WILL POSTEMERGENCE-DIRECTED HERBICIDE APPLICATIONS BE NEEDED AFTER COMMERCIALIZATION OF ROUNDUP READY FLEX COTTON?

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Introduction

Cotton is currently the dominate agronomic crop in Georgia. It is planted on about 1.2 million acres, with over 94% of the acreage devoted to glyphosate-resistant cultivars (USDA-AMS 2002; USDA-ERS 2003). Traditional cotton herbicide programs that include cultivation, preplant incorporated and preemergence herbicides, plus postemergence-directed herbicides having both postemergence and residual herbicides, have been largely replaced by weed management systems often consisting of only glyphosate (Culpepper and York 1998; Wilcut et al. 1996). Growers enjoy the ease and economic value of Roundup Ready technology; however, there are still several limitations.

Current Roundup Ready cotton technology does not recommend an application of glyphosate overtop of Roundup Ready cotton past the fifth leaf stage of development. In 2006, Roundup Ready Flex cotton will be commercialized and available for growers. Roundup Ready Flex cotton will allow glyphosate applications overtop of cotton from emergence through bloom. Growers will attempt to replace all previous postemergence-directed herbicide applications with glyphosate or glyphosate mixtures applied topically. Thus, it is critical that replicated field trials determine if weeds can be managed in Roundup Ready Flex cotton without the use of postemergence-directed herbicide applications.

Materials and Methods

'DP 555 B/RR' cotton was planted in late April or early May in 2004 and 2005 at either the Ponder Farm Research Station, Tifton, Georgia, or at the Sunbelt Expo, Moultrie, Georgia. The experimental design was a randomized complete block with treatments replicated four times. Plots were four rows by 25 feet in length and all inputs for cotton production followed those recommended by the University of Georgia Cooperative Extension Service, with the exception of herbicide treatments. The middle two rows of each plot were harvested with a spindle picker modified for plot work.

Results and Discussion

Visual Cotton Response and Seed Cotton Yield: Soil applied herbicides and Roundup WeatherMax applied alone did not injure cotton (data not shown). Dual Magnum, Envoke, or Staple mixed with Roundup injured 6-leaf cotton 12, 12, and 18%, respectively, at 7 days after application when averaged over three locations. Cotton

quickly recovered and injury was not detectable by 18 days after application. Applications made overtop of 12- to 13-leaf cotton caused less than 10% injury. Seed cotton yield was measured at two of the three locations and yields were similar among herbicides systems reported. Yield differences would not be expected as weed control during the first eight weeks was excellent (data not shown).

Weed Response: Roundup WeatherMax applied topically to 1-, 6-, and 13-leaf cotton controlled large crabgrass, Texas panicum, bristly starbur, Florida beggarweed, sicklepod, pitted morningglory, and Palmer amaranth at least 92% at harvest (Tables 1, 2, 3, and 4). The addition of Cotoran, Dual Magnum, Prowl, Staple, or Envoke to the Roundup only system did not improve weed control for any of these weeds.

The Roundup only system controlled smallflower morningglory 93%. The addition of Cotoran, Dual Magnum, Envoke, Prowl, or Staple to the Roundup only system improved late-season control by 6% (Table 3). Similar results were noted with Florida pusley. The addition of most residual herbicides to the Roundup only program improved control to pusley control to at least 92%. When Cotoran was applied PRE or Envoke was applied to 6-leaf cotton, pusley control was at least 95%.

Tropical spiderwort and doveweed were much more challenging to manage with Roundup Weathermax applied alone. Three applications of Roundup provided 49 to 59% control of these weeds late in the season (Table 4). The addition of Dual Magnum to the Roundup only system improved spiderwort control at least 21% while Staple or Dual Magnum added in the Roundup only system improved doveweed control 15 to 30%. For doveweed and tropical spiderwort, the most effective system only provided 86% control which is usually unacceptable.

Conclusions

Topical applications of Roundup WeatherMax when applied to 1-, 6-, and 13-leaf cotton provided excellent control of seven common weed species in Georgia. The addition of residual herbicides mixed with Roundup in the Roundup only program further improved control to at least 90% for two additional weed species. Thus for nine weeds present in this experiment, Roundup Ready Flex programs applying herbicides topically was effective. However for tropical spiderwort and doveweed, a Roundup Ready Flex program will require precision postemergence-directed applications to obtain adequate late-season control.

Literature Cited

Culpepper, A. S. and A. C. York. 1998. Weed management in glyphosate-tolerant cotton. J. Cot. Sci. 2:174-185.

United States Department of Agriculture - Agricultural Marketing Service - Cotton Program (USDA-AMS). 2002. Cotton Varieties Planted 2002 Crop. Memphis, TN.

United States Department of Agriculture - Economic Research Service (USDA-ERS). 2003. The extent of adoption of bioengineered crops. Available online at http://www.ers.usda.gov/publications/aer810/aer810d.pdf.

Wilcut, J. W., H. D. Coble, A. C. York, and D. W. Monks. 1996. The niche for herbicide-resistant crops in U.S. agriculture. p. 213-230. *In* S.O. Duke (ed.) Herbicide-resistant crops: Agricultural, environmental, economic, regulatory, and technical aspects. Boca Raton, FL: CRC Press.

Table 1. Late-season grass response to Roundup Ready Flex systems.*

Herbicide systems**				Weed species***	
PRE	1 lf cotton	6 lf cotton	13 lf cotton	Large crabgrass	Texas Panicum
--	RU	RU	RU	99 a	95 a
--	RU	RU + Dual	RU	99 a	96 a
--	RU	RU	RU + Dual	99 a	98 a
--	RU	RU + Envoke	RU	99 a	97 a
--	RU	RU	RU + Envoke	99 a	97 a
--	RU	RU + Staple	RU	99 a	95 a
--	RU	RU	RU + Staple	99 a	97 a
--	RU	RU + Staple	RU + Dual	99 a	97 a
Prowl	--	RU	RU	99 a	98 a
Prowl + Cotoran	--	RU	RU	99 a	97 a
Prowl + Staple	--	RU	RU	99 a	98 a

*Values within a column followed by the same letter are not different at P = 0.05.
**Abbreviations: Dual = Dual Magnum; PRE = preemergence; RU = Roundup WeatherMax.
**Herbicide rates per acre: Cotoran 1 qt, Dual Magnum 1.3 pt, Envoke 0.1 oz, Prowl 2.4 pt, Roundup at 1-leaf 22 oz, Roundup at 6- or 13-leaf 28 oz, Staple 0.8 oz.
***Large crabgrass was present at 1 location. Panicum was present at two locations.

Table 2. Late-season starbur, beggarweed, and sicklepod response to Roundup Ready Flex systems.*

Herbicide systems**				Weed species***		
PRE	1 lf cotton	6 lf cotton	13 lf cotton	Bristly starbur	Florida beggarweed	Sicklepod
--	RU	RU	RU	93 a	97 a	99 a
--	RU	RU + Dual	RU	96 a	97 a	99 a
--	RU	RU	RU + Dual	90 a	98 a	99 a
--	RU	RU + Envoke	RU	99 a	99 a	99 a
--	RU	RU	RU + Envoke	90 a	99 a	99 a
--	RU	RU + Staple	RU	98 a	97 a	99 a
--	RU	RU	RU + Staple	97 a	96 a	99 a
--	RU	RU + Staple	RU + Dual	96 a	97 a	99 a
Prowl	--	RU	RU	93 a	99 a	99 a
Prowl + Cotoran	--	RU	RU	99 a	96 a	99 a
Prowl + Staple	--	RU	RU	91 a	99 a	99 a

*Values within a column followed by the same letter are not different at P = 0.05.
**Abbreviations: Dual = Dual Magnum; PRE = preemergence; RU = Roundup WeatherMax.
**Herbicide rates per acre: Cotoran 1 qt, Dual Magnum 1.3 pt, Envoke 0.1 oz, Prowl 2.4 pt, Roundup at 1-leaf 22 oz, Roundup at 6- or 13-leaf 28 oz, Staple 0.8 oz.
***Starbur and sicklepod were present at one location. Beggarweed was present at two locations.

Table 3. Late-season pusley and morningglory response to Roundup Ready Flex systems.*

Herbicide systems**				Weed species***		
PRE	1 lf cotton	6 lf cotton	13 lf cotton	Florida pusley	Smallflower morningglory	Pitted morningglory
--	RU	RU	RU	87 d	93 b	92 a
--	RU	RU + Dual	RU	93 bc	99 a	91 a
--	RU	RU	RU + Dual	90 cd	99 a	92 a
--	RU	RU + Envoke	RU	96 ab	99 a	93 a
--	RU	RU	RU + Envoke	90 cd	99 a	95 a
--	RU	RU + Staple	RU	93 bc	99 a	94 a
--	RU	RU	RU + Staple	87 d	99 a	96 a
--	RU	RU + Staple	RU + Dual	95 ab	99 a	94 a
Prowl	--	RU	RU	92 bc	99 a	95 a
Prowl + Cotoran	--	RU	RU	98 a	99 a	97 a
Prowl + Staple	--	RU	RU	90 cd	99 a	92 a

*Values within a column followed by the same letter are not different at P = 0.05.
**Abbreviations: Dual = Dual Magnum; PRE = preemergence; RU = Roundup WeatherMax.
**Herbicide rates per acre: Cotoran 1 qt, Dual Magnum 1.3 pt, Envoke 0.1 oz, Prowl 2.4 pt, Roundup at 1-leaf 22 oz, Roundup at 6- or 13-leaf 28 oz, Staple 0.8 oz.
***Smallflower morningglory, Florida pusley, and pitted morningglory were present at 1, 2, and 3 locations, respectively.

Table 4. Late-season spiderwort and doveweed response to Roundup Ready Flex systems.*

Herbicide systems**				Weed species***		
PRE	1 lf cotton	6 lf cotton	13 lf cotton	Palmer amaranth	Tropical spiderwort	Doveweed
--	RU	RU	RU	99 a	59 c	49 c
--	RU	RU + Dual	RU	99 a	80 ab	64 b
--	RU	RU	RU + Dual	99 a	86 a	70 ab
--	RU	RU + Envoke	RU	99 a	63 c	44 c
--	RU	RU	RU + Envoke	99 a	61 c	43 c
--	RU	RU + Staple	RU	99 a	68 c	78 a
--	RU	RU	RU + Staple	99 a	76 b	75 ab
--	RU	RU + Staple	RU + Dual	99 a	86 a	79 a
Prowl	--	RU	RU	99 a	64 c	44 c
Prowl + Cotoran	--	RU	RU	99 a	65 c	44 c
Prowl + Staple	--	RU	RU	99 a	60 c	52 c

*Values within a column followed by the same letter are not different at P = 0.05.
**Abbreviations: Dual = Dual Magnum; PRE = preemergence; RU = Roundup WeatherMax.
**Herbicide rates per acre: Cotoran 1 qt, Dual Magnum 1.3 pt, Envoke 0.1 oz, Prowl 2.4 pt, Roundup at 1-leaf 22 oz, Roundup at 6- or 13-leaf 28 oz, Staple 0.8 oz.
***All weeds were present at one location.