WEED CONTROL IN ROUNDUP-RESISTANT SUGAR BEETS

Corey J. Guza, Corey V. Ransom, and Joey Ishida
Malheur Experiment Station
Oregon State University
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Introduction

Sugar beet varieties have been developed that are resistant to the herbicide Roundup (glyphosate). The proper application rates and timings of Roundup need to be determined for the greatest weed control. Also, research needs to be conducted to determine if soil-active herbicides can be used to improve weed control in Roundup-resistant sugar beets.

Methods

Two studies were conducted with Roundup-resistant sugar beet varieties. One trial evaluated different Roundup application timings, and the second examined Roundup rates, timings, and tank mixtures with soil-active herbicides. HM Pillar RR sugar beets were planted April 22 using a tool-bar planter with a 22-in row spacing. Seeds were planted to a 2-in spacing and subsequently thinned to an 8-in spacing. Trials were designed as randomized complete block with three replications. Plots were 4-rows wide and 30-ft long. Counter CR 20 was applied over the row at a rate of 6 oz/1000ft one day after planting. On June 5, plots were side-dressed with 210 lb N/acre as urea. Herbicide applications were made with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi. Weed control was evaluated June 29 and September 3. Yield was determined by harvesting sugar beets from the center two rows of each plot on October 15.

Roundup Application Timing
To determine effective timings for Roundup applications, Roundup was applied at 0.75 lb ai/acre at different stages of sugar beet growth. The first applications were at either cotyledon or at 2- to 4-leaf sugar beets, and then sequential applications were applied 1 and 2 wk, 2 and 3 wk, and 4 wk after the initial application. Roundup treatments were compared to a standard herbicide program of Progress (0.33 lb ai/acre) applied to cotyledon, 2- to 4-leaf, and 6- to 8-leaf sugar beets.

Roundup Rates, Timings, and Tank Mixtures
In this trial, Roundup applications were based on sugar beet growth stage. Applications were made to cotyledon, 2- to 4-leaf , and 6- to 8-leaf sugar beets. Treatments of Roundup at 0.37, 0.56, and 0.75 lb ai/acre were applied three times as sequential treatments. Roundup at 0.37 lb ai/acre with the addition of ammonium sulfate (AMS) also was evaluated. Roundup (0.75 lb ai/acre) was applied one time alone and in combination with Nortron (1.0 lb ai/acre) or BAS 656 07 H (0.64 lb ai/acre) to 2- to

4-leaf sugar beets. All treatments were compared to a handweeded check and a standard herbicide program of Nortron (1.0 lb ai/acre) applied preplant incorporated (PPI) followed by Progress (0.25 lb ai/acre) applied to cotyledon sugar beets, Progress (0.33 lb ai/acre) plus Upbeet (0.0156 lb ai/acre) applied to 2- to 4-leaf sugar beets, and Progress plus Upbeet with Poast (0.3 lb ai/acre) applied to 6- to 8-leaf sugar beets.

Results

Roundup Application Timing

On June 29, all Roundup treatments provided weed control (95 percent) equal to the handweeded check and the standard program of Progress (Table 1). On September 3, redroot pigweed control was lower (67-86 percent) than the handweeded check (98 percent) for treatments of Roundup applied to cotyledon sugar beets followed by applications 1 and 2 wk (67 percent), and 4 wk (86 percent) after the initial application. The redroot pigweed control (72 percent) with the standard also was lower than the hand-weeded check. The sugar beet yield in the Roundup treatments (34-37 ton/acre) was equal to the yield in the hand-weeded check (37 ton/acre) and was greater than the yield with the standard treatment (29 ton/acre). The untreated check yielded 9 tons/acre.

Roundup Rates, Timings, and Tank Mixtures

On June 29, all Roundup treatments provided weed control equal to and greater than the standard herbicide program (Table 2). On September 3, Roundup Ultra (0.75 lb ai/acre) applied one time to 2- to 4-leaf sugar beets provided less control of redroot pigweed (68 percent), hairy nightshade (62 percent) and barnyardgrass (68 percent) than the standard (89, 92, and 85 percent). Other Roundup treatments provided redroot pigweed, common lambsquarters and hairy nightshade control ranging from 90-98 percent. Several treatments provided greater barnyardgrass control than the standard treatment. Sugar beet yields with all Roundup treatments (34 to 39 tons/acre) were equal to and greater than the standard (35 tons/acre). Single applications of Roundup in a tank mixture with a soil-active herbicide provided acceptable weed control and sugar beet yields. While weed control was less than the standard when Roundup was applied alone one time, yields were similar to the standard and some other treatments. All treatments increased sugar beet yield compared to the untreated check.

Table 1. Weed control and sugar beet yields of Roundup-resistant sugar beets in response to Roundup application timing, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

			Weed control							Sugar beet yield					
			Redroot pigweed		Lambsquarters		Hairy nightshade		Barnyard-grass						
Treatment	Rate	Timing	June 29	Sept. 3	June 29	Sept. 3	June 29	Sept. 3	Sept. 3	Root Yield	Sugar Content	Gross sugar	Extraction	Estimated recoverable sugar	
	lb ai/acre		----------%----------							ton/acre	%	lb/acre	%	lb/acre	lb/ton
Roundup Ultra	0.75	cot + 1wk + 2wk	95	67	95	98	95	95	55	34.66	16.06	11,125	91.05	10,128	292.5
Roundup Ultra	0.75	cot + 2wk + 3wk	95	88	95	98	95	97	77	34.98	15.96	11,162	90.43	10,097	288.6
Roundup Ultra	0.75	cot + 4wk	95	86	95	98	95	96	94	36.38	16.25	11,824	90.90	10,748	295.4
Roundup Ultra	0.75	2-4 lf + 1wk + 2wk	95	96	95	98	95	98	77	36.46	15.87	11,568	90.30	10,446	286.6
Roundup Ultra	0.75	2-4 lf + 2wk + 3wk	95	97	95	98	95	98	97	36.87	16.35	12,052	90.88	10,953	297.1
Roundup Ultra	0.75	2-4 lf + 4wk	95	94	95	98	95	98	93	36.05	16.24	11,708	90.82	10,634	295.0
Handweeded	-		95	98	95	98	95	98	98	36.95	16.06	11,862	90.60	10,748	290.9
Progress	0.33	cot + 2-4 lf + 4wk	95	72	95	98	95	98	20	28.76	16.19	9,313	90.90	8,465	294.3
Untreated	-	-	0	0	0	0	0	0	0	9.02	16.13	2,904	91.23	2,649	294.2
LSD (0.05)			1	10	1	10	1	3	27	2.94	0.34	970	0.76	903	8.08

Table 2. Weed control and sugar beet yield in response to Roundup rates, timings, and combinations with soil-active herbicides, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

			Weed control							Sugar beet yield					
			Redroot pigweed		Lambsquarters		Hairy nightshade		Barnyard grass	Root yield	Sugar content	Gross sugar	Extraction	Estimated recoverable sugar	
Treatment	Rate	Timing	June 29	Sept. 3	June 29	Sept. 3	June 29	Sept. 3	Sept. 3						
	lb ai/acre	leaf	----------%----------							ton/acre	%	lb/acre	%	lb/acre	lb/ton
Roundup + AMS	0.37 + 2.5	cot + 3-4 + 6-8	95	92	95	97	95	92	85	37.61	16.02	12,053	90.33	10,891	289.5
Roundup	0.37	cot + 3-4 + 6-8	95	83	95	97	95	98	87	35.15	16.27	11,439	90.04	10,303	293.0
Roundup	0.56	cot + 3-4 + 6-8	95	95	95	98	95	98	92	37.19	15.98	11,879	90.63	10,767	289.6
Roundup	0.75	cot +3-4 + 6-8	95	98	95	98	95	98	97	37.28	16.02	11,942	90.32	10,788	289.4
Roundup Roundup + Nortron	0.75 0.75 + 1.0	cot + 3-4 6-8	95	96	95	97	95	94	97	38.51	16.08	12,382	90.54	11,213	291.1
Roundup	0.75	3-4	92	68	95	98	92	62	68	33.51	15.93	10,666	90.24	9,625	287.5
Roundup + Nortron	0.75 + 1.0	3-4	95	91	95	98	95	98	90	35.23	16.16	11,390	89.98	10,251	290.9
Roundup + BAS 656 07 H	0.75 + 0.64	3-4	95	90	95	98	95	94	98	36.79	16.05	11,806	90.56	10,692	290.7
Nortron Roundup	1.0 0.75	PPI 3-4 + 6-8	95	97	95	98	95	95	98	37.12	16.63	12,341	91.08	11,242	302.8
Nortron Roundup	1.0 0.37	PPI 3-4 + 6-8	95	95	95	98	95	98	94	36.87	16.24	11,969	90.27	10,806	293.2
Nortron Roundup + AMS	1.0 0.37 + 2.5	PPI 3-4 + 6-8	95	97	95	98	95	95	95	37.44	16.16	12,100	90.53	10,953	292.6
Nortron + Progress+ Progress+ Upbeet Progress+ Upbeet + Poast	1.0 0.25 0.33+0.0156 0.33+0.0156+ 0.3	PPI cot 3-4 6-8	95	89	95	98	85	92	85	34.74	15.78	10,951	90.12	9,870	284.5
Untreated	-	-	0	0	0	0	0	0	0	11.63	15.90	3,689	90.81	3,344	288.9
LSD (0.05)			3	12	1	1	3	20	10	2.83	0.66	970	1.08	908	14.6