WEED MANAGEMENT PROGRAMS IN NO-TILL COTTON, PEANUT, AND SOYBEAN

M.W. Edenfield[1], R.N. Gallaher[2], B.J. Brecke[3], and J.A. Tredaway[4]

AUTHORS: [1]Graduate Research Assistant, [2]Professor, and [4]Assistant Professor Agronomy Department, University of Florida, Gainesville. [3]Professor, University of Florida West Florida Research and Education Center, Jay, FL. *Corresponding Author: M.W. Edenfield, P.O. Box 110500. University of Florida, Gainesville, FL 32611; E-mail: mwe@ufl.edu.

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Abstract. Strip-till (in-row subsoil no-till) crop management continues to be a viable alternative to conventional tillage. Field experiments were conducted in 1998 to evaluate herbicide programs for weed control and yield improvement in Roundup Ready cotton (*Gossypium hirsutum*) ('DP 5415 RR'), peanut (*Arachis hypogaea*) ('Georgia Green'), and Roundup Ready soybean (*Glycine max*) ('Hartz 7550 RR'). Treatments were randomized in a complete block design and crops were direct seeded into rye (*Secale cereale*) residue. One early postemergence (EPOT) followed by a post-directed spray (PDS) of Roundup Ultra provided the best overall weed control and cotton lint yield (1168 lbs/acre). Cotoran (fluometuron) PRE followed by Bladex (cyanazine) plus Bueno 6 (MSMA) PDS provided equal control at the late rating of sicklepod (*Senna obtusifolia*) with two applications of Roundup Ultra but this treatment resulted in less control of Texas panicum (*Panicum texanum*) and pitted morningglory (*Ipomoea lacunosa*). Starfire (paraquat) plus Basagran (bentazon) plus surfactant at-cracking (AC) followed by Cadre (imazapic) plus surfactant (POST) resulted in excellent weed control and peanut pod yield (4067 lbs/acre). Cadre POST resulted in similar weed control and pod yield (4139 lbs/acre) as the AC Starfire treatment followed by Cadre POST with the exception of Texas panicum control (<90%). Two applications of Roundup Ultra provided best total weed control and the highest soybean yield (46.8 bu seed/acre). A single application of Roundup Ultra EPOT resulted in similar control of volunteer peanut, but gave less control of pitted morningglory, sicklepod and Texas panicum resulting in lower yield (34.7 bu seed/acre).

INTRODUCTION

Reduced tillage crop production is becoming more widely accepted by growers in the southeastern U.S. There are several advantages with no-tillage production systems including reduced soil erosion, lower fuel requirements, greater flexibility in planting, reduced labor requirements, adaptability to most crops, reduced equipment requirements, and improved water retention (Phillips, 1984; Gallaher and Hawf, 1997). No-till planting of agronomic crops into rye (*Secale cereale* L.) residue provides all of the above benefits, especially water conservation (Gallaher, 1977).

Weed control is often considered one of the major hindrances to the successful adoption of conservation tillage systems. A shift in the spectrum of weed species may occur when tillage practices are altered because tillage favors annual weed species while no-tillage favors a reduction in such weed species (Kells and Meggitt, 1985; Phillips, 1984). Conversely, minimum tillage practices tend to increase the numbers of perennial species, especially grasses, which are often much more difficult to control under no-till conditions (Witt, 1984). As tillage is reduced, weed germination may extend over a longer period of time. As a result, the acceptance of conservation tillage practices has been dependent on the development and availability of herbicides for postemergence (POST) weed control. As tillage is reduced, a greater dependence on herbicides, especially POST applications, will follow.

Cotton (*Gossypium hirsutum* L.) and peanut (*Glycine max* L. Merr) acreage has significantly increased in north central Florida over the past 20 years, which has helped offset the loss in acreage of other field crops such as soybean (*Glycine max* L. Merr) (Gallaher and Brecke, 1998). This overall increase has been accompanied by a substantial increase in utilization of reduced tillage production systems. Each of these crops remains economically important and the newly developed Roundup Ready cotton and soybean varieties should improve management, yields, and profits for Florida growers. For this reason it is important to determine weed management strategies under Florida conditions. Therefore, the objectives of this research were to determine treatment requirements for optimum weed control in strip-till Roundup Ready cotton, strip-till peanut, and strip-till Roundup Ready soybean.

MATERIALS AND METHODS

Experiments were conducted in 1998 at the Green Acres Agronomy Field Research Laboratory, 12 miles west of Gainesville, Florida. Soil type was Arredondo fine sand (Sandy Sileceous Thermic Paleudult), and consists of 95 to

97% sand and 3 to 5% silt plus clay (Soil Survey Staff, 1994). Treatments were randomized in a complete block design with six replications. Each 4-row plot was 20 feet long and had rows spaced 30 inches apart. When rainfall was inadequate experiments were irrigated to ensure a minimum of 1 1/4 acre inches of water per week throughout the growing season. All summer crops were preceded by a winter crop of 'Wrens Abruzzi' rye for grain and were direct seeded into the rye residue with a Brown-Harden strip-till planter. Cotton ('DP 5415 RR'), peanut ('Georgia Green') and soybean ('Hartz 7550 RR') were planted directly into the rye residue at a rate of 6, 6, and 10 seed per linear foot of row, respectively.

Glyphosate Resistant Cotton

Preemergence (PRE) herbicides common to all treatments and which also served as the control treatment consisted of 2 lb a.i./acre Roundup Ultra (glyphosate) plus 0.75 lb a.i../acre Prowl (pendimethalin). The four herbicide treatments evaluated included 1) a control; 2) a single over-the-top early postemergence (EPOT) application of Roundup Ultra at 0.75 lb a.i./acre applied to 4 leaf cotton; 3) a sequential application of Roundup at 0.75 lb a.i./acre EPOT followed by a post-directed spray (PDS) of Roundup Ultra at 0.75 lb a.i./acre; and 4) Cotoran (fluometuron) PRE at 1.5 lb a.i./acre followed by a PDS spray of Bladex (cyanazine) at 0.75 lb a.i./acre plus Bueno 6 at 2.0 lb a.i./acre.

Fertilizer (13 (N)-5(P_2O_5)-29(K_2O)-1(Mg)-2.5(S)/acre) was applied prior to planting. An additional application of 60 pounds N/acre as ammonium nitrate was sidedressed mid-season. Six applications, made 7 to 14 days apart, of labeled rates of Lannate (methomyl) and Baythroid (cyfluthrin) were used for insect control beginning 10 July and ending 24 August.

Peanut

A broadcast application of 200 pounds muriate of potash (KCl)/acre and 200 pounds sulphate of potash magnesium (K_2SO_4:$MgSO_4$)/acre was made at planting. Preemergence herbicides common to all treatments and which also served as the control treatment consisted of Roundup Ultra at 0.75 lb a.i./acre plus Prowl at 1.00 lb a.i./acre. The four herbicide treatments included a 1) control; 2) at-cracking (AC) application of Starfire (paraquat) at 0.125 lb a.i./acre plus Basagran (bentazon) at 0.5 lb a.i./acre; 3) the AC application in treatment 2 followed by a POST application of Cadre (imazapic) at 0.063 lb a.i./acre; and 4) Cadre at 0.063 lb a.i./acre POST. Induce (non-ionic surfactant) at 0.25% v/v was included in all herbicide mixtures following PRE**.**

Glyphosate Resistant Soybean

A broadcast application of 200 pounds muriate of potash (KCl)/acre and 200 pounds sulphate of potash magnesium (K_2SO_4:$MgSO_4$)/acre was made PRE. Preemergence herbicides common to all treatments and which also served as the control treatment consisted of Roundup Ultra at 2 lb a.i./acre plus Prowl at 0.75 lb a.i./acre. The four herbicide treatments evaluated included a 1) control; 2) single application of Roundup Ultra at 0.75 lb a.i./acre EPOT; 3) sequential application of Roundup Ultra at 0.75 lb a.i./acre EPOT and POST; and 4) Sencor (metribuzin) PRE at 0.38 lb a.i./acre followed by Classic (chlorimuron) at 0.008 lb a.i./acre plus Induce at 0.25 % v/v POST.

Weed control evaluations in each experiment were made at two dates in 1998, 18 July and 22 August. Evaluations were based on visual observations of treated plots compared to the control treatment, with 100% representing complete weed control and 0% being no control. At the end of the season crop yield was determined from the two center rows of the four row plots.

Data was recorded and transformed as appropriate using Quattro Pro for windows (1987) spreadsheet software and analyzed using MSTAT 4.0 (Nissen, 1985). When treatments were significant at the 0.05 level of probability, means were separated using the LSD test.

RESULTS AND DISCUSSION

Glyphosate Resistant Cotton

The sequential treatment of Roundup Ultra EPOT followed by Roundup Ultra POST provided the best overall weed control for all species evaluated. Cotoran PRE followed by a PDS spray of Bladex plus Bueno 6 did ultimately provide season-long control of sicklepod (*Senna obtusifolia*) equal to that obtained with Roundup Ultra. Nonetheless, a sequential application of Roundup Ultra maintained the best control of Texas panicum (*Panicum texanum*) and pitted morningglory (*Ipomoea lacunosa*) of the herbicide treatments evaluated (Table 1). Furthermore, a single application of Roundup Ultra was not better than Cotoran PRE followed by a PDS of Bladex plus Bueno 6 control of pitted morningglory on 22 August.

Lint yield was positively correlated with the level of weed control and was greatest with the sequential application of Roundup Ultra (Table 1). Yield was 65% greater for the sequential application of Roundup Ultra compared with only one application. If one assumes a lint cotton price of $0.60/pound, then the extra Roundup Ultra application would add $261/acre to gross returns.

Peanut

An AC treatment of Starfire plus Basagran followed by Cadre POST provided complete control of weeds that were rated on both dates (Table 2). However, a small

amount of peanut stunting occurred with this treatment compared to other herbicide treatments. Both the AC treatment alone and Cadre alone provided less Texas panicum control than the sequential application.

Peanut yield was similar for Starfire plus Basagran AC followed by Cadre POST and Cadre POST without the AC treatment even though weed control was less for Cadre alone. Both treatments yielded better than the AC treatment alone. Therefore, based on these data the appropriate choice under conditions of this study would be the weed control program prescribed employing both the AC and POST treatment. If one assumed that peanut in the shell sold for $0.50/pound, then the herbicide treatments following PRE provided an increased gross return of $1660/acre over the control. However, additional testing will be necessary to provide accurate extension recommendations for specific cropping systems and varieties in order to maximize strip-till peanut yield and profit.

Glyphosate Resistant Soybean

Weed ratings (Table 3) show that two sequential POST applications of Roundup Ultra provided the best overall weed control. This was especially true for sicklepod and Texas panicum compared to a single application of Roundup Ultra. Sencor PRE followed by Classic ultimately provided sicklepod and pitted morningglory control equal to that of a sequential application of Roundup Ultra, however, this treatment did not control Texas panicum or volunteer peanut.

As was the case for best overall weed control, seed yield was also greatest for a sequential application of Roundup Ultra (Table 3). Yields for the sequential Roundup Ultra application was 29 and 35 % greater than those of a single application of Roundup Ultra and Sencor PRE followed by Classic POST, respectively. If one assumed that soybean sold for $5/bushel, then the sequential application of Roundup Ultra would provide an increase in gross returns of $60/acre compared to a single application of Roundup Ultra.

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Table 1. Control of sicklepod, Texas panicum, and pitted morningglory and cotton (DP 5415 RR) yield as affected by herbicide programs, Gainesville, FL 1998.

Herbicide[1]	Application		Weed Control						Cotton Yield
Treatment	Rate	Timing	CASOB[2]		PANTE		IPOLA		Lint
			Early[4]	Late	Early	Late	Early	Late	
	lb a.i/acre				%				lb/acre
1. Control			0	0	0	0	0	0	189
2. Roundup Ultra	0.75	EPOT[3]	90	75	79	58	76	65	733
3, Roundup Ultra Roundup Ultra	0.75 0.75	EPOT PDS	98	97	98	90	96	94	1168
4. Cotoran(fb) Bladex + MSMA	1.5 0.75 2.0	PRE PDS PDS	93	93	74	42	87	72	686
LSD@0.05	------	------	2.8	9.4	4.9	7.8	8.9	14.2	280

[1]Entire study received preemergence (PRE) application of Roundup Ultra at 2.0 lb a.i./acre plus Prowl at 0.75 lb a.i./acre.
[2]CASOB = sicklepod; PANTE = Texas panicum; IPOLA = pitted morningglory. [3]EPOT = early postemergence over-the-top; PDS = post-directed spray; PRE = preemergence. [4]Early season rating 18 July 1998; Late season rating 22 August 1998.

Table 2. Control of sicklepod, Texas panicum, and pitted morningglory and peanut (Georgia Green) yield as affected by herbicide programs, Gainesville, FL 1998.

Herbicide[1]	Application		Weed Control						Peanut Yield
Treatment	Rate	Timing	CASOB[2]		PANTE		IPOLA		Pod
			Early[4]	Late	Early	Late	Early	Late	
	lb a.i/acre				%				lb/acre
1. Control			0	0	0	0	0	0	819
2. Starfire + Bassgran + surfactant	0.125 0.50	AC[3] AC AC	97	91	87	71	96	93	3285
3. Starfire + Bassgran + surfactant Cadre+ surfactant	0.125 0.50 0.063	AC AC AC POST POST	100	100	100	100	100	100	4067
4. Cadre + surfactant	0.063	POST POST	100	100	91	82	98	100	4139
LSD@0.05	------	------	3.7	4.1	7.2	9.7	3.7	5.4	566

[1]Entire study received preemergence (PRE) application of Roundup Ultra at 0.75 lb a.i./acre plus Prowl at 1.0 lb a.i./acre.
[2]CASOB = sicklepod; PANTE = Texas panicum; IPOLA = pitted morningglory. [3]AC = at-cracking postemergence; EPOST early postemergence over-the-top; POST = postemrgence. [4]Early season rating 18 July 1998; Late season rating 22 August 1998. [5]Induce (non-ionic surfactant) included in mixture at 0.25% v/v.

Table 3. Control of sicklepod, Texas panicum, pitted morningglory, volunteer peanut and soybean (Hartz 7550 RR) yield as affected by herbicide programs, Gainesville, FL 1998.

Herbicide[1]	Application		Weed Control								Soybean
Treatment	Rate	Timing	CASOB[2]		PANTE		IPOLA		ARAHY		Yield
			Early[4]	Late	Early	Late	Early	Late	Early	Late	
lb a.i/acre						%					Bu Seed/acre
1. Control			0	0	0	0	0	0	0	0	16.0
2. Roundup Ultra	0.75	EPOT[3]	83	80	79	78	86	92	93	97	34.7
3. Roundup Ultra Roundup Ultra	0.75 0.75	EPOT POST	98	100	98	100	98	100	98	100	46.8
Sencor Classic + surfactant	0.38 0.008	PRE POST POST	92	97	67	48	89	95	72	67	36.3
LSD@0.05	------	-------	11.4	5.5	5.0	7.3	4.7	8.7	6.7	6.7	9.7

[1]Entire study received preemergence (PRE) application of Roundup Ultra at 2.0 lb a.i./acre plus Prowl at 0.75 lb a.i./acre.
[2]CASOB = sicklepod; PANTE = Texas panicum; IPOLA = pitted morningglory. [3]EPOT = early postemergence; PRE = preemergence ; POST = postemergence. [4]Early season rating 18 July 1998; Late season rating 22 August 1998. [5]Induce (non-ionic surfactant) included in mixture at 0.25% v/v.