WEED MANAGEMENT SYSTEMS IN GEORGIA COTTON UTILIZING ROUNDUP-READY® COTTON

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Abstract

Field research was conducted in 1996 to evaluate the utility of Roundup Ready® cotton (*Gossypium hirsutum* L.) for weed management systems in Georgia. Small plots were established at the Plant Sciences Farm near Athens, GA. A tillage experiment with weed management systems with glyphosate (Roundup®) alone or in sequence with a residual broadleaf or residual grass herbicide was examined in either conventional- or conservation-tillage cotton and a systems experiment in which weed management systems utilizing glyphosate were compared to several standard residual grass and broadleaf herbicides were initiated. Roundup Ready® cotton showed no differences in germination, vigor, emergence, or cut-out when compared to non-transgenic cotton. Glyphosate did not injury cotton at any application timing and differences in yield were due to weed management. Weed control for all weed management systems including glyphosate was good (>80% control at 84 days after planting). Norflurazon plus fluometuron or pyrithiobac plus fluometuron followed by one application of glyphosate provided the best weed control, seed cotton yield, and greatest yield return on herbicide dollar spent of the postemergence systems examined..

Introduction

Weeds cost Georgia growers approximately $120 million dollars each year in cotton yield and quality losses. Current weed management systems often fail to adequately control the most troublesome and common weeds in Georgia cotton production such as Texas panicum (*Panicum texanum* Buckl.), sicklepod (*Senna obtusifolia* L.), and common cocklebur (*Xanthium strumarium* L.). Currently, growers must utilize inefficient weed management strategies such as post-directed and shielded herbicide applications. The introduction of glyphosate -resistant cotton has the potential to improve weed management systems and the profitability of Georgia cotton production.

Materials and Methods

Research was conducted in 1996 at Plant Sciences Farm near Athens, GA on a Cecil sandy loam (clayey, kaolinitic, thermic, Typic Hapludults) with 76% sand, 16% silt, 8% clay, 0.9% organic matter, and pH was 5.9. 'Coker 312 x 1445RR" cotton was planted.

The experimental design was a randomized complete block with six replications for the tillage experiment and three replications for the systems experiment. Individual plots consisted of four rows, spaced 91-cm apart, 6.1 m long. Cotton was planted May 18. Common cocklebur, large crabgrass (*Digitaria sanguinalis*), and morningglory complex (*Ipomoea spp.*) were present in the tillage experiment. Common cocklebur, sicklepod, and johnsongrass [*Sorghum halepense* (L.) Pers.] was present in the systems experiment at an approximate density of 50 plants/m^2.

All herbicide treatments were applied with a tractor-mounted or backpack CO_2-pressurized sprayer, calibrated to deliver 170 L/ha at 220 kPa. PRE herbicides were applied the same day as planting. In the tillage experiment, there were two conventional-tillage treatments that included trifluralin (Treflan®) applied at 0.6 kg a.i./ha preplant incorporated followed by : 1) fluometuron (Cotoran®) applied at 1.6 kg a.i./ha at planting followed by pyrithiobac (Staple®) applied at 70 g a.i./ha early postemergecne followed by a post-directed application of MSMA (Bueno®) applied at 2.2 kg a.i./ha followed by MSMA applied at 2.2 kg/ha plus cynazine (Bladex®) applied at 0.84 kg a.i./ha at layby and 2) four applications of glyphosate applied at 0.62 kg a.e./ha at planting, two - three leaf stage, post-directed, and late post-directed. There were four conservation-tillage treatments in which glyphosate was applied at 1.1 kg a.e. /ha preplant followed by either: 1) pendimethalin (Prowl®) plus fluometuron applied at 0.84 kg a.i./ha and 1.6 kg/ha, respectively at planting followed by pyrithiobac applied at 70 g/ha at two-leaf stage followed by MSMA applied at 2.2 kg/ha post-directed followed by MSMA plus cyanazine applied at 2.2 kg/ha and 0.84 kg/ha, respectively at layby; 2) glyphosate applied at 0.62 kg/ha at the two-leaf stage, post-directed, and late post-directed; 3) fluometruon applied at 1.6 kg/ha at planting followed by glyphosate applied at 0.62 kg/ha at two-leaf stage, post-directed,a nd late-post-directed; and 4) glyphosate applied at 0.62 kg/ha at two-leaf stage and post-directed, and mixed with cyanazine applied at 0.84 kg/ha at late post-direct. In the second systems experiment, four postemergence systems consisting of 1) glyphosate applied at 0.62 kg/ha applied at two leaf stage, 2) glyphosate applied at 0.62 kg/ha at two leaf stage and post-directed, 3) glyphosate applied at 0.62 kg/ha at the two leaf stage followed by MSMA applied at 2.2 kg/ha post-directed, and 4) pyrithiobac applied at 70 g/ha at two leaf stage followed by MSMA applied at 2.2 kg/ha post-directed after one of four preemergence systems 1) untreated, 2) norflurzon (Zorial®) applied at 0.84 kg a.i./ha preplant incorporated and at planting with fluometuron applied at 1.6 kg/ha at planting, 3) clomazone (Command®) plus fluometuron applied at 1.1 kg a.i./ha and 1.6 kg/ha, respectively, and 4) pyrithiobac plus fluometuron applied at 70 g/ha and 1.6 kg/ha, respectively. Disulfoton

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(Di-Syston®) was applied in-furrow at 0.84 kg/ha to all clomazone treated plots.

Weed control was visually estimated on a 0 to 100% scale where 0 = no control and 100 = complete control. Cotton injury was visually estimated on a 0 to 100% scale where 0 = no injury and 100 = complete kill. Visual estimates of weed control and cotton injury was taken 21, 42, and 84 DAP and 10 wk after planting. The cotton crop was mechanically harvested on October 25.

All weed control data were subjected to arcsine transformations before analysis. Significance of differences in treatment means for weed control ratings, cotton yield were determined with Fisher's Protected Least Significance Difference Test at the 5% level of probability. Visual estimates of weed control are expressed as untransformed data for reader clarity.

To compare economic effectiveness of each weed management system, a return on each herbicide dollar function was used. The price of herbicides were taken from Georgia Cooperative Extension Service. The return on herbicide dollar function was calculated as [approximate lint yield x price ($0.75/lb)/herbicide costs for each treatment]. The Monsanto technology fee of $8/A for picker cotton was added to costs of treatments including glyphosate postemergence or post-directed in cotton.

Results and Discussion

Roundup Ready® cotton showed no differences in germination, vigor, emergence, or cut-out when compared to non-transgenic cotton. Glyphosate did not injury cotton at any application timing and differences in yield were due to weed management. Weed control for all weed management systems was good (>80% control at 84 days after planting).

In the tillage experiment, there were not differences in seed cotton yield due to tillage systems used. In the conservation-tillage system, the inclusion of fluometuron as a residual improved yields over systems examined. In conventional-tillage, the use of only glyphosate performed better than other systems. The systems that relied on glyphosate alone provided the greatest return of yield on herbicide dollar spent in both conventional and conservation-tillage systems.

In the systems experiment, norflurazon plus fluometuron or pyrithiobac plus fluometuron followed by one application of glyphosate provided the best weed control, seed cotton yield, and greatest yield return on herbicide dollar spent of the postemergence systems examined. Following clomazone plus fluometuron, pyrithiobac provided the best seed cotton yield and return on herbicide dollar spent.

These studies indicate that weed management systems utilizing Roundup Ready® cotton provide growers with flexibility that they have not had previously.

Acknowledgments

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Reference

Delaplane, K. S. 1994. 1994 Georgia Pest Control Handbook. Coop. Ext. Serv., Univ. Georgia, Athens.