

# **ENVOKE, STAPLE, AND DUAL MAGNUM FOR POST EMERGENCE FLEX COTTON WEED CONTROL**

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## **Introduction**

Glyphosate resistant (GR) cotton became the standard technology grown throughout the southern U.S. due to its ease of use for weed control and high-yield, productive cultivars (i.e DP 555). Traditional cotton herbicide programs included preplant incorporated, preemergence (PRE), and postemergence-directed herbicide applications, but these were largely replaced with weed management systems often consisting of only glyphosate postemergence (POST) applications. Although glyphosate effectively controls most common weeds, herbicide tolerant and herbicide resistant weeds became more troublesome. This was in part due to the elimination of other, more effective herbicides with POST and residual activity. These weeds include glyphosate tolerant Benghal dayflower (a.k.a. tropical spiderwort) and glyphosate resistant Palmer amaranth with both becoming two of the most common and troublesome weeds in Georgia cotton. These weeds have significantly altered weed control tactics, especially with respect to POST glyphosate applications. The need to reduce the number of glyphosate applications has led farmers to become more dependent on other herbicides. In addition, ALS resistant Palmer amaranth is also prevalent across Georgia.

Flex-cotton was developed for use with glyphosate POST, and the successor to Roundup Ready-cotton. Sales of DP 555 seed will end in 2009. Farmers have not adapted to other Roundup Ready cotton cultivars due to DP 555s positive agronomic attributes. Thus, after 2009 they will be seeking other quality cultivars. Some Flex cotton cultivars may become more prevalent as farmers shift away from Roundup Ready cotton. However, with the increase in Flex cotton production, changes in weed control will need to be made. This is because farmers are likely to become less reliant on glyphosate due to herbicide tolerant and resistant weeds and the need to manage the use of ALS herbicide applications given the high incidence of ALS-resistant Palmer amaranth in Georgia. Therefore, studies were conducted to evaluate POST herbicides in Flex cotton for weed control using Roundup Weathermax (glyphosate), Staple (pyrithiobac), Envoke (trifloxysulfuron), or Dual Magnum (S-metolachlor) at Plains and Ty Ty, GA.

## **Materials and Methods**

Field trials were conducted in 2007 and 2008 at the University of Georgia Ponder Research Farm near Ty Ty, GA and the Southwest Georgia Research and Education Center near Plains, GA. Stoneville ST4554B2RF Flex cotton was planted for all experiments using a Monosem precision vacuum planter set to deliver 4.3 seed per foot of row. The experimental design was a randomized complete block with a factorial

arrangement of treatments replicated four times. Plots were two rows by 25 feet long in Tifton, and two rows by 30 feet long in Plains. Standard agronomic practices were conducted including conventional tillage along with fertility, and pest control recommendations (other than weeds) by the University of Georgia Cooperative Extension.

All tests included a nontreated control for weed comparison. Applications of herbicides began at the 3 leaf stage of cotton with a POST treatment of Roundup Weathermax at 22 oz/ac applied to all plots, except the nontreated control. Other treatments included Envoke at 0.15 oz/ac, Envoke 0.15 oz/ac plus Dual Magnum at 16 oz/ac, Dual Magnum at 16 oz/ac plus Roundup Weathermax at 22 oz/ac, Envoke at 0.15 oz/ac plus Roundup Weathermax at 22 oz/ac, Staple at 3.8 oz/ac, Envoke at 0.15 oz/ac plus Staple at 3.8 oz/ac POST applied to either 5 leaf, or 8 leaf cotton, for a total of 13 treatments (Table 1). Herbicides were applied by tractor or backpack, pressurized by compressed air or CO<sub>2</sub>, delivering 15 gal/ac.

Visual estimates of crop tolerance and weed control (on a scale of 0 to 100%, where 0% = no injury or weed control and 100% = cotton death or complete weed control) were estimated throughout the growing season. Weed species included sicklepod, wild poinsettia, and Palmer amaranth at Plains and smallflower and ivyleaf morningglory, Florida beggarweed, and Texas panicum at Ty TY. Yield was determined by mechanically harvesting each plot. Data was subjected to an analysis of variance appropriate for a randomized complete block design for a factorial arrangement of treatments. The nontreated control was not included in the analysis to provide homogeneity.

## **Results and Discussion**

Different weeds appeared at each location so these were analyzed separately. Weed pressure also varied between years for each location so data is presented separately by year. There was an interaction between the 5 leaf and 8 leaf treatments for all variables for Plains so data is presented by treatment application timing for this location. There was not a significant interaction for the treatment timing for the Ty Ty location, therefore data was combined across application timing. Additionally, there were no differences for cotton injury for any treatment, with less than 8% observed for any treatment and this was transient across years and locations (Data not shown).

Wild poinsettia control was very poor, (50% or less) in 2007 for Plains for any 5 leaf herbicide application (Table 1). This was attributed to the continued emergence of wild poinsettia after the 3 leaf glyphosate and 5 leaf residual herbicide applications. Even though the initial treatments controlled wild poinsettia, only the 8 leaf applications that contained Roundup Weathermax provided acceptable control (95% and greater). By the time the 8 leaf applications of Envoke, Envoke plus Dual Magnum, Staple, or Envoke plus Staple were applied, the wild poinsettia had become established, greater than 4 inches tall, and were not controlled (36% and less). In contrast, in 2008 all 5 leaf treatments provided 88% or greater wild poinsettia control. Only Staple alone applied at

the 8 leaf stage did not provide acceptable wild poinsettia control, 63% in 2008. These data indicate that wild poinsettia control with these herbicides can be highly variable from one year to the next, and farmers should continue to scout fields where this weed is present since it can continuously emerge throughout the growing season.

Sicklepod was effectively controlled by all 5 leaf herbicide treatments following the 3 leaf application of Roundup Weathermax (Table 1). Only Staple applied alone at the 8 leaf cotton stage of growth had reduced sicklepod control at 80% in 2007 and 84% in 2008. Envoke and Roundup Weathermax provided good to excellent sicklepod control, but Staple has poor activity for this weed. While early season control of sicklepod control was achieved with the 3 leaf application, Roundup Weathermax or Envoke was required to maintain adequate season-long control.

For Plains, this Palmer amaranth population was susceptible to Roundup Weathermax and the ALS herbicide Envoke and Staple with 82% or greater control for the 5 leaf applications (Table 1). However, Envoke plus Dual Magnum applied at 8 leaf cotton resulted in reduced Palmer amaranth control, 67%. Compared to Envoke alone at the 8 leaf stage of cotton growth, which was 88%, there could be some antagonism of Envoke activity by Dual Magnum for control of Palmer amaranth when these two herbicides were tank-mixed. Further research needs to be conducted to establish if there is potential antagonism occurring.

For the Ty Ty studies in 2007 and 2008, all herbicide treatments and timings effectively controlled Florida beggarweed, smallflower and ivyleaf morningglory, and Palmer amaranth (Table 2). Previous reports have indicated poor smallflower morningglory control with Envoke, but this was avoided with the use of Roundup Weathermax applied to 3 leaf cotton growth.

Seed cotton yield varied by location and year (Table 2 and 3). For Plains in 2007, data indicated significant seed cotton yield reductions for any application containing Envoke or Staple. This was attributed to the lack of wild poinsettia control at this location for these treatments. Yield was significantly greater for the treatments containing Roundup Weathermax in 2007 at the 5 leaf and 8 leaf growth stages. While farmers may try to reduce the overall use of glyphosate in their Roundup Ready or Flex cotton systems due to herbicide resistance, other weed spectrums may necessitate its use to prevent crop failure. Yield for Plains and Ty Ty in 2007 and 2008 were greater than the nontreated controls each year (Tables 2 and 3).

In conclusion, farmers need to continue to scout fields and properly identify weed spectrums in order to apply herbicides that will provide timely weed control. But they should also scout fields to ensure that their herbicides are working properly after application and throughout the growing season. Flex cotton can be adapted into these systems.

**Table 1.** Cotton weed control as influenced by herbicide and timing of post emergence application for Plains GA<sup>1</sup>.

Herbicide	Rate	Wild poinsettia				Sicklepod				Palmer amaranth			
		2007		2008		2007		2008		2007		2008	
		Timing		Timing		Timing		Timing		Timing		Timing	
		5 leaf	8 leaf	5 leaf	8 leaf	5 leaf	8 leaf	5 leaf	8 leaf	5 leaf	8 leaf	5 leaf	8 leaf
	oz/ac	%				%				%			
Envoke	0.15	24 c <sup>2</sup>	35 bc	98 a	99 a	92	92	99 a	99 a	82 ab	88 ab	99 a	99 a
Envoke + Dual	0.15 + 16	24 c	24 c	91 a	99 a	92	92	99 a	99 a	88 ab	67 c	99a	99 a
Magnum													
Dual Magnum +	16 + 22	50 b	95 a	95 a	99 a	93	97	96 ab	99 a	93 ab	95 ab	98ab	99 a
RUWM													
Envoke + RUWM	0.15 + 22	24 c	97 a	93 a	99 a	94	96	96 ab	99 a	88 ab	97 a	96 ab	99 a
Staple LX	3.8	24 c	24 c	88 b	63 c	92	80	91 bc	84 c	90 ab	86 ab	93 bc	88 c
Envoke + Staple LX	0.15 + 3.8	24 c	36 bc	98 a	99 a	88	92	99 a	99 a	88 ab	89 a	99 a	99 a

<sup>1</sup>Ratings taken in mid August of each year, 8 to 12 weeks after herbicide applications. A nontreated control was included for all treatments (data not shown), but not included in the analysis. A 3 leaf application of Roundup Weathermax at 22 oz/ac was applied to all treatments, except the nontreated control each year.

<sup>2</sup>Means followed by same letter in columns for the same year do not differ significantly (P=0.05) using Fishers protected LSD test.

**Table 2.** Cotton weed control and yield as influenced by herbicide and timing of post emergence application for Ty Ty GA<sup>1</sup>.

Herbicide	Rate	Morningglory species									
		Florida beggarweed		Smallflower		Ivyleaf		Texas panicum		Yield	
				2007	2008	2007	2008	2007	2008	2007	2008
				%		%		%		lb/ac	
Envoke	0.15	98	98 a <sup>2</sup>	97	96 a	96	96 a	96	95	1140	1550
Envoke + Dual Magnum	0.15 + 16	99	91 b	99	92 b	99	93 b	98	92	1040	1440
Dual Magnum + RUWM	16 + 22	99	96 a	99	95 ab	99	95 ab	99	95	1210	1750
Envoke + RUWM	0.15 + 22	99	98 a	99	96 a	99	96 a	99	96	1070	1680
Staple LX	3.8	99	97 a	99	97 a	99	96 a	98	96	1070	1690
Envoke + Staple LX	0.15 + 3.8	98	96 a	99	96 a	99	96 a	98	96	1130	1440

<sup>1</sup>Ratings taken in mid August of each year, 8 to 12 weeks after herbicide applications. A nontreated control was included for all treatments (data not shown), but not included in the analysis. A 3 leaf application of Roundup Weathermax at 22 oz/ac was applied to all treatments, except the nontreated control each year. Yield of the nontreated was 530 and 60 lbs/ac for 2007 and 2008, respectively.

<sup>2</sup>Means followed by same letter in columns for the same year do not differ significantly (P=0.05) using Fishers protected LSD test. The two-way interaction of herbicide application timing of 5 leaf and 8 leaf was not significant, therefore data were combined across treatment timings.

**Table 3.** Cotton yield as influenced by herbicide and timing of post emergence application for Plains GA<sup>1</sup>.

Herbicide	Rate	2007		2007	
		Timing		Timing	
		5 leaf	8 leaf	5 leaf	8 leaf
	oz/ac	lbs/ac			
Envoke	0.15	1190 e <sup>2</sup>	1340 e	1190	1150
Envoke + Dual	0.15 + 16	1660 de	1510 e	1060	1170
Magnum					
Dual Magnum +	16 + 22	2480 bcd	3530 a	1110	1110
RUWM					
Envoke + RUWM	0.15 + 22	2600 bc	3350 ab	1140	1160
Staple LX	3.8	1270 e	1210 e	1070	1200
Envoke + Staple LX	0.15 + 3.8	1700 cde	1920 cde	1170	1110

<sup>1</sup>A nontreated control was included for all treatments (data not shown), but not included in the analysis. A 3 leaf application of Roundup Weathermax at 22 oz/ac was applied to all treatments, except the nontreated control each year. Yield of the nontreated was 1240 and 150 lbs/ac for 2007 and 2008, respectively.

<sup>2</sup>Means followed by same letter in columns for the same year do not differ significantly (P=0.05) using Fishers protected LSD test.