Weed Management in No-Till Roundup Tolerant Soybean and Cotton

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INTRODUCTION

Conservation tillage is not a new concept in row-crop agriculture. Benefits associated with cover crops and reduced tillage are well documented and include decreased soil erosion, enhanced soil moisture, and reduced equipment, energy, and labor input. (Gallaher, 1977; Hayes, 1982; Young, 1982; Papendick, 1987; Teasdale, 1993). However, even though cover crops can offer some suppression of weed growth (Barnes, 1983; Lodhi, 1987), inadequate weed management systems have been a barrier to further adoption of conservation tillage practices (Yenish, 1996; Gebhardt, 1985).

With the recent introduction of genetically altered crops which can tolerate postemergence over-the-top application of Roundup (glyphosate), new systems are now available for weed management in no-till soybeans *(Glycine max* L.) and cotton *(Gossypium hirsutum* L.). The objective of this research was to evaluate several soybean and cotton weed management programs which include Roundup postemergence as a component in a no-till cropping system.

MATERIALS AND METHODS

General Procedures

Studies were conducted at the University of Florida, West Florida Research and Center near Jay, FL, to evaluate weed management in Roundup tolerant soybean and cotton. The soil in the study area was a Red Bay sandy loam (fine loamy, siliceous, thermic Rhodic Paleudults) with pH 5.5 and 2% organic matter. A wheat *(Triticum aestivum* L.) cover crop was killed with an application of Roundup (1 lb/a) 2 wk prior to planting. Crops were planted at the rate of 5 seeds/ft in rows spaced 30 in apart into the killed cover crop with an in-row subsoil no-till planter.

Soybean

'Hartz **6686'** soybean (Roundup tolerant) was planted in 1995 and 1996 during late May. Herbicides were applied with a tractor-mounted boom sprayer using air as a propellent and 10004 flat fan nozzles operated at 20 psi to deliver 20 g/a spray solution. Herbicide treatments included Roundup at 0.5, 0.75, and 1.0 lb/a applied early postemergence (EF) over the top of soybean 6 to 8 in and weeds 1 to 4 in tall and postemergence POST) to soybean 10 to 12 in and weeds 4 to 8 in tall. Sequential applications of Roundup EP followed by Roundup late postemergence (LP) to soybeans 20 to 24 in and weeds 3 to 12 in tall were also evaluated. The standard treatment of Treflan (trifluralin) plus Sencor (metribuzin) preplant incorporated (PPI) followed by Classic (chlorimuron) LP was included for comparison.

Cotton

'Coker 312' cotton (Roundup tolerant) was planted on 20 May 1996, using the procedures described above. Preemergence (PRE) and postemergence over-the-top treatments were applied with the same equipment and settings as for soybean. Early postemergence applications were made to cotton 5 to 8 in (3 to 4 leaf) and weeds 1 to 6 in tall. Directed postemergence (DP) treatments were applied to cotton 10 to 15 in and weeds 4 to 10 in tall. The applicator used for DP treatments consisted of 11002 flat fan nozzles mounted on skids (two per skid) using CO_2 as a propellant and operated at 25 psi to deliver 20 gal/a. The nozzles were adjusted so that the spray was directed toward the base of the cotton plants to minimize contact with the crop foliage.

Herbicide treatments evaluated in cotton included Roundup applied at 1 lb/a EP over the top or DP, a sequential application of EP followed by DP, Roundup EP followed by Bladex (cyanazine) at 0.75 lb/a plus MSMA at 2 lb/a DP, Prowl 0.75 lb/a PRE followed by Roundup EP, Prowl PRE followed by the Roundup sequential EP and DP and Prowl plus Cotoran (fluometuron) 1.5 lb/a PRE followed by Roundup EP. The standard treatments of Prowl plus Cotoran PRE and Prowl plus Cotoran followed by Bladex plus MSMA DP were included for comparison.

Data collected included visual weed control ratings during August using a scale of 0 to 100 where 0 = no weed control and 100 represents complete control of the species evaluated. Crop yield was determined by harvesting the center two rows of each plot with standard commercial harvesting equipment.

Plots were four rows by 25 ft, and treatments were replicated three times in a randomized complete block

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experimental design. Data was subjected to analysis of variance, and Fisher's Protected LSD test was used for mean separation.

RESULTS AND DISCUSSION

Soybean

Roundup-applied EP provided good to excellent control of sicklepod *(Cassia obtusifolia* L.) and morningglory *(Ipomoea* spp.) species in 1995 (Table 1). However, Roundup provided no better than 85% control of Florida pusley *(Richardia scabra* L.) regardless of rate applied EP. When *application* was delayed to POST, sicklepod control declined significantly for all rates tested Control did improve, however, as the POST rate increased from 0.50 to 1.0 lb/a. Roundup applied as a sequential application EP followed by LP provided excellent (95 to 100%) control of all species evaluated and was comparable to the standard herbicide program of Treflan plus Sencor PPI followed by Classic LP. Soybean yield reflected control of sicklepod and was reduced when sicklepod was not adequately controlled.

In 1996, a single application of Roundup at 0.75 lb/a EP provided 90 to 100% control of all weed species evaluated (Table 2). Unlike 1995, there was no advantage to a sequential application in 1996. Weather conditions were more suitable for soybean growth in 1996 than in 1995 and resulted in a more competitive crop. In addition, the level of weed infestation was less in 19%. The more vigorous crop growth provided better competition for late-season weeds than during the previous season and, combined with the lower weed density, required only early-season weed control with herbicides for excellent season-long weed management and soybean yield.

Cotton

Roundup has a narrower window for over-the-top application in cotton than in soybean. In cotton, over-the-top application cannot be made after the four-leaf stage or unacceptable crop damage may occur. After the four-leaf sage. Roundup can be applied as a DP treatment without causing injury to Roundup tolerant cotton. In 1996, a single application of Roundup EP provided 80% control of purple nutsedge *(Cyperus rotundus* L.) and Florida beggarweed *(Desmodium tortuosum* [Sw] DC.) and 90% control of Florida pusley and smallflower momingglory *(Jaquemontia tamnifolia)* (Table 3). When application was delayed to DP, however, control of all species evaluated was less than acceptable. A sequential application of Roundup EP followed by Roundup DP provided excellent control of all species including the perennial purple nutsedge while Roundup EP followed by Bladex plus MSMA DP provided good purple nutsedge control and excellent control of the broadleaf species evaluated. Both of these treatments controlled purple nutsedge better than standard Prowl plus Cotoran PRE followed by Bladex plus MSMA DP. Cotton yield reflected the level of weed control observed and was lowest for Roundup DP alone and Prowl plus Cotoran PRE alone, treatments which provided only 65% or less control of the species evaluated.

CONCLUSION

Roundup has the potential to be an important component of weed management systems for both no-till soybeans and no-till cotton. Sequential applications of Roundup EP followed by LP over the top in soybeans or EP over the top followed by DP in cotton provided excellent control of problem annual weed species such as Florida pusley, sicklepod, Florida beggarweed, morningglory, and common cocklebur *(Xanthium Pensylvanicum* Wallr.). The cotton system also provided excellent control of the perennial species purple nutsedge, a troublesome weed in many crops. These Roundup *systems* provide control comparable to or better than the standard programs for soybean and cotton.

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Table 1. Weed management in no-ttill Roundup tolerant soybean, 1995, WFREC, Jay, F L

Treatment	Rate	Applic.[b]	Weed control[a]			Soybean yield
			Fl. pusley	Sicklepod	Morningglory	
	lb/a		%			bu/a
Roundup	0.50	EP	85	90	100	45
Roundup	0.75	EP	*80*	90	100	40
Roundup	1.00	EP	80	85	100	40
Roundup	0.50	POST	80	55	100	35
Roundup	0.75	POST	**85**	70	100	40
Roundup	1.00	POST	90	80	100	**45**
Roundup+ R'up	0.5 + 0.25	EP + LP	95	100	100	40
Roundup+ R'up	0.75 + 0.25	EP + LP	100	100	100	45
Roundup+ R u p	0.5 + 0.5	EP + LP	95	100	100	45
Treflan + Sencor + Classic	0.5 +0.5 +0.008	PPI + PPI +LP	100	100	100	40
Untreated			0	0	0	25
$LSD_{0.05}$			8	10	5	7

[a] Fl. Pusley = Florida pusley; Morningglory = mixture of pitted and tall morningglory.
[b] Application timings: PPI = Preplant Incorporated, EP = Early Postemergence, POST = Postemergence; LP = Late Postemergence.

Table 2. Weed management in no-till Roundup tolerant soybean, 1996, WFREC, Jay, FL

Treatment	Rate	Applic.[b]	Weed control[a]				Soybean yield
			Sicklepod	Fl. beg.	Cockle.	Smflwr.	
	lb/a		%				bu/a
Roundup	0.75	EP	100	100	100	90	50
Roundup	1.00	EP	95	100	100	90	55
Roundup	1.50	EP	95	100	100	100	55
Roundup + Rup	0.75 + 0.50	EP + LP	100	100	100	100	50
Roundup+ R'up	0.75 + 0.75	EP + LP	100	100	100	100	55
Treflan + Sencor + Classic	0.5 + 0.38 + 0.008	PPI + PPI +LP	100	95	100	90	50
Untreated			0	0	0	0	20
$LSD_{0.05}$			10	5	5	5	10

[a] Fl. beg = Florida beggarweed; Cockle. = common cocklebur; Smflwr. = smallflower morningglory.
[b] Application timings: PPI = Preplant Incorporated; EP = Early Postmergence, LP = Late Postemergence.

Table 3. Weed management in no-ti Roundup tolerant cotton, 1996, WFREC, Jay, F L

Treatment	Rate	Applic.[b]	Weed control[a] P. nut.	Fl. beg.	Fl. pusley	Smflwr.	Cotton yield
	lbla		%				lint/a
Roundup	1.0	EP	80	80	90	90	1070
Roundup	1.0	DP	60	55	50	50	450
Roundup + R'up	1.0 + 1.0	EP + DP	90	95	100	100	1100
Roundup + Bladex + MSMA	1.0 + 0.75 + 2.0	EP + DP + DP	85	100	100	95	1100
Prowl + R'up	0.75 + 1.0	PRE + EP	80	95	100	75	1010
Prowl + Rup + R'up	0.75 + 1.0 + 1.0	PRE + EP +DP	95	100	100	80	1100
Prowl + Cotoran	0.75 + 1.5	PRE + PRE	0	65	60	65	900
Prowl + Cotoran + R'up	0.75 + 1.5 + 1.0	PRE + PRE + EP	80	100	100	100	1060
Prowl + Cotoran + Bladex + MSMA	0.75 + 1.5 + 0.75 + 2.0	PRE + PRE + DP + DP	70	100	100	100	1100
Untreated			0	0	0	0	200
$LSD_{0.05}$			15	15	15	15	190

[a] P. nut =purple nutsedge; Fl. beg = Florida beggarweed; Fl. Pusley = Florida pusley; Smflwr. = smallflower morningglory.
[b] Application timings: PRE = preemergence; EP = Early Postemergence; DP = directed postemergence.