations having 3 and 4% of mepiquat chloride, but this effect appeared to be somewhat counteracted by the addition of 2 g/gallon of *Bacillus cereus*.
- Yield responses to the addition of *Bacillus cereus* to mepiquat chloride were mixed between the two locations and the two years, and did not show a consistent improvement of the effects mepiquat chloride on yield of cotton.

Acknowledgment

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References

Parvis, D. and R. Atkins. 1997. Three years experiences with a new PGR-*Bacillus cereus* (BC). *In* Proceedings of 1997 Beltwide Cotton Conferences, Vol. 2, 1396-1398.

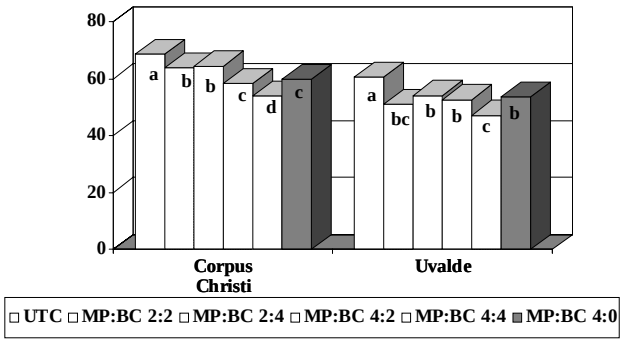

Figure 1. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on height of cotton plants in Corpus Christi and Uvalde in 1996.

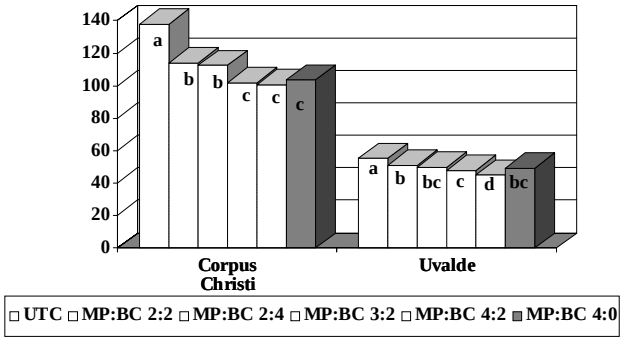

Figure 2. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on height of cotton plants in Corpus Christi and Uvalde in 1997.

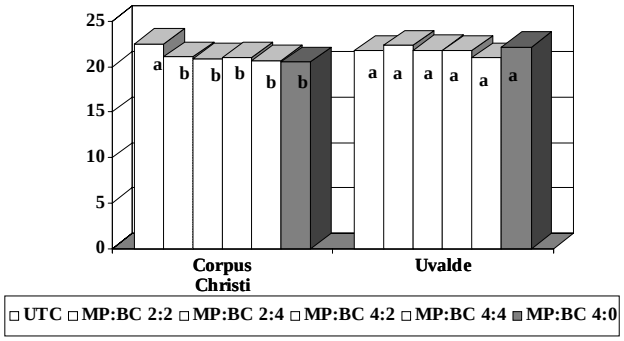

Figure 3. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on number of main-stem nodes in cotton plants in Corpus Christi and Uvalde in 1996.

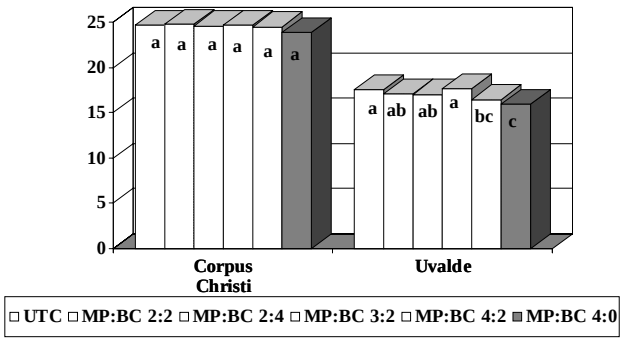

Figure 4. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on number of main-stem nodes in cotton plants in Corpus Christi and Uvalde in 1997.

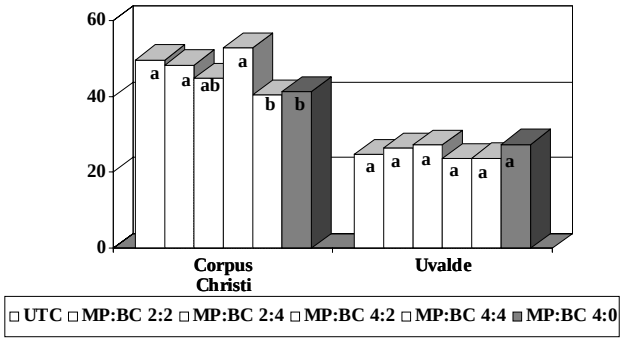

Figure 5. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on number of fruiting positions in cotton plants in Corpus Christi and Uvalde in 1996.

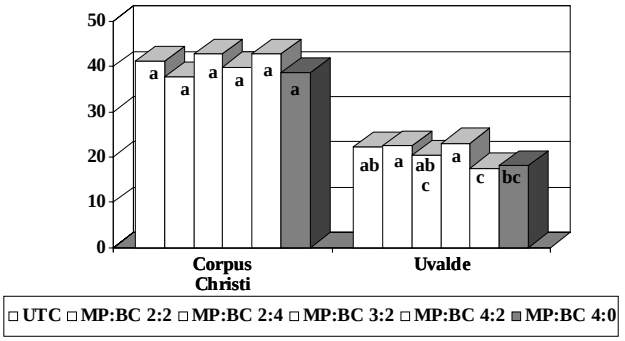

Figure 6. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on number of fruiting positions in cotton plants in Corpus Christi and Uvalde in 1997.

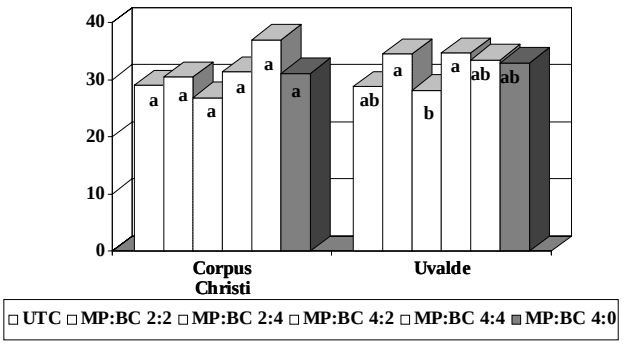

Figure 7. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on % retention of bolls in cotton plants in Corpus Christi and Uvalde in 1996.

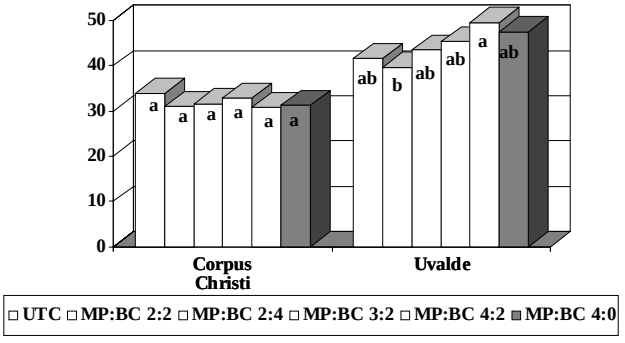

Figure 8. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on % retention of bolls in cotton plants in Corpus Christi and Uvalde in 1997.

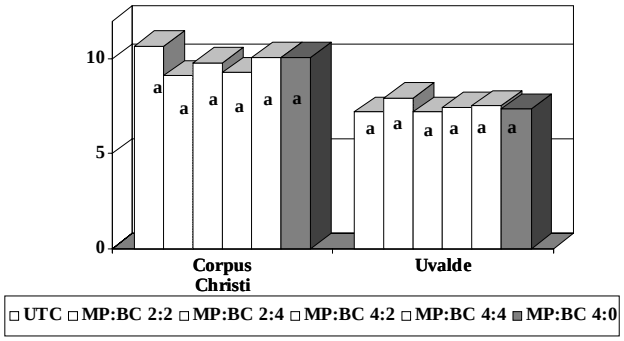

Figure 9. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on number of bolls per plant in Corpus Christi and Uvalde in 1996.

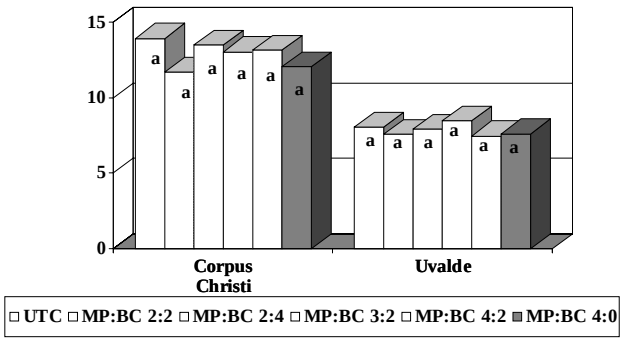

Figure 10. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on number of bolls per plant in Corpus Christi and Uvalde in 1997.

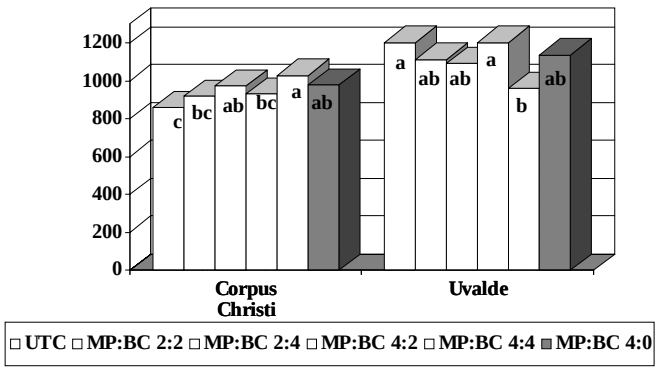

Figure 11. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on lint yield of cotton in Corpus Christi and Uvalde in 1996.

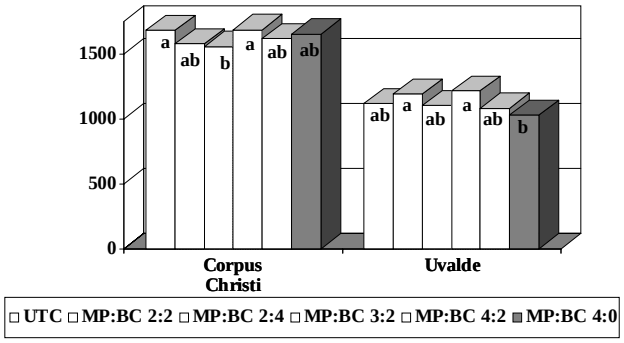

Figure 12. Effects early-season applications of mepiquat chloride and *Bacillus cereus* combinations on lint yield of cotton in Corpus Christi and Uvalde in 1997.