EVALUATION OF WEED CONTROL PROGRAMS AND SALT FORMULATIONS IN GLYPHOSATE-RESISTANT COTTON

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ABSTRACT

The purpose of this study was to evaluate the influence of glyphosate and glyphosate potassium salt on weed control, plant growth and yields of glyphosate-resistant cotton (*Gossypium hirsutum* L.). Field research was conducted at the University of Florida's North Florida Research and Education Center in Quincy, FL in 2002. Evaluated treatments were glyphosate and glyphosate potassium salt herbicides at 0.38, 0.56, and 0.75 lb ae/A, and glyphosate and glyphosate potassium salt herbicides at 0.75 lb ae/A with ammonium sulfate at 2% v/v. The sicklepod (*Cassia obtusifolia* L.) weed control was generally great, except less control for treatments with glyphosate at 0.75 lb ae/A and glyphosate potassium salt at 0.38 ae/A (68 and 75%, respectively) at 10 days after treatment (DAT). However, sicklepod control was not significantly different among herbicide treatments at 21 DAT. Dayflower (*Commelina communis* L.) control was great for most herbicide treatments, except least control obtained with glyphosate application at 0.56 lb ae/A at 10 and 21 DAT (53 and 76%, respectively). Ammaranth spp. (*Amaranthus* ssp.) control was above 90% for all herbicide treatments. Compared to glyphosate treatment at 0.56 lb ae/A, the application of glyphosate potassium salt at 0.56 lb ae/A increased boll number per cotton plant from 8.4 to 11.6 bolls/plant and lint cotton yields from 445 to 609 lb/A, respectively. However, cotton lint yields decreased from 559 lb/A to 381 lb/A when ammonium sulfate (2% v/v) was mixed with glyphosate potassium salt (0.75 lb ae/A). The results of this study indicate that application of glyphosate potassium salt may help to increase the boll number and lint yields of glyphosate-resistant cotton.

INTRODUCTION

With the recent introduction and growing interest in glyphosate-resistant cotton more herbicide programs are needed to effectively control weeds. Glyphosate-resistant cotton has been available for research testing at Universities since 1995 (Hayes et al., 1996). Glyphosate-resistant cotton was introduced to farmers in 1997 with little variety trial testing (May et al., 2000). Generally, glyphosate can be applied broadcast up to the four-leaf stage and followed by post-directed application in glyphosate resistant cotton (Kerby and Voth, 1998). Foliar herbicide applications were intended to replace soil-applied herbicides used in standard systems (Askew and Wilcut, 1999), because weed management systems that included a post-directed or postemergence herbicide application provided greater weed control than those with preemergence herbicides only (Vencill et al., 1994). According to McCarty (1997), a glyphosate weed control program may allow the reduction of herbicide rates or the elimination of certain preemergence herbicides in sandy, low organic matter soils, thereby preventing herbicide injury to seedlings. The objective of this study was to evaluate treatments with glyphosate, glyphosate potassium salt, and a mix of these herbicides with ammonium sulfate on weed control, plant growth, and yields of glyphosate-resistant cotton.

METHODS AND MATERIALS

Field research with glyphosate-resistant cotton was conducted during 2002 on a Dothan sandy loam (fine, loamy siliceous, thermic Plinthic Kandiudults) at the North Florida Research and Education Center / University of Florida in Quincy, FL. The rows were ripped with the Brown Ro-till

implement (Brown Manufacturing Co., Ozark, AL) on 15 April. The following day, the study was fertilized with 5-10-15 (N-P_2O_5-K_2O) at 500 lbs/A material and planted with DP 458 B/RR cotton at 4 seeds/ft of row and 36 inch row spacing using a Monosem air planter. Herbicide treatments were applied broadcast postemergence in cotton on 7 May (the targeted weed species were approximately 2 - 4 inch tall). The experiment was sprayed with mepiquat chloride (0.7 oz a.i./A) + Induce (0.5% v/v) on 12 June and 3 July, and mepiquat chloride (0.35 oz a.i./A) + Agridex (0.5% v/v) on 23 July to control plant height. Cotton was defoliated with ethephon (1.14 lb a.i./A) + thidiazuron (0.1 lb a.i./A) on 17 September and picked with the International Spindle Picker on 23 October. Cotton was irrigated with 0.5 and 0.6 inch water on 18 April and 4 June, respectively.

Sickepod, dayflower, and amaranth spp. weed control was evaluated at 10 and 28 days after treatment (DAT) application. Weeds were evaluated based on the visual scale from 0 (no weed control) to 100% (complete weed control). The plant height, node number and plant ratio (plant height divided by node number) were obtained at 90 and 150 days after planting. The number of bolls per plant was recorded at 120 days after planting. Lint yields were calculated by multiplying seed cotton yields by lint percent.

The experimental design was a Randomized Complete Block with four replications. Data were analyzed using the general linear models (SAS, 1999), and means were separated using Fisher's Least Significant Difference Test ($P \leq 0.05$).

RESULTS AND DISCUSSION

The influence of herbicide treatment on weed control at 10 and 28 days after treatment (DAT) application is shown in Table 1. The sicklepod weed control was generally great for most herbicide treatments at 10 and 21 DAT. Among herbicide treatments, the least sicklepod control was obtained with glyphosate at 0.75 lb ae/A and glyphosate potassium salt at 0.38 ae/A (67.5 and 75.0%, respectively) at 10 DAT. However, at 21 DAT, sicklepod control was not influenced by herbicide treatment. Dayflower control was also great for most herbicide treatments, except least control with glyphosate application at 0.56 lb ae/A at 10 and 21 DAT. Among herbicide treatments, amaranth spp. control was above 90% with the least control for treatment with the application of glyphostate at 0.38 lb ae/A at 10 DAT and 28 DAT, and glyphosate potassium salt at 0.56 lb ae/A at 28 DAT. The herbicide treatment of glyphosate potassium salt at 0.38 lb ae/A provided greater (100%) amaranth ssp. control than glyphosate application at 0.38 lb ae/A (93.2%). Vencill et al. (1994) also noted that weed management systems that included a postemergence herbicide application provided great weed control. According to Wiatrak et al. (2002), post applications of glyphosate provided weed control ranging from 82 to 89%.

Glyphosate-resistant cotton plant height and node number at 90 and 150 DAP, and plant ratio at 90 DAP were greater from herbicide treatments than the untreated control (Table 2). Plant ratio at 150 DAP was generally high, except the plant ratio for untreated check and treatments with glyphosate potassium salt at 0.56 lb ae/A and glyphosate application at 0.56 lb ae/A. However, Wiatrak et al. (2002) showed no significant influence of herbicide treatment on cotton plant height, node number, and plant ratio 90 DAP.

Boll number per plant was relatively high, except least number from untreated control and treatments with glyphosate potassium salt at 0.75 lb ae/A + ammonium sulfate and glyphosate at 0.56 lb ae/A (Table 2). Moreover, application of glyphosate potassium salt at 0.56 lb ae/A significantly increased boll number per plant compared to the treatment with glyphosate at 0.56 lb ae/A. Herbicide treatment did not affect percent lint. Greatest lint yields of cotton were obtained

from treatments with glyphosate potassium salt at 0.56 lb ae/A, glyphosate at 0.75 lb ae/A, glyphosate potassium salt at 0.75 lb ae/A, glyphosate potassium salt at 0.38 lb ae/A, and glyphosate at 0.75 lb ae/A + ammonium sulfate at 2% v/v.

CONCLUSIONS

Generally, weed control was relatively high with the application of most herbicide treatments. At 10 and 28 DAT, herbicide treatments provided at least 68 and 71% sicklepod control, 53 and 76% dayflower control, and 93 and 92% amaranth ssp. weed control, respectively. Glyphosate-resistant cotton plant height, node number, and plant ratio were greater from herbicide treatments than untreated control at 90 and 150 DAP, except less plant ratio for untreated control and treatments with glyphosate potassium salt at 0.56 lb ae/A and glyphosate at 0.56 lb ae/A at 150 DAP. Compared to the treatment with glyphosate at 0.56 lb ae/A, glyphosate potassium salt at 0.56 lb ae/A significantly increased the number of bolls per plant and lint yields of cotton.

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Table 1. Influence of herbicide treatment on sicklepod, dayflower, and amaranth ssp. control at 10 and 28 days after treatment (DAT) application at Quincy, FL.

Product	Rate	Sicklepod control (DAT)		Dayflower control (DAT)		Amaranth ssp. control (DAT)	
	lb ae/A	10	28	10	28	10	28
Glyphosate	0.38	85	85	66	81	93	93
Glyphosate	0.56	90	84	53	76	100	100
Glyphosate	0.75	68	88	81	95	100	98
Glyphosate potassium salt	0.38	75	88	68	85	100	98
Glyphosate potassium salt	0.56	79	71	58	84	95	92
Glyphosate potassium salt	0.75	98	89	73	93	95	100
Glyphosate + amm. sulfate (2% v/v)	0.75	79	89	71	94	100	100
Glyphosate potassium salt + amm. sulfate (2% v/v)	0.75	84	75	65	95	100	100
Untreated control	-	0	0	0	0	0	0.0
$LSD_{(0.05)}$		21	21	27	14	5	6

Table 2. Influence of herbicide treatment on plant height, node number, and plant ratio (plant height / node number) at 90 and 150 days after planting (DAP), and yields and percent lint of glyphosate-resistant cotton at Quincy, FL.

Product	Rate	90 DAP			150 DAP			Boll number	Percent lint	Lint yield
	lb ae/A	Plant height	Node number	Plant ratio	Plant height	Node number	Plant ratio			
		- inch -	#/plant	- ratio -	- inch -	#/plant	- ratio -	#/plant	-- % --	- lb/A -
Glyphosate	0.38	31.0	18.1	1.72	35.9	23.8	1.51	9.5	43.4	442
Glyphosate	0.56	29.9	17.3	1.73	35.4	24.2	1.46	8.4	46.2	445
Glyphosate	0.75	32.2	17.8	1.82	36.9	23.4	1.58	11.0	42.7	574
Glyphosate potassium salt	0.38	31.2	17.7	1.76	36.6	23.9	1.53	9.7	44.7	557
Glyphosate potassium salt	0.56	31.6	18.0	1.76	35.2	24.3	1.45	11.6	43.6	609
Glyphosate potassium salt	0.75	31.1	17.3	1.80	36.2	22.8	1.59	9.3	42.4	559
Glyphosate + amm. sulfate (2% v/v)	0.75	32.0	17.9	1.79	37.5	24.0	1.57	10.7	39.1	480
Glyphosate potassium salt + amm. sulfate (2% v/v)	0.75	31.9	17.7	1.80	35.2	22.8	1.55	8.3	38.0	381
Untreated control	-	21.1	13.0	1.60	23.4	18.4	1.27	2.5	40.9	123
$LSD_{(0.05)}$		2.71	1.08	0.12	2.9	1.9	0.09	3.2	NS	144