ROUNDUP READY® COTTON PROGRAMS IN CONSERVATION TILLAGE

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RESEARCH PROBLEM

The inclusion of glyphosate-resistant (Roundup Ready®) cotton into our arsenal of weed control options for cotton can benefit producers. Glyphosate (Roundup Ultra®) has a broad spectrum of activity and can be applied throughout the season. Topical applications can be made through the four-leaf stage of cotton growth, with later applications post-directed. Because glyphosate can be applied over the top early in the season and controls both grass and broadleaf weeds, it may be especially beneficial in conservation-tillage cotton where early-season weed control is crucial to success, and standard preplant-incorporated herbicides are not used. However, the economic performance of cotton programs in Roundup Ready cotton must be evaluated before producers can choose an appropriate program for a conventional or conservation production system.

BACKGROUND INFORMATION

Roundup Ready cotton programs have been shown to fit well into several conservation-tillage systems (Askew *et al.*, 1998; Smith *et al.*, 1998). Producers have a number of options in the Roundup Ready system, including Roundup alone, preemergence herbicides followed by (*fb*) Roundup postemergence (POST), or Roundup POST *fb* a residual herbicide at layby, with Roundup applied as needed but not to exceed 4 lb of active ingredient (4 qt) in a season. Several studies were conducted in the mid-South in 1998 to examine the efficacy and economics of weed control in Roundup Ready systems (Askew *et al.*, 1998; Bradley *et al.*, 1998; Kendig *et al.*, 1998; Patterson *et al.*, 1998; Smith *et al.*, 1998; Wilcut *et al.*, 1998). The Roundup Ready systems provided good weed control and cotton yield and generally were equal to control and yield from conventional herbicide programs. At several of the test locations, Roundup alone was as good a treatment as Roundup with residual herbicides applied PRE or post-directed. Although yield of cotton treated with conventional herbicides did not differ from yield in Roundup Ready systems, Bradley *et al.* (1998) reported lower cost in the Roundup system. Patterson *et al.* (1998) also reported higher net returns in Roundup Ready systems than in conventional.

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RESEARCH DESCRIPTION

The experiment was conducted in 1996 through 1998 at Rohwer on a silt loam soil. Each plot was eight, 38-inch rows by 50 ft, and each experiment was a randomized complete-block design with four replications. The conservation-tillage system used each year was a stale seedbed (beds hipped and leveled in fall 1995 and rehipped and leveled in spring 1997 and 1998), after which no tillage was used. Conventionally tilled plots were disked and hipped in the spring, leveled at planting, and cultivated during the season. Each plot was maintained in the same location in the field for the 3 years. Roundup Ready cultivars were planted 23 May 1996, 16 May 1997, and 8 May 1998. Glyphosate was applied to conservation-tillage plots at planting to control winter and early spring weeds. Herbicides were applied with a backpack or tractor-mounted, CO_2-propelled sprayer at 15 gal/acre. Treatments and designations used in results are presented in Table 1. Plots were rated visually for percentage of weed control and cotton injury during the season and were harvested for seedcotton yield. Data were analyzed by analysis of variance, and means were separated using Fisher's Protected Least Significant Difference at the 0.05 level.

RESULTS AND DISCUSSION

Control of barnyardgrass (*Echinochloa crus-galli*) and pitted morningglory (*Ipomoea lacunosa*) was good and did not differ among treatments in any year of the experiment (Table 2). The barnyardgrass population was high and necessitated cultivation in conventional-tillage plots and broadcast postemergence applications in conservation-tillage plots.

Seedcotton yields differed slightly among treatments in 1996 (Table 3). (Yield was not obtained in 1997 because of an inadvertent overspray to the test area.) By 1998, yields were statistically equal. For equivalent herbicide treatments, cost in conventional tillage was lower than in conservation tillage (Table 4). Stale seedbed was used rather than no-till because bed integrity was not maintained in the light soil at this location; therefore, cost of tillage differed only in the cost of disking. Savings in tillage cost in conservation tillage was offset by cost of the burndown treatment at planting. The cost of the two Roundup Ultra-alone programs was lower than the cost of standard programs.

Revenue, thus return on tillage and weed control system, was based on a $0.68/lb cotton price. Return on the weed control system was affected by cotton yield, with slight differences in 1996 and no difference among treatments in 1998.

As also reported by Kendig *et al.* (1998), glyphosate did not add any specific benefit to the conservation-tillage systems. However, it performed as well as a standard herbicide program and provides an economical alternative to the standard system.

PRACTICAL APPLICATION

The Roundup Ready system provides a new weed control option for cotton producers and can be used in either conventional or conservation-tillage production practices. Results from this study indicate that the return from conservation-tillage systems

can equal or exceed that from conventional systems. Because saving time (fewer trips across the field, potentially earlier planting, etc.) is an advantage of conservation-tillage systems and because return on tillage and the weed control system is equal to that of conventional systems, conservation-tillage production using the Roundup Ready system is a viable option for some cotton producers.

LITERATURE CITED

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Table 1. Treatments and treatment designations.

Designation[z]	Herbicide[y]	Rate	Application Time
		lb ai/acre	
STD	Fluometuron +	0.8 +	PRE
(conv. and con-till)	pendimethalin *fb*	1.0	
	fluometuron +	0.8 +	EDIR
	MSMA *fb*	1.5	
	cyanazine +	1.0 +	LDIR
	MSMA *fb*	1.5	
	cyanazine + COC	1.0	Layby
RU, RU	Glyphosate *fb*	1.0	EOT
(conv. and con-till)	glyphosate	0.75	LDIR
PRE, RU, RU	Fluometuron +	0.8 +	PRE
(con-till)	pendimethalin *fb*	1.0	
	glyphosate *fb*	1.0	EOT
	glyphosate	0.75	LDIR
RU, RU, Layby	Glyphosate *fb*	1.0	EOT
(con-till)	glyphosate *fb*	0.75	EDIR
	cyanazine + COC	1.0	Layby

[z] Abbreviations: ai, active ingredient; conv., conventional tillage; con-till, conservation tillage; COC, crop oil; EDIR, early post-directed (2- to 4-lf cotton); *fb*, followed by; LDIR, late post-directed (6- to 9-lf cotton); PRE, preemergence; RU, glyphosate; STD, standard program.

[y] Commercial trade names of herbicides used: cyanazine, Bladex; fluometuron, Cotoran; glyphosate, Roundup Ultra; MSMA, Bueno 6; pendimethalin, Prowl.

Table 2. Percentage of weed control 3 wk after layby, Rohwer, AR.

	Barnyardgrass			Pitted morningglory	
Treatment[z]	1996	1997	1998	1997	1998
	---------- % ----------				
Conv. - STD.	95	93	95	97	100
Con-till - STD.	94	89	93	93	94
Con-till - PRE, RU, RU	94	89	93	94	100
Con-till - RU, RU, Layby	96	89	86	96	100
Con-till - RU, RU	96	88	94	95	100
Conv. - RU, RU	93	84	96	95	100
LSD (0.05)	NS[y]	NS	NS	NS	NS

[z] Treatment descriptions are listed in Table 1.

[y] NS indicates not significant.

Table 3. Seedcotton yield, Rohwer, AR.

Treatment[z]	Seedcotton Yield 1996	1998
	lb/acre	
Conv. - STD.	2400 cd[y]	3028 a
Con-till - STD.	2630 abc	3385 a
Con-till - PRE, RU, RU	2309 d	2912 a
Con-till - RU, RU, Layby	2703 ab	3048 a
Con-till - RU, RU	2521 bcd	3079 a
Conv. - RU, RU	2777 a	3240 a

[z] Treatment descriptions are listed in Table 1.

[y] Means followed by the same letter do not differ according to LSD (0.05).

Table 4. Cost and return of tillage and weed management treatments, Rohwer, AR.

Treatment[y]	Cost	Return[z] 1996	1998
	$/acre		
Conv. - STD.	55.30	483.15 cd	624.16 a
Con-till - STD.	66.40	523.72 bc	693.24 a
Con-till - PRE, RU, RU	53.21	464.82 d	600.18 a
Con-till - RU, RU, Layby	48.13	558.42 ab	635.91 a
Con-till - RU, RU	34.54	531.12 bc	656.38 a
Con-till - RU, RU	33.49	589.61 a	693.50 a

[z] Means followed by the same letters do not differ according to LSD (0.05).

[y] Treatment descriptions are listed on Table 1.