# ARE ROUNDUP® APPLICATIONS NECESSARY FOR EVALUATION OF ROUNDUP READY® CULTIVARS

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## Abstract

Studies were conducted at the University of Arkansas Northeast Research and Extension Center at Keiser Arkansas and at the University of Missouri Delta Center at Portageville Missouri to evaluate the effect of glyphosate on Roundup Ready® cotton. Eleven Roundup Ready® cotton varieties common to both the north Arkansas and southeast Missouri official variety test (OVT) were selected for the evaluation and planted during the 2001 growing season. The test at Keiser was a split plot with varieties receiving glyphosate applications and varieties receiving no glyphosate. The Missouri test was a traditional variety test with all varieties receiving an over-the-top and a post direct application of glyphosate. Both tests were irrigated and arranged as a randomized complete block with 4 replication. All other production practices were based on university recommendations for optimal cotton production in the respective locations. There was no significant variety by glyphosate interaction in the Arkansas test and yields followed similar trends as the Missouri test. In both tests, variety had a significant effect on yield and fiber data. These data suggest that Roundup Ready® cotton cultivars can be accurately evaluated in conventional variety testing programs. The application of glyphosate did not effect the yield or fiber properties of any variety tested in this test.

## Introduction

Glyphosate is a non-selective postemergence herbicide used for broad spectrum weed control in Roundup Ready® cotton production systems. The introduction of this technology has given producers a much needed tool to help control problem weeds across the belt. Research has shown that over-the-top applications of glyphosate, within the 4-true leaf window, has no significant effect on cotton growth or yield (Voth et al. 1997; Matthews *et al*. 1997). Bourland *et al*. (2000) documented several unintentional biases which were inherent to the Arkansas cotton variety testing program. These include management associated with varieties expressing herbicide and insect resistance. Recognizing the genetic differences among entries is the ultimate goal of the Arkansas cotton variety test, therefore, all varieties are treated the same. Although a standard conventional herbicide program applied to all varieties in the test would help reduce the probability of unintentional biases, producers still question the validity of variety tests where Roundup Ready® varieties are not treated with glyphosate. Therefore, the objectives of this study were to evaluate Roundup Ready® cotton varieties treated with glyphosate.

## Materials and Methods

Cotton varieties expressing the Roundup Ready® gene were selected from those entered in both the north Arkansas and southeast Missouri official variety tests (OVT). Eleven cotton cultivars were tested and included: DP 436 RR, DP 451 B/RR, Garst/Agripro 1500 RR, PM 1199 RR, PM 1218 BG/RR, SG 215 BG/RR, Sure-Grow 501BR, Sure-Grow 521 R, ST 4793 R, ST 4892 BR, and ST X9905.

### Arkansas Location

The test was planted on April 27 at the Northeast Research and Extension Center at Kieser Arkansas on a Steele loamy sand soil. Plots were two rows (38-in) fifty feet long. The study was designed as a randomized complete block split plot with four replications. Varieties represented sub-plots and herbicide treatment represented whole plots and included plots treated with conventional herbicides only (Conventional) and plots treated with glyphosate (Glyphosate). Conventional herbicides and hand hoeing were used across the test to insure all plots were as near weed free as possible. All plots were furrow irrigated as needed to maximize production. To measure any effects on relative maturity, nodes-above-white-flower (NAWF) measurements were taken from approximately first flower until cutout (NAWF = 5). Glyphosate treated plots received 1.5 pints per acre of glyphosate (Roundup Ultra Max®) applied as an over-the-top application on May 22 (approximately 4-true leaf stage). A second, post-directed, application of 1.5 pints per acre of glyphosate was applied on June 17. All fertility, irrigation and insect control practices were the same for all plots. Plots were defoliated on September 12 and machine harvested on October 2. Whole plots were ginned and fiber samples tested using HVI.

**Missouri Location**

The test was planted on May 8 at the University of Missouri Delta Center at Portageville Missouri. Plots were 2-rows (38-in.) by 30 feet long. The test was arranged in a randomized complete block with 4 replications. Conventional herbicide programs, common to the area and weed species present, were implemented based on University recommendations. Glyphosate was applied in two applications to all plots. Glyphosate (Roundup® @ 1 ½ pints per acre) was applied as a directed spray on May 25. A second glyphosate (Roundup Max® @ 52 oz per acre) application was made as an "over-the-top" broadcast treatment on June 29. All other production practices, included furrow irrigation, were consistent across the test and were based on recommended cotton production practices for optimal yields. The test was defoliated on September 26 and machine harvested on October 22. Whole plots were ginned and fiber samples tested using HVI.

## Results

**Arkansas Location**

Lint yields ranged from a high of 1410 lbs per acre to a low of 863, but were not significantly effected by glyphosate treatment (Table 1). Although not statistically different, yields of varieties treated with glyphosate tended to be lower than yields of the same varieties not treated (Figure 1.). Only variety had a significant effect on yield, maturity (measured as days to NAWF = 5), micronaire, length and strength. The application of glyphosate had no significant effect on yield, maturity or fiber quality. Furthermore, the variety by glyphosate interaction was not significant indicating that no variety tested was more or less effected by glyphosate applications.

**Missouri Location**

Yields in the Missouri test were similar to both the treated and non-treated Arkansas (Figure 1.). Yields ranged from a high of 1520 lb/A to a low of 1104 lb/A (Table 2.). As was the case with the Arkansas, variety had a significant effect on all variables reported.

## Conclusions

These data suggest that glyphosate applications are not necessary for the evaluation of Roundup Ready® cotton cultivars. Yields of all varieties, without glyphosate treatments, followed trends similar to the same varieties treated with glyphosate. Although it is important to determine the appropriate "*fit*" of glyphosate in Roundup Ready® cotton production, the ability to test the genetic differences of cotton varieties should remain the ultimate goal of variety tests. Comparing the relative performance of all varieties, conventional and genetically enhanced, would be impossible if cotton variety tests were split into categories based on herbicide tolerance. Testing Roundup Ready® ready varieties in a glyphosate treated test, although important, could remain adjunct to states OVT.

## References

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Table 1. Effects of glyphosate applications on yield, maturity, and fiber of Roundup Ready cotton; Keiser, Arkansas.

| Variety | Treatment | Yield lb/a | NAWF = 5 days to | Mic | Len in. | Str g/tex |
|---|---|---|---|---|---|---|
| DP 436 RR | conventional | 1199 | 91 | 4.4 | 1.15 | 27.3 |
| DP 436 RR | glyphosate | 1296 | 88 | 4.4 | 1.15 | 26.9 |
| DP 451 B/RR | conventional | 1178 | 98 | 4.1 | 1.17 | 27.8 |
| DP 451 B/RR | glyphosate | 1204 | 97 | 4.1 | 1.17 | 27.4 |
| Garst/Agripro 1500RR | conventional | 1007 | 99 | 3.6 | 1.16 | 28.4 |
| Garst/Agripro 1500RR | glyphosate | 863 | 101 | 3.6 | 1.16 | 28.8 |
| PM 1199 RR | conventional | 1142 | 92 | 4.5 | 1.14 | 28.6 |
| PM 1199 RR | glyphosate | 1176 | 95 | 4.6 | 1.12 | 27.9 |
| PM 1218 BG/RR | conventional | 1373 | 93 | 4.9 | 1.10 | 26.7 |
| PM 1218 BG/RR | glyphosate | 1370 | 95 | 4.8 | 1.11 | 27.0 |
| SG 215 BG/RR | conventional | 1410 | 98 | 4.3 | 1.11 | 26.2 |
| SG 215 BG/RR | glyphosate | 1349 | 100 | 4.2 | 1.11 | 25.7 |
| SG 501BR | conventional | 1196 | 97 | 4.2 | 1.13 | 27.7 |
| SG 501BR | glyphosate | 1106 | 97 | 4.2 | 1.13 | 27.1 |
| SG 521R | conventional | 1159 | 93 | 4.4 | 1.11 | 27.3 |
| SG 521R | glyphosate | 1250 | 95 | 4.5 | 1.14 | 28.2 |
| ST 4793R | conventional | 1210 | 98 | 4.6 | 1.10 | 28.0 |
| ST 4793R | glyphosate | 1250 | 100 | 4.5 | 1.13 | 28.7 |
| ST 4892BR | conventional | 1209 | 93 | 4.7 | 1.13 | 28.7 |
| ST 4892BR | glyphosate | 1115 | 96 | 4.7 | 1.12 | 28.5 |
| ST X9905 | conventional | 1311 | 93 | 4.6 | 1.13 | 28.9 |
| ST X9905 | glyphosate | 1314 | 92 | 4.5 | 1.14 | 29.0 |
| | | | | | | |
| Glyphosate Mean | | 1208 | 96 | 4.4 | 1.13 | 27.7 |
| Conventional Mean | | 1218 | 95 | 4.4 | 1.13 | 27.8 |
| | | | | | | |
| treatment | | 0.90 | 0.39 | 0.58 | 0.67 | 0.79 |
| variety | | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| variety x treatment | | 0.79 | 0.97 | 0.99 | 0.11 | 0.63 |

Table 2. Effects of glyphosate applications on yield, maturity, and fiber of Roundup Ready cotton; Portageville, Missouri.

| Variety | Turnout % | Yield lb/a | Mic | Len in. | Str g/tex |
|---|---|---|---|---|---|
| SG 215 BR | 37 | 1520 | 4.7 | 1.10 | 28.1 |
| DP 451 BR | 36 | 1402 | 4.5 | 1.18 | 29.3 |
| ST 4892BR | 39 | 1391 | 4.5 | 1.13 | 30.0 |
| SG 501 BR | 36 | 1372 | 4.7 | 1.12 | 29.7 |
| PM 1218 BR | 38 | 1344 | 4.9 | 1.11 | 29.1 |
| ST X9905 | 38 | 1335 | 4.4 | 1.14 | 30.7 |
| SG 521 RR | 38 | 1335 | 4.4 | 1.13 | 28.5 |
| PM 1199 RR | 38 | 1327 | 4.6 | 1.15 | 30.9 |
| DP 436 RR | 34 | 1263 | 4.5 | 1.17 | 29.0 |
| ST 4793R | 39 | 1199 | 4.2 | 1.11 | 29.8 |
| G/AP 1500 RR | 37 | 1104 | 4.0 | 1.13 | 30.6 |
| | | | | | |
| Mean | 37 | 1327 | 4.5 | 1.13 | 29.6 |
| LSD (0.05) | 0.01 | 127.0 | 0.3 | 0.02 | 0.9 |
| C.V. | 2.5 | 6.6 | 4.1 | 1.1 | 2.1 |
| Prob. | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |

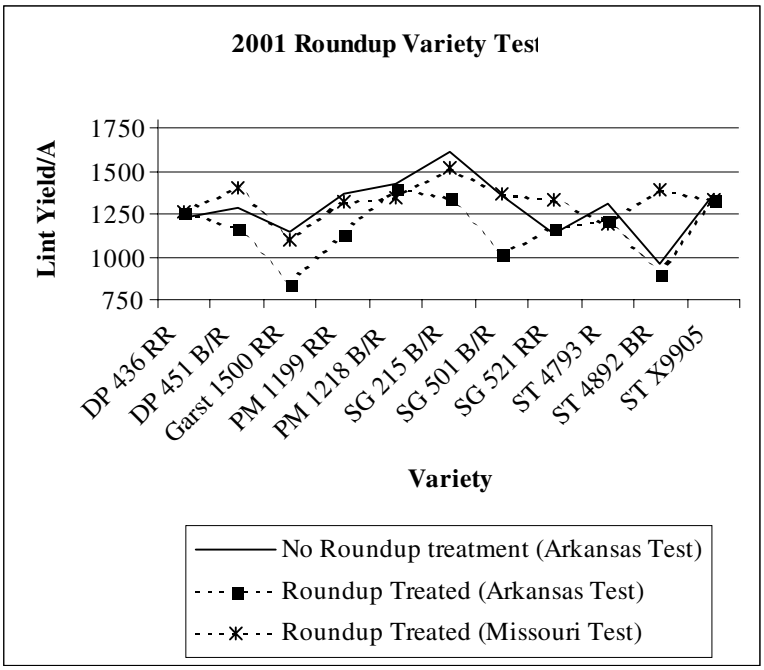


Figure 1. Lint yields of conventional treated cotton vs. cotton treated with glyphosate.