WEED CONTROL IN LIBERTY®- RESISTANT SUGAR BEETS

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Ontario, OR, 2000

Introduction

Rates and timings of Liberty herbicide were evaluated to determine the most effective weed control in Liberty-resistant sugar beets. Research also was conducted to determine how Liberty compared to a standard registered sequential herbicide treatment currently used in the Treasure Valley. Grass control with Liberty may be weak. Select was added to Liberty to evaluate volunteer wheat control in Liberty-resistant sugar beets.

Methods

Two trials were established at the Malheur Experiment Station. The soil type was silt loam with pH 7.6 and 1.4 percent organic matter. Cultural practices were similar for both trials. Liberty resistant sugar beets 'Beta 8757 LL' were planted on April 12 using a tool bar planter with 22-inch row spacing. Seeds were planted every 2 inches and subsequently thinned to an 8-inch spacing. Trials were designed as randomized complete blocks with four replications. Plots were four rows wide and 27 ft long. Counter 20 CR was applied in a 6-inch band over the row at 6 oz/1,000 ft after planting. On May 22, plots were sidedressed with 240 lb N/acre as urea. Herbicide applications were made with a CO_2-pressurized backpack sprayer delivering 20 gal/acre at 30 psi. Yields were determined by harvesting sugar beets from the center two rows of each plot on October 4. Sugar beet yields were adjusted for a 5 percent tare.

Liberty Application Timing and Rates

Liberty at three rates (0.2379, 0.2676, and 0.3568 lb ai/acre) was evaluated for sequential applications initiated at three different stages of sugar beet growth. First applications began at either the cotyledon, two-leaf, or four-leaf stage of beet growth. Second applications were made either 10 days after the initial treatment or at a subsequent beet leaf stage. Third applications were made 10 days after the second application. Two Liberty treatments included Nortron (1.0 lb ai/acre) applied postemergence. Liberty treatments were compared to a standard herbicide program of Progress (0.33 lb ai/acre) and Upbeet (0.0156 lb ai/acre) applied to cotyledon beets, followed by applications of Progress, Upbeet, Stinger (0.094 lb ai/acre), and Poast (0.3 lb ai/acre) 10 and 20 days after the first application. Weed control and beet injury were rated on June 12, 27, and July 11.

Liberty and Select for Volunteer Wheat Control

Prior to beet planting, wheat seed was broadcast over the entire trial area to represent a stand of volunteer wheat. Three herbicide applications were made to all treatments. All initial applications were made to beets in the cotyledon stage. Subsequent treatments were made 10 and 20 days after the initial application. Liberty was applied alone at two different rates (0.2676 and 0.35 lb ai/acre) and compared to combinations of Liberty with Select. For all treatments including Select, Liberty was applied at 0.2676 lb ai/acre. Select at 0.094 lb ai/acre was added to Liberty at either the first, second, or third application timing. Select at 0.125 lb ai/acre was added to Liberty at the second or third application timing. In two treatments, Select at 0.032 or 0.047 lb ai/acre was added to all three Liberty application timings. All Liberty applications included a crop oil concentrate (COC) at 1.0 qt/acre. Beet injury and weed control were rated on June 12, 27, and July 18.

Results

Liberty Application Timing and Rates

On June 12 all treatments gave equally good pigweed control (96-100 percent)(Table 1). In most cases Liberty alone was weak on common lambsquarter, although Liberty at 0.03568 lb ai/acre applied three times beginning at two-leaf sugar beets and Liberty at 0.03568 plus Nortron also applied to two-leaf beets provided 100 percent lambsquarter control. It is impossible to determine if the addition of Nortron increased weed control because Liberty at the high rate beginning at the two-leaf beet stage gave 100 percent weed control for all weed species. The standard Progress, Upbeet, Stinger treatment also provided lambsquarter control better than most Liberty treatments. All Treatments except Liberty (0.2676 lb ai/acre) beginning at the four-leaf stage provided hairy nightshade control significantly better than the standard Progress treatment. On July 11, Liberty at the high rate (0.3568 lb ai/acre) beginning at two-leaf, the two Liberty treatments including Nortron, and the Progress, Upbeet, Stinger treatment were among the best treatments for all weed species. Liberty at 0.2676 lb ai/acre beginning at the four-leaf stage continued to provide among the poorest weed control for all weeds.

On June 12, treatments including Liberty plus Nortron and the standard of Progress, Upbeet, and Stinger exhibited among the highest sugar beet injury (11-16 percent). By July 11, only Liberty at 0.03568 lb ai/acre plus Norton added to the third application had any visible injury (5 percent).

Sugar beet root yield for the Liberty plus Nortron and the standard Progress treatment were greater than or equal to all other herbicide treatments, showing that the injury recorded on June 12 for these treatments did not have an effect on yield. Also, the excellent weed control provided by these treatments could be responsible for the increased yields. Liberty at 0.2676 lb ai/acre applied three times beginning at the two-leaf stage produced significantly higher yields than when Liberty at the same rate was initially applied to cotyledon beets.

Liberty and Select for Volunteer Wheat Control

On June 12, sequential applications of Liberty alone at 0.2676 or 0.35 lb ai/acre provided only 66 and 78 percent control of volunteer wheat, respectively (Table 2). All treatments where Select was added at any rate or timing increased volunteer wheat control significantly over Liberty at 0.2676 lb ai/acre applied alone. In treatments where Select was added to every application of Liberty, 100 percent volunteer wheat control was achieved. Timing appeared to be critical for treatments when Select was added only at one Liberty application timing. Volunteer wheat control was significantly better when Select was added to the first or second Liberty application timing than when it was added with the third Liberty application.

No sugar beet injury was visible for the duration of this trial.

When comparing only the Liberty treatments, Liberty applied three times at the 0.35 lb ai/acre rate increased sugar beet root yield significantly over the 0.2676 lb ai/acre rate. All treatments that included Select had yields significantly above Liberty alone at 0.2676 lb ai/acre. When Select was added to Liberty at 0.125 lb ai/acre at the second or third application timing, beet yields were equal to the treatments where Select was added to all three Liberty applications.

Table 1. Weed control, sugar beet injury, and sugar beet root yields in response to Liberty rates and timings on Liberty-resistant sugar beets, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Treatment	Rate	Timing*	Beet injury†	Weed control‡				Sugar beet root yield
				Redroot pigweed	Lambs-quarters	Hairy nightshade	Barnyard-grass	
	lb ai/acre		%	----------	----------	% ----------	----------	tons/acre
Liberty	0.2379	cotyledon 10, 20 DAIT	9	100	78	100	80	35.0
Liberty	0.2676	cotyledon 10, 20 DAIT	1	100	63	100	76	32.6
Liberty	0.2379 0.2676 0.3568	cotyledon 10 DAIT 20 DAIT	1	100	66	100	83	32.6
Liberty	0.2379	2-leaf 10, 20 DAIT	3	100	80	98	81	38.5
Liberty	0.2676	2-leaf 10, 20 DAIT	4	100	88	100	99	39.9
Liberty	0.3568	2-leaf 10, 20 DAIT	0	100	100	100	100	43.1
Liberty	0.2676	4-leaf 10, 20 DAIT	0	96	69	96	79	34.6
Liberty	0.3568	4-leaf 10, 20 DAIT	3	96	77	100	88	39.1
Liberty	0.2379 0.3568	cotyledon 4-leaf, 10 DAPT	4	100	64	100	98	36.0
Liberty	0.2676 0.3568	cotyledon 4-leaf, 10 DAPT	1	100	75	100	85	37.8
Liberty	0.3568	cotyledon 4-leaf, 10 DAPT	0	100	67	100	75	38.0
Liberty Liberty + Nortron Liberty	0.3568 0.3568 + 1.0 0.3568	2-leaf 10 DAIT 20 DAIT	16	100	100	100	94	41.3
Liberty Liberty Liberty + Nortron	0.3568 0.3568 0.3568 + 1.0	2-leaf 10 DAIT 20 DAIT	11	96	100	100	98	41.7
Progress + Upbeet Progress + Upbeet + Stinger Poast + COC	0.33 + 0.0156 0.33 + 0.0156 + 0.094 0.3 + 1% v/v	cotyledon 10, 20 DAIT 20 DAIT	14	100	99	93	100	39.5
Untreated			0	0	0	0	0	7.1
LSD (0.05)			7	4	16	4	16	5.8

*Most treatments were initially applied to cotyledon, two-leaf, or four-leaf sugar beets and followed by two subsequent applications 10 and 20 days after the initial treatment (DAIT). Other treatments were first applied to cotyledon beets and again to four-leaf beets. Third applications were then made 10 days after the previous treatment (DAPT).
†Crop injury rated on June 12.
‡Weed control rated on June 12.

Table 2. Volunteer wheat control and sugar beet injury and yield in response to Liberty and Select on Liberty-resistant sugar beets, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Treatment	Rate	Timing*	Beet injury†	Volunteer wheat control			Sugar beet
				6-12	6-27	7-18	Root Yield
	lb ai/acre		%	----------%----------			tons/acre
Liberty	0.27	cotyledon 10, 20 DAIT	0	66	65	65	31.1
Liberty + Select Liberty	0.2676 + 0.094 0.2676	cotyledon 10, 20 DAIT	0	99	100	98	38.5
Liberty Liberty + Select Liberty	0.2676 0.2676 + 0.094 0.2676	cotyledon 10 DAIT 20 DAIT	0	98	100	100	38.3
Liberty Liberty + Select	0.2676 0.2676 + 0.094	cotyledon, 10 DAIT 20 DAIT	0	80	95	98	38.8
Liberty + Select	0.2676 + 0.047	cotyledon 10, 20 DAIT	0	100	100	100	40.7
Liberty Liberty + Select	0.2676 0.2676 + 0.125	cotyledon, 10 DAIT 20 DAIT	0	80	95	99	40.1
Liberty Liberty + Select Liberty	0.2676 0.2676 + 0.125 0.2676	cotyledon 10 DAIT 20 DAIT	0	100	100	100	39.4
Liberty	0.35	cotyledon 10, 20 DAIT	0	78	81	81	38.1
Liberty + Select	0.2676 + 0.032	cotyledon 10, 20 DAIT	0	100	100	100	41.4
Untreated			0	0	0	0	1.5
LSD (0.05)				2	3	3	2.3

*Initial applications were made to cotyledon sugar beets and followed by two subsequent applications 10 and 20 days after the initial treatment (DAIT).
†Crop injury rated on June 12.