

ROUNDUP READY COTTON RESPONSE TO STAPLE AND ENVOKE

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Abstract

Throughout the southern production region of the US, Roundup Ready cotton has become the standard. Glyphosate can control many of the common and troublesome weeds that are found in this region. However, long growing seasons and weed tolerance issues necessitate the use of residual herbicides applied preemergence (PRE), or either tank-mixed with, or as a sequential too, glyphosate. Studies were initiated to evaluate season long cotton response to various herbicide programs in Tifton and Plains GA, Rocky Mount and Lewiston NC, and Alexandria LA. Treatments included a 2 x 5 factorial arrangement of treatments of PRE applied Cotoran + Prowl or Cotoran + Prowl + Staple (08 oz/ac) with post-emergence (POST) applied Roundup Weathermax followed by (fb) Roundup WeatherMax, Roundup WeatherMax + Staple (0.4 oz/ac) fb Roundup WeatherMax + Staple (0.4), Roundup WeatherMax fb Roundup WeatherMax + Staple (0.6 oz/ac), Roundup WeatherMax fb Roundup WeatherMax + Staple (0.9 oz/ac), or Roundup WeatherMax fb Roundup WeatherMax fb Envoke (0.1 oz/ac). For the factorial analysis, PRE herbicide applications did not injure cotton. There was ~30% injury and 19% height reduction for the Tifton location for glyphosate + Staple POST applied. The other 4 locations exhibited less or no Staple injury. Envoke injured cotton at all locations but was most sever at Alexandria with 56% stunting and 17% height reduction. Season ending height, number of bolls, height/boll ratio, and seed cotton yield were not affected by any treatment. Plant map data for the positions one and two for nodes five through twenty five did not reveal any significant differences for boll development at the GA and NC locations.

Introduction

Roundup Ready cotton is now the standard technology grown throughout the southern US. Traditional cotton herbicide programs have been largely replaced with weed management systems often consisting of only the herbicide glyphosate. Although glyphosate effectively controls most of the common weeds, several weed species, including morningglory species (*Ipomoea*), 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 producers, the addition of Staple herbicide with early topical glyphosate applications has become a common practice. Nearly half of the 1.3 million acres grown in Georgia 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 series of studies 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. Therefore, Envoke will be applied overtop of 5- to 8-leaf cotton grown in a weed free environment.

Thus, the objective of this work was to measure the impact of Staple used sequentially and in combination with glyphosate and the use of Envoke following glyphosate on Roundup Ready cotton development, maturity, and yield. Studies were conducted in a multiple states and locations.

Materials and Methods

Roundup Ready cotton was planted at the respective locations. Cotton was grown in a weed free environment without irrigation after the cotton emerged. The experimental design was a randomized complete block with treatments factorially arranged 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. Applications made to 4- and 6-leaf cotton were purposely applied when injury potential was most likely. Plots were four rows by 25 to 35 feet in length and all inputs for cotton production followed those by the University Extension Services, 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.

Results and Discussion

Visual Cotton Injury

Soil applied herbicides did not injure cotton and had no effects on cotton response to topical applications at any location. Main effects from topical applications were significant at Tifton, Rocky Mount, Lewiston, and Alexandria. Roundup WeatherMax did not visually injure cotton throughout the experiment. 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) at Tifton (Table 2). Injury was a measure of leaf necrosis and leaf drop. Sequential applications of Staple (0.4 oz) plus Roundup 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. This same pattern of injury was noted at Alexandria (Table 3), Rocky Mount, and Lewiston but was not as severe (data not shown).

Envoke applied topically to 6-leaf cotton caused only 13 and 8% injury at 4 and 18 DAT at Tifton (Table 2) and was similar at Rocky Mount and Lewiston NC (data not shown). Injury from Envoke was a measure of leaf chlorosis which was transient and short lived at these locations. Injury from Envoke was severe at Alexandria at 56% at 7 DAT (Table 3).

Cotton Height

Soil applied herbicides did not affect cotton height and had no effects on cotton response at any location. Main effects from topical applications were significant at Tifton and Alexandria and were reflective of herbicide injury. Mixing Staple (0.6 or 0.9 oz/A) with Roundup reduced cotton heights by 17 to 19% at 7 and 12 DAT at Tifton and was similar at Alexandria (data not shown). Although this treatment did not statistically reduce cotton height at harvest at Tifton, the trend for smaller cotton was apparent at this location. 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 or 0.9 oz) plus Roundup, although there was a trend for less stunting with the sequential applications containing low rates of Staple. At 3 DAT, Envoke did not affect cotton height. 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. No height differences were noted at Plains, Rocky Mount, or Lewiston.

Plant Mapping Data

At each location, ten plants per plot were mapped to evaluate the impact Staple plus Roundup or Envoke would have 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.

Seed Cotton Yield

Cotton yield was similar among all herbicide systems at all locations.

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

<u>At-plant options</u>	<u>Topical options</u>		
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 22 oz/A. A nonionic surfactant was included with Envoke 0.1 oz/A only. The entire trial received Caparol plus MSMA directed application.

Table 2. Visual estimates of cotton injury throughout the season at Tifton, GA*.

Stage of Cotton Growth**			3 day after	4 & 8 day after 6- &	18 & 22 d after 6- &
1-leaf	4- to 5-leaf	6-leaf	4-leaf application	4-leaf applications, respectively	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 22 oz/A. A nonionic surfactant was included with Envoke (0.1 oz/A) only.

Table 3. Visual estimates of cotton injury throughout the season at Alexandria, LA*.

Stage of Cotton Growth**			3 days after	3 days after	7 days after
1-leaf	4- to 5-leaf	6-leaf	1-leaf	the 4-leaf	the 6-leaf
				%	
RU	RU		0 b	0 c	0 b
RU + Staple (0.4 oz/A)	RU + Staple (0.4 oz/A)		23 a	15 a	0 b
RU	RU + Staple (0.6 oz/A)		0 b	9 b	0 b
RU	RU + Staple (0.9 oz/A)		0 b	13 a	0 b
RU	RU	Envoke	0 b	0 c	56 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 22 oz/A. A nonionic surfactant was included with Envoke (0.1 oz/A) only.