

ROUNDUP READY COTTON RESPONSE TO GLYPHOSATE PLUS STAPLE OR ENVOKE APPLIED TOPICALLY

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Introduction

Roundup Ready cotton is now the standard technology grown throughout Georgia. Traditional cotton herbicide programs have been largely replaced with weed management systems often consisting of only the herbicide glyphosate (Roundup, others). Although glyphosate effectively controls most of the common weeds in Georgia, several weed species including morningglories have become more troublesome in part to the elimination of traditional herbicide chemistry.

With morningglory being the most common and one of the most troublesome weeds facing Georgia producers, the addition of Staple herbicide with early topical glyphosate applications has become a common practice. Nearly half of Georgia's 1.3 million acres was treated with glyphosate plus Staple in 2003. This mixture effectively controls morningglory but growers continue to voice concerns regarding crop tolerance and potential yield losses from crop injury when applying this mixture to their cotton. Therefore, a study was implemented to evaluate the impact of glyphosate/Staple mixtures applied topically to cotton in the 1- to 5-leaf stage when grown in a weed free environment.

Similar to Staple in *Ipomoea* morningglory activity, Envoke herbicide has recently been commercialized. Envoke will be labeled for application overtop of 5- to 8-leaf cotton, including both conventional and transgenic cotton. The addition of this herbicide in a Roundup Ready system will improve morningglory control. Unfortunately, no research has been conducted evaluating cotton response to Envoke when applied topically following label recommendations.

Thus, the objective of this work was to measure the impact of Staple plus glyphosate or Envoke applied topically on development, maturity, and yield of Roundup Ready Cotton.

Materials and Methods

'DP 555 B/RR' cotton was planted in TyTy and Plains Georgia in early May of 2003. Cotton was grown in a weed free environment without irrigation after the cotton emerged. However, rainfall was plentiful during 2003 and drought stress was not observed for more than two days on this cotton throughout the season. The experimental design was a randomized complete block with treatments arranged factorially and replicated six times. Six replications and the factorial design were utilized to have the greatest ability to separate out treatments statistically. Treatments included two at-plant and five topical herbicide options as shown in Table 1. In TyTy, applications made to 4- and 6-leaf cotton were

purposely applied when injury potential was most likely to occur. For example, soils were wet from a previous rain and a small amount of dew was present on the cotton leaf tissue at the time of these applications. Plots were four rows by 25 feet in length and all inputs for cotton production followed those recommended by the University of Georgia Extension Service, with the exception of herbicide treatments. Visual estimates of crop tolerance were estimated throughout the season. Additionally, cotton heights were measured on three separate dates and 10 plants per plot were mapped prior to harvest. The middle two rows of each plot were harvested with a spindle picker modified for plot work.

Table 1. Factorial arrangement of treatments including 2 at-plant and 5 topical options.*

At-plant options		Topical options		
Prowl + Cotoran		1-leaf cotton	4-leaf cotton	6-leaf cotton
Prowl + Cotoran + Staple		RU	RU	
		RU + Staple (0.4 oz/A)	RU + Staple (0.4 oz/A)	
		RU	RU + Staple (0.6 oz/A)	
		RU	RU + Staple (0.9 oz/A)	
		RU	RU	Envoke

*Prowl, Cotoran, and Staple PRE applied at 2 pt, 1.5 pt, and 0.8 oz/A, respectively. RU = Roundup WeatherMax applied at 26 oz/A. A nonionic surfactant was included with Envoke (0.1 oz/A) only. The entire trial received a Caparol plus MSMA directed application.

Results and Discussion

Visual Cotton Injury. In Plains, herbicide applications had minor and insignificant effects on cotton (data not shown). In TyTy, soil-applied herbicides did not injure cotton and had no effects on cotton response to topical applications. In contrast, injury main effects from topical applications were significant and are reported.

Roundup WeatherMax did not visually injure cotton throughout the experiment (Table 2). Mixing Staple (0.6 or 0.9 oz/A) with Roundup and applying topically to 4-leaf cotton visually injured cotton 36 to 37% at 3 days after treatment (DAT). Injury was a measure of leaf necrosis and leaf drop. Sequential applications of Staple (0.4 oz) plus Roundup applied to 1- and 4-leaf cotton caused injury similar to that of the single application. By 8 DAT, visual cotton injury was still severe with Roundup plus Staple topical systems but injury did begin to disappear by 22 DAT with 10% or less injury detected.

Envoke applied topically to 6-leaf cotton caused only 13 and 8% injury at 4 and 18 DAT (Table 2). Visual injury from Envoke was a measure of leaf chlorosis which was transient and short lived.

Table 2. Visual estimates of cotton injury throughout the season. TyTy, Georgia.*

Cotton Growth Stage at Time of Topical Application**			Percent Cotton Injury		
1-leaf	4- to 5-leaf	6-leaf	3 day after 4-leaf application	4 & 8 day after 6- & 4-leaf applications, respectively	18 & 22 d after 6- & 4-leaf applications, respectively
RU	RU		0 b	0 c	0 b
RU + Staple (0.4 oz/A)	RU + Staple (0.4 oz/A)		34 a	26 a	8 a
RU	RU + Staple (0.6 oz/A)		36 a	27 a	9 a
RU	RU + Staple (0.9 oz/A)		37 a	29 a	10 a
RU	RU	Envoke	0 a	13 b	8 a

*Means followed by the same letter within a column are not significantly different ($P=0.05$). Data pooled over the at-plant herbicide options.
**Prowl, Cotoran, and Staple PRE applied at 2 pt, 1.5 pt, and 0.8 oz/A, respectively. RU = Roundup WeatherMax applied at 26 oz/A. A nonionic surfactant was included with Envoke (0.1 oz/A) only.

Cotton Height. Herbicide applications did not affect cotton height in Plains. Similarly, soil applied herbicides did not affect cotton height and had no effects on cotton response to topical applications in TyTy (data not shown). Main effects from topical applications in TyTy were significant and are reported.

Mixing Staple (0.6 or 0.9 oz/A) with Roundup reduced cotton heights by 17 to 19% at 7 and 12 DAT (Table 3). Although these treatments did not statistically reduce cotton height at harvest, the trend for smaller cotton was apparent. Cotton height response to the sequential Staple (0.4 oz) plus Roundup treatment was similar to that noted with the single application of Staple (0.6 to 0.9 oz) plus Roundup, although there was a trend for less stunting with the sequential low Staple rate applications.

At 3 DAT, Envoke did not affect cotton height (Table 3). However, cotton growth was stunted 10% at 8 DAT. Cotton height was not statistically impacted at harvest but the trend for smaller cotton was noted in the Envoke treatment as compared to the Roundup only system.

Table 3. Cotton heights as impacted by topical herbicide applications. TyTy, GA.*

Stage of Cotton Growth at Time of Topical Application**			Cotton Height (cm)		
1-leaf	4- to 5-leaf	6-leaf	3 & 7 day after 6- & 4-leaf applications, respectively	8 & 12 day after 6- & 4-leaf applications, respectively	At harvest
RU	RU		22.7 a	32.1 a	90.1 a
RU + Staple (0.4 oz/A)	RU + Staple (0.4 oz/A)		19.4 ab	28.1 bc	90.1 a
RU	RU + Staple (0.6 oz/A)		18.8 b	26.7 c	87.7 a
RU	RU + Staple (0.9 oz/A)		18.4 b	26.7 c	85.0 a
RU	RU	Envoke	22.8 a	29.0 b	85.9 a

*Means followed by the same letter within a column are not significantly different ($P=0.05$). Data pooled over the at-plant herbicide options.
**Prowl, Cotoran, and Staple PRE applied at 2 pt, 1.5 pt, and 0.8 oz/A, respectively. RU = Roundup WeatherMax applied at 26 oz/A. A nonionic surfactant was included with Envoke (0.1 oz/A) only.

Plant Mapping Data. Ten plants per plot were mapped to evaluate the impact Staple plus Roundup or Envoke had on cotton maturity and boll set throughout the cotton profile. Treatments did not impact the number of total nodes produced as well as bolls set on fruiting positions 5-9, 10-14, 15-20, 20-24, and 5-24 at Plains or TyTy.

Seed Cotton Yield. Cotton yield was statistically similar among all herbicide systems.