

YIELD, QUALITY AND FRUIT DISTRIBUTION IN BGII/RR FLEX AND BG/RR COTTONS EXPOSED TO EXCESSIVE GLYPHOSATE APPLICATIONS, FRUIT LOSS, AND WATER DEFICIT STRESS

Cory Mills, Craig Bednarz, Jared Whitaker, and Glen Ritchie
Crop and Soil Sciences, University of Georgia, Tifton

Abstract

Roundup Ready Flex and Bollgard II are new advancements in cotton biotechnology intended to increase yield by allowing more control of weeds and pests. Roundup Ready Flex technology promises to be insensitive to glyphosate applications throughout the season, whereas the reproductive tissue of the current Roundup Ready cotton technology is sensitive to glyphosate, meaning that glyphosate applications after a particular plant stage can damage the crop. The flexible spray time of the Roundup Ready Flex cotton will allow better control of weeds that are sensitive to glyphosate. The new Bollgard II technology is intended to be more successful than the current Bollgard technology in controlling some Lepidopteran pests. This experiment compared the ability of Bollgard II Roundup Ready Flex and Bollgard Roundup Ready cottons to withstand late applications of glyphosate and mismanaged Lepidopteran pests in irrigated and dryland conditions. The two technologies were planted in a split plot design in a five acre field equipped with a linear travel irrigation system specifically designed for irrigation research at the University of Georgia, Tifton Campus. Three Roundup application rates of 22, 33, and 33 ounces per acre were applied at the 3rd leaf stage (broadcast), 7th leaf stage (broadcast), and 12th node stage (directed), respectively. Plant height and fruit retention measurements were taken once a week over a three month period. The plots were machine harvested as well as hand harvested by fruiting position at crop maturity. Machine harvested samples were ginned at the University of Georgia MicroGin facility. Fiber quality data was obtained at Cotton Incorporated.

Introduction

Roundup Ready and Bt technologies have changed cotton farming throughout the United States, and most of the cotton planted in the U.S. has one or both of these technologies. However, the reproductive parts of Roundup Ready cotton are sensitive to glyphosate, limiting the stages of growth at which glyphosate can be sprayed over-the-top. The original Bollgard technology also has a limitation, which is that some lepidopteran species are not sufficiently sensitive to its mode of action to be reliably controlled. Roundup Ready Flex and Bollgard II technologies offer less sensitivity to glyphosate and more insect resistance, but the technologies are new and need to be closely evaluated to determine their abilities.

Materials and Methods

The study was conducted at the University of Georgia Gibbs Research Farm in Tifton, Georgia. The two technologies were planted in a split plot design with 5 dryland and 5 irrigated replicates. Plots were 70 ft long and 12 ft (4 rows) wide, with 30 ft buffer regions between irrigation treatments. Variety and flower removal treatments were randomized within each irrigation treatment.

The plots were irrigated using a linear overhead sprinkler system, and irrigation was based on daily watermark readings in the irrigated plots at 8, 16, and 24". Irrigation triggers were set at 40 centibars at 8" and 50 centibars at 16" and 24".

Ten plants in each plot were mapped weekly for nodes, nodes above first square or white flower, and number of present and missing first-position fruit. In the bloom removal plots, bloom shedding was simulated by removing blooms by hand. Blooms were removed daily for one week after flowering began. Bollworms and armyworms were also counted in the blooms that were pulled.

The cotton was ginned and weighed at the University of Georgia Microgin, a state-of-the-art ginning facility in Tifton, Georgia. Samples were sent to Cotton Incorporated for HVI analysis. Data analysis was performed in SAS 8.0 with the help of Ben Mullinix, a University of Georgia statistician. We compared seed cotton yield, lint yield, and percent lint among all treatments, as well as interactions between these parameters using a mixed model.

Results

The original Bollgard Roundup Ready cotton had significantly higher first-position fruit shed at peak bloom on irrigated plots than did the Bollgard II Roundup Ready Flex cotton. This supports the idea that late Roundup application on the original Roundup Ready cotton does indeed increase fruit shedding (Figure 1). Both varieties of cotton had similar maturity rates in terms of nodes above first square and nodes above white flower, except that the Bollgard II cotton had lower nodes above white flower on August 3 than the original Bollgard cotton. This suggests that the Bollgard II cotton had a higher maturity rate after peak bloom (Figure 2).

Irrigation had a highly significant effect on final yield, while variety and fruit removal did not have significant effects on yield. However, irrigation x variety also had a significant effect on yield, with the Roundup Ready Flex/Bollgard II technology yielding better on dryland in relation to irrigated than the Roundup Ready Bollgard technology. These results suggest the original Bollgard Roundup Ready cotton could not compensate for fruit shed from late Roundup applications under non irrigated conditions. Our study suggested that variety had no effect on yield in this study. However, the interaction of irrigation and variety for this study suggested that the Roundup Ready Flex/Bollgard II technology has

a positive effect on yield under water limiting conditions. Fruit distribution analyses will provide additional information.

Acknowledgments

The authors gratefully thank The Georgia Cotton Commission, Cotton Incorporated and Monsanto for funding this project.

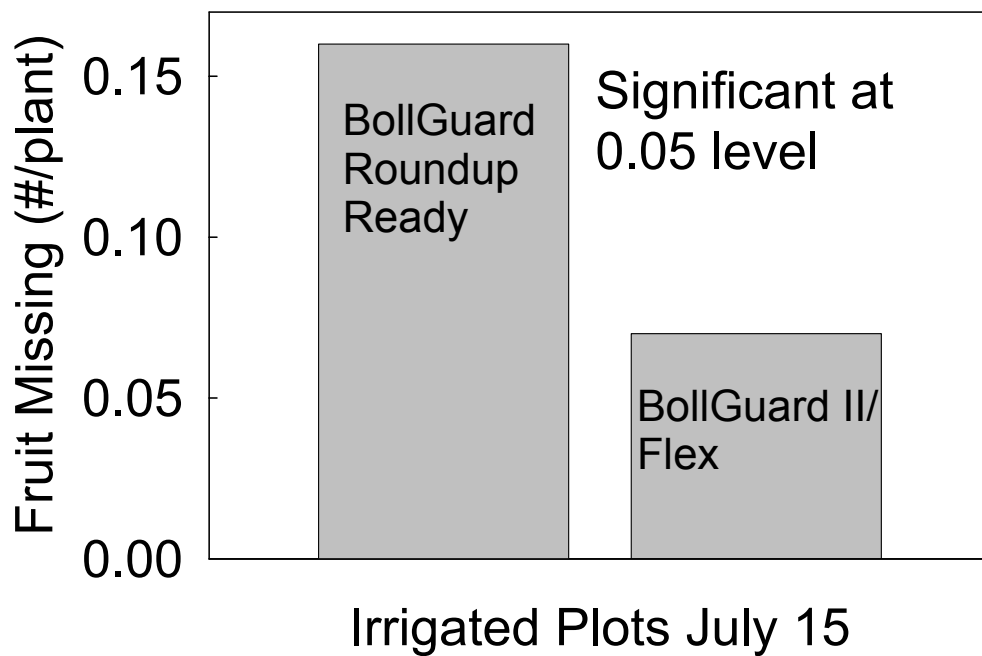


Figure 1. Comparison of fruit shed between technologies on irrigated plots.

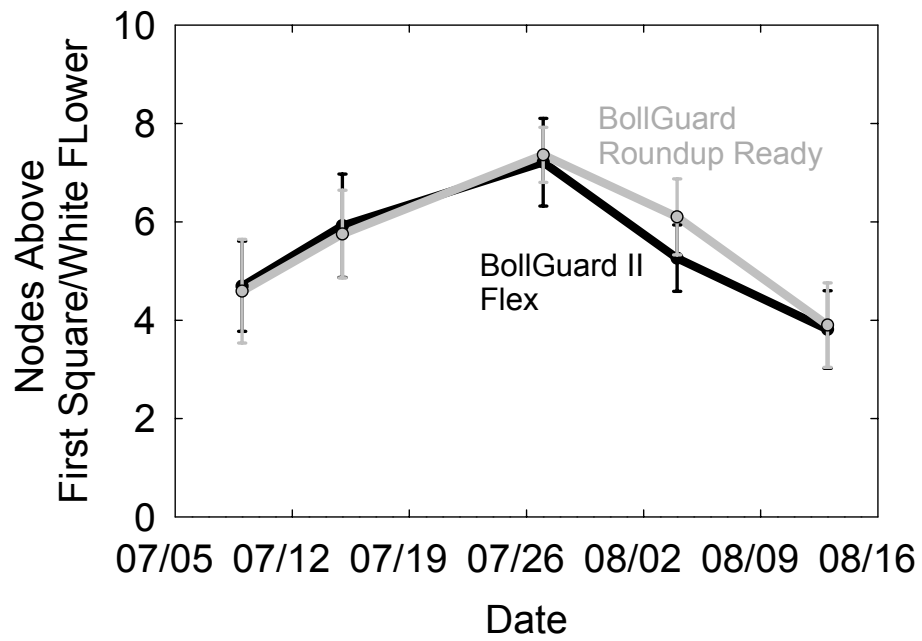


Figure 2. Cotton maturity estimates based on nodes above first square and nodes above white flower data.