

WEED CONTROL WITH POSTEMERGENCE COMBINATIONS OF OUTLOOK® IN SUGAR BEET

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Introduction

As weed problems and management systems change, it is important to evaluate new herbicides with potential use in sugar beets. Continual review of pesticides by the U.S. Environmental Protection Agency (EPA) also may reduce the herbicides available for use in sugar beets in the future. In these trials, weed control in sugar beet from postemergence applications of Outlook (dimethenamid-P) was evaluated. Outlook is a soil-active herbicide that provides control of annual grasses as well as control or suppression of several small-seeded annual broadleaf weeds.

Methods

General

This trial was established at the Malheur Experiment Station under furrow irrigation on April 8, 2002. Sugar beets (Hilleshog 'PM-21') were planted in 22-inch rows at a 2-inch seed spacing. After planting, the trial was corrugated and Counter 20 CR was applied in a 7-inch band over the row at 6 oz/1,000 ft of row. Sugar beets were thinned to 8-inch spacings on May 6 and 7. Plots were sidedressed on May 22 with 150 lb N/acre as urea. All plots were treated with Roundup (0.75 lb ai/acre) prior to sugar beet emergence. On May 13, Temik 15G (10 lb/acre) was applied for sugar beet root maggot control. For powdery mildew control, Super-Six liquid sulfur was applied on June 20 and August 14, sulfur dust (30 lb/acre) was applied July 23, and Laredo fungicide was applied on July 11. All fungicide treatments were applied by air. Herbicide treatments were broadcast applied with a CO₂-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 30 psi. Plots were four rows wide and 27 ft long and treatments were arranged in a randomized complete block design with four replicates. Sugar beet injury and weed control were evaluated throughout the season. Sugar beet yields were determined by harvesting the center two rows of each plot on October 8 and 9. Root yields were adjusted to account for a 5 percent tare. One sample of 16 beets was taken from each plot for quality analysis. The samples were coded and sent to Hilleshog Mono-Hy Research Station in Nyssa, Oregon, to determine beet pulp sucrose content and purity. Sucrose content and recoverable sucrose were estimated using empirical equations. Data were analyzed using analysis of variance procedures and means were separated using protected LSD at the 95 percent confidence interval ($P = 0.05$).

Outlook Combined with Standard Herbicide Programs for Weed Control in Sugar Beet

Outlook was applied at several rates between 0.33 and 0.84 lb ai/acre to sugar beet in various tank-mix combinations with standard rates of Progress (0.33 lb ai/acre), UpBeet (0.016 lb ai/acre), and Stinger (0.094 lb ai/acre). All plots were treated with Progress plus UpBeet when sugar beets were in the cotyledon stage of growth on April 22. On May 2, applications consisting of Progress, UpBeet, and Stinger or Progress, UpBeet, Stinger, and Outlook (0.5, 0.64, or 0.84 lb ai/acre) were applied to two-leaf sugar beets. Tank-mix combinations of Progress, UpBeet, and Stinger with and without Outlook (0.32, 0.5, or 0.65 lb ai/acre) were applied to six-leaf sugar beets on May 13. Two treatments included the systemic fungicide Headline applied at 0.19 lb ai/acre. In one treatment Headline was applied to six-leaf sugar beets tank-mixed with selected herbicides and in the other treatment Headline was applied alone on July 20. These treatments were included to evaluate Headline for potential influence on weed control, crop response, and/or sugar beet yield when tank-mixed with selected herbicides.

Outlook Rates for Weed Control in Sugar Beet

This trial was established to examine weed control and crop response when Outlook was applied at rates specified in the Section 18 label that had recently been granted. Because this trial was in direct response to the new label, it was established later than the other trials and initial applications were not made until the two-leaf stage of sugar beet development. Outlook was applied with standard rates of Progress (0.33 lb ai/acre), UpBeet (0.016 lb ai/acre), and Stinger (0.094 lb ai/acre) to two-leaf sugar beets at rates of 0.65, 0.84, and 0.98 lb ai/acre and as a split application at 0.5 lb ai/acre applied to two- and six-leaf sugar beets. Weed control with Outlook applied with standard rate herbicides was compared to the standard rate treatment of Progress (0.33 lb ai/acre), UpBeet (0.016 lb ai/acre), and Stinger (0.094 lb ai/acre) applied to two- and six-leaf sugar beets on May 2 and 13.

Results and Discussion

Sugar beets grew slowly and exhibited higher than expected herbicide injury because of cool temperatures and late frost. Overnight low temperatures at the Malheur Experiment Station were 25°, 29°, and 27°F on April 24, 25, and May 8, respectively. The slow growth of sugar beet resulting from the combination of frost and herbicide injury delayed the formation of a competitive sugar beet canopy.

Outlook Combined with Standard Herbicide Programs for Weed Control in Sugar Beet

Sugar beet injury on May 10 (8 days after treatment [DAT], two-leaf application) and on May 20 (7 DAT, six-leaf application) ranged from 30 to 40 percent (Table 2). Plots receiving a split application of Outlook at 0.5 lb ai/acre applied to two- and six-leaf sugar beets displayed the greatest injury on May 20. By June 1 (19 DAT) injury from all treatments had decreased and ranged from 4 to 13 percent.

Control of pigweed species (i.e., Powell amaranth and redroot pigweed) was similar among treatments except when Headline was applied in the third application, which was less than the same treatment without Headline on July 16 (64 DAT) (Table 1). Common lambsquarters control was less with the standard rate treatment without Outlook than with treatments where Outlook was applied at 0.66 lb ai/acre in the second application, 0.66 lb and 0.34 lb ai/acre in the second and third applications, respectively, and with Outlook applied at 0.5 lb ai/acre in both the second and third applications. Hairy nightshade control on June 1 (19 DAT) was greater with Outlook applied at 0.66 lb and 0.34 lb ai/acre in the second and third applications compared to the standard without Outlook. There were no significant differences in hairy nightshade control on July 16. Kochia control was 100 percent on both June 24 and July 16 when Outlook was applied at 0.84 lb ai/acre in the second application.

All herbicide treatments had greater sugar beet stand, root yield, and estimated recoverable sucrose yield than the untreated control (Table 2). There were no significant differences in sucrose content or extractable sucrose among treatments. Sugar beet yields from the standard treatment without Outlook were similar to treatments with Outlook regardless of rate or number of applications in which Outlook was applied.

Outlook Rates for Weed Control in Sugar Beet

There were no differences in control among herbicide treatments with regard to pigweed species (i.e., Powell amaranth and redroot pigweed), common lambsquarters, and barnyardgrass (Table 3). Hairy nightshade control was increased over the standard without Outlook when Outlook was applied at 0.84 and 0.98 lb ai/acre to six-leaf sugar beets evaluated on June 24 (42 DAT). By July 15 (63 DAT) all treatments including Outlook controlled hairy nightshade better than the standard alone except for Outlook applied at 0.5 lb ai/acre to both two- and six-leaf sugar beets.

Sugar beet injury on May 10 (8 days after the two-leaf application) ranged from 27 to 32 percent (Table 4). The treatment receiving Outlook at 0.5 lb ai/acre had more injury than the standard alone on May 10. By May 20 (7 DAT), sugar beet injury ranged from 23 to 38 percent. Treatments with Outlook at 0.98 lb ai/acre included in the six-leaf application and the treatment with Outlook applied at 0.5 lb ai/acre included in both the two- and six-leaf applications injured sugar beets to a greater extent than the standard treatment without Outlook.

Sugar beet stands were similar among herbicide treatments and were all greater than the untreated control (Table 4). Sugar beet root yields among herbicide treatments ranged from 33.8 to 38.1 ton/acre. Treatments including Outlook at 0.65 or 0.84 lb ai/acre in the two-leaf application provided greater sugar beet root yields than when Outlook was applied at 0.5 lb ai/acre to both two- and six-leaf sugar beet.

Table 1. Weed control with Outlook combined with standard herbicide programs in sugar beet, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate lb ai/acre	Timing*	Weed control							
			Pigweed spp. [†]		Common Lambsquarters		Hairy nightshade		Kochia	
			6-1	7-16	6-1	7-16	6-1	7-16	6-24	7-16
Untreated control	--	--	0	0	0	0	0	0	0	0
Progress + UpBeet	0.25 + 0.016	1	99	91	98	89	90	85	98	98
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2								
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	3								
Progress + UpBeet	0.25 + 0.016	1	95	88	99	95	95	90	94	93
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	3								
Progress + UpBeet	0.25 + 0.016	1	97	88	97	95	92	86	96	94
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2								
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	3								
Progress + UpBeet	0.25 + 0.016	1	95	90	99	97	97	93	98	96
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.34	3								
Progress + UpBeet	0.25 + 0.016	1	95	85	99	94	93	91	94	93
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger + Outlook + Headline	0.33 + 0.016 + 0.094 + 0.34 + 0.19	3								
Progress + UpBeet	0.25 + 0.016	1	96	87	98	94	95	90	96	96
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger + Outlook + Headline	0.33 + 0.016 + 0.094 + 0.34 + 0.19	3								
Progress + UpBeet	0.25 + 0.016	1	97	88	97	97	94	91	95	96
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	2								
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	3								
Progress + UpBeet	0.25 + 0.016	1	95	92	98	91	93	86	100	100
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.84	2								
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	3								
LSD (0.05)			5	5	2	6	6	10	5	6

*Application timings were (1) April 22 to cotyledon sugarbeet, (2) May 2 to two-leaf sugar beet and (3) May 13 to six-leaf sugar beet.

†Pigweed species were predominantly Powell amaranth mixed with some redroot pigweed.

Table 2. Sugar beet injury and yield with Outlook combined with standard rate herbicide programs, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate lb ai/acre	Timing*	Sugar beet injury			Sugar beet yield				ERS†
			5-10	5-20	6-1	Stand 1,000/acre	Root yield ton/acre	Sucrose ----- % -----	Extraction ----- % -----	
Untreated control	--	--	0	0	0	30.4	7.8	17.1	92.7	2,512
Progress + UpBeet	0.25 + 0.016	1	33	31	6	38.5	42.5	17.0	92.4	13,356
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2								
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	3								
Progress + UpBeet	0.25 + 0.016	1	34	36	11	38.1	40.5	17.1	92.7	12,847
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	3								
Progress + UpBeet	0.25 + 0.016	1	30	30	4	34.3	40.4	17.3	92.8	12,951
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2								
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	3								
Progress + UpBeet	0.25 + 0.016	1	38	33	13	38.0	41.4	17.2	92.8	13,204
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.34	3								
Progress + UpBeet	0.25 + 0.016	1	38	37	9	36.6	41.1	17.1	92.5	12,995
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger + Outlook + Headline	0.33 + 0.016 + 0.094 + 0.34 + 0.19	3								
Progress + UpBeet	0.25 + 0.016	1	39	35	11	36.4	41.6	17.2	92.7	13,243
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.66	2								
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.34	3								
Headline	0.19	4								
Progress + UpBeet	0.25 + 0.016	1	40	40	13	38.2	41.3	17.1	93.0	13,158
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	2								
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	3								
Progress + UpBeet	0.25 + 0.016	1	37	29	5	38.5	42.6	17.3	92.9	13,701
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.84	2								
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	3								
LSD (0.05)			8	7	8	4.9	3.7	NS	NS	1,232

*Application timings were (1) April 22 to cotyledon sugarbeet, (2) May 2 to two-leaf sugar beet and (3) May 13 to six-leaf sugar beet.
†Estimated recoverable sucrose.

Table 3. Outlook rates for weed control in sugar beet, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate lb ai/acre	Timing*	Weed control						
			Pigweed spp. [†]		Lambsquarters		H. nightshade		Barnyardgrass
			6-24	7-15	6-24	7-15	6-24	7-15	6-1
Untreated control	--	--	0	0	0	0	0	0	0
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	1	82	75	91	83	84	79	85
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2							
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.65	1	85	79	88	66	91	92	90
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2							
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.84	1	84	75	92	81	96	91	95
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2							
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.98	1	84	75	84	70	95	95	96
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2							
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	1	82	70	85	76	86	88	87
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	2							
LSD (0.05)			4	8	10	30	8	11	11

*Application timings were (1) May 2 to two-leaf sugar beet and (2) May 13 to six-leaf sugar beet.

[†]Pigweed species were predominantly Powell amaranth mixed with some redroot pigweed.

Table 4. Sugar beet injury and yield with various Outlook rates, Malheur Experiment Station, Oregon State University, Ontario, OR, 2002.

Treatment	Rate lb ai/acre	Timing*	Sugar beet injury			Sugar beet yield	
			5-10 ----- % -----	5-20	6-1	Stand 1,000/acre	Root yield ton/acre
Untreated control	--	--	0	0	0	65	1.0
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	1	27	23	4	84	35.3
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2					
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.65	1	30	30	9	81	38.1
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2					
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.84	1	31	25	6	85	38.0
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2					
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.98	1	30	31	10	84	36.2
Progress + UpBeet + Stinger	0.33 + 0.016 + 0.094	2					
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	1	32	38	12	86	33.8
Progress + UpBeet + Stinger + Outlook	0.33 + 0.016 + 0.094 + 0.5	2					
LSD (0.05)			5	8	NS	8	3.7

*Application timings were (1) May 2 to two-leaf sugar beet and (2) May 13 to six-leaf sugar beet.