Effect of the Plant Growth Regulator
PGR-IV Plus as a Safener for
Glyphosate Applications in Cotton

Evangelos D. Gonias, Derrick M. Oosterhuis,
Androniki C. Bibi, and Robert S. Brown

RESEARCH PROBLEM

Over-the-top applications of glyphosate (Roundup) for weed control can occur up to the fourth true-leaf stage in transgenic Roundup Ready cotton cultivars without noticeable damage to lint yield. However, if applications are made past this developmental stage, lint yields can be substantially reduced. With so many acres of cotton throughout the Cotton Belt planted to Roundup Ready or Roundup/Bt cultivars, it is essential to determine the effect of glyphosate application on lint yield if used later than the recommended time. This research investigated the possibility of using a commercially available plant growth regulator to ameliorate the detrimental effect of late glyphosate applications.

BACKGROUND INFORMATION

PGR-IV Plus is a multi-entity plant growth regulator from Microflo, Memphis, Tenn., consisting mainly of 0.225% (w/v) gibberellic acid and 0.100% (w/v) Bacillus cereus, a naturally occurring soil bacteria. The effects of Bacillus cereus as a plant growth regulator were first tested in 1994 in conjunction with mepiquat chloride (MC), which was subsequently registered in 1997 as Mep Plus and now marketed as Pix Plus by BASF (Research Triangle Park, N.C.). Research has shown that Pix Plus had a similar effect on plant height control as MC (Oosterhuis et al., 1998, Parvin and Atkins, 1997). In addition, Pix Plus (MC plus Bacillus cereus) has been reported to increase photosynthesis, leaf starch content, dry-matter partitioning (Zhao and Oosterhuis, 2000), and

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1 Graduate assistant, distinguished professor, graduate assistant, and graduate assistant, respectively, Crop, Soil, and Environmental Sciences Department, Fayetteville.
lint yield (Parvin and Atkins, 1997) of field-grown cotton compared with the untreated control and MC-treated plants.

Based on this activity it was determined that PGR-IV Plus could aid plant metabolism and affect square and boll retention of glyphosate-tolerant varieties. It was hypothesized that the action of PGR-IV Plus may ameliorate the detrimental effects of applying glyphosate to cotton after the recommended 4-leaf stage.

**RESEARCH DESCRIPTION**

Field studies were conducted at the University of Arkansas Delta Branch Experiment Station, Clarkedale, northeast Arkansas, for two growing seasons, 2003 and 2004, in a Dundee silt loam.

In 2003, the cotton cultivar ‘Paymaster 1218BR’ was planted on 5 May, and treatments consisted of an untreated control (Treatment 1); paired treatments of Roundup and Roundup with PGR-IV Plus at the 4-leaf stage (Treatments 2 and 3) and at the 8-leaf stage post-direct (Treatments 4 and 5); Roundup at the 4- and 12-leaf stage (post-direct) with and without PGR-IV Plus (Treatments 6 and 7); and Roundup at the 8- (post-direct) and 12 (post direct)-leaf stage with and without PGR-IV Plus (Treatments 8 and 9).

The second year, 2004, the cotton cultivar ‘Stoneville 5599BR’ was planted on 5 May and the treatments consisted of an untreated control (Treatment 1); and paired treatments of Roundup and Roundup and PGR-IV Plus at the 4-leaf stage (Treatments 2 and 3), the 8-leaf stage (Treatments 4 and 5), and the 12-leaf stage (Treatments 6 and 7).

**RESULTS AND DISCUSSION**

In 2003, applications of glyphosate after the 8-leaf stage, with or without PGR-IV Plus, significantly decreased lint yield of cotton (Fig. 1). Similarly, in 2004, lint yield was significantly reduced compared to the untreated control, after glyphosate application at the 12-leaf stage (Fig. 2). Although not statistically significant, the use of PGR-IV Plus appeared to moderate the effect of glyphosate past the 4-leaf growth stages, especially in 2004 (Fig. 2). Also, an indication of PGR-IV Plus alleviating the effect of glyphosate can be observed in the yield component parameters as the number of seeds per acre and the average boll weight (Table 1).

**PRACTICAL APPLICATION**

In general, applications of glyphosate made past the 4-leaf stage severely decreased plant growth and yield components. The use of PGR-IV Plus moderated the detrimental effect of late (past the 4-leaf stage) applications of glyphosate, but growth and yield reductions still occurred.
LITERATURE CITED


<table>
<thead>
<tr>
<th>Treatments</th>
<th>Bolls (#/acre x 10^3)</th>
<th>Seeds (#/acre x 10^6)</th>
<th>Average boll weight (g)</th>
<th>Fiber/seed turnout (%)</th>
<th>Gin turnout</th>
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\textit{LSD_{0.05}} 69.2 2.05 0.55 3.4 1.1

\textsuperscript{2} Numbers followed by the same letter within a column are not significantly different (P=0.05).
Fig. 1. Effect of PGR-IV Plus and Roundup combinations on lint yield of field-grown cotton in 2003.

Fig. 2. Effect of PGR-IV Plus and Roundup combinations on lint yield of field-grown cotton in 2004.