

MICRO-RATE HERBICIDE PROGRAMS FOR WEED CONTROL IN SUGAR BEETS

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Introduction

Many growers are adapting the use of micro-rate herbicides for weed control in sugar beets. Research has shown that sugar beet herbicides can be applied as a broadcast treatment at the band application rate if a methylated seed oil (MSO) surfactant is added. In order for these extremely low-rate treatments to be effective they must be applied while weeds are small and treatments are applied four or more times on a 5- to 7-day interval. Trials were initiated to examine micro-rate herbicide treatments for weed control efficacy and sugar beet tolerance. One trial compared four applications of the micro-rate with three applications of the micro-rate alone or in combination with Dual Magnum, Nortron, or Outlook. All micro-rate treatments were compared to a standard herbicide program. The second trial compared micro-rate treatments containing different grass herbicides and/or the addition of Outlook for weed control efficacy.

Methods

General

Trials were established at the Malheur Experiment Station under furrow irrigation on April 12, 2001. Sugar beets (Hilleshog 'WS 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 16. Plots were sidedressed on May 23 with 200 lb N/acre as urea. All plots were treated with Roundup (0.75 lb ai/acre) prior to sugar beet emergence. On May 24, Temik 15G (10 lb/acre) was applied for sugar beet root maggot control. For powdery mildew control, Super Six liquid sulfur (1 gal/acre) was applied on June 23, sulfur dust (60 lb/acre) was applied July 1 and July 14, and Laredo fungicide combined with liquid sulfur was applied on July 27 and August 25. All fungicide treatments were applied by air.

Herbicide treatments were applied with a CO₂-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 30 psi. Plots four rows wide and 27 ft long were arranged in a randomized complete block design with three replications. 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 2. Root yields were adjusted to account for a 5 percent tare.

Data were analyzed using analysis of variance and means were separated using protected LSD at the 95 percent confidence interval ($P = 0.05$).

Number of Applications and Additions of Soil-active Herbicides to the Micro-rate Herbicide Program

Micro-rate treatments were applied three or four times. In some of the treatments receiving only three applications, Dual Magnum, Nortron, or Outlook were applied in the last application to provide residual control of germinating weeds. All treatments were compared to the micro-rate applied four times and to standard and half-rate treatments that contained MSO, both applied three times. Micro-rate treatments contained Progress (1.3 oz ai/acre), Upbeet (0.063 oz ai/acre), Stinger (0.5 oz ai/acre), Select (0.5 oz ai/acre), and MSO (1.5 percent v/v). Micro-rate treatments were applied on April 24, April 30, May 7, and May 12. The standard treatments were applied on April 24, May 4, and May 12. At the first application, sugar beets were in the cotyledon growth stage. At harvest, one sample of 16 beets was taken from each plot for quality analysis. The samples were coded and sent to Hillehog Mono-Hy Research Station in Nyssa, Oregon, to determine beet pulp sugar content and purity. The percent sugar extraction and recoverable sugar were estimated using empirical equations.

Micro-rate Treatments with Various Grass Herbicides and/or Outlook

Micro-rate treatments with the addition of different grass herbicides and/or Outlook were evaluated for broadleaf and grass control. Micro-rate treatments contained Progress (1.3 oz ai/acre), Upbeet (0.063 oz ai/acre), Stinger (0.5 oz ai/acre), and MSO (1.5 percent v/v). Poast was added to the micro-rate at 1.15 or 1.5 oz ai/acre alone and at 1.2 oz ai/acre with Outlook applied in the third application or split between the third and fourth applications. Outlook was also added to the third micro-rate application with no grass herbicide applied. Grass control was compared with Poast, Select (0.5 oz ai/acre), and Assure II (0.44 oz ai/acre). Treatments were applied on April 24, April 30, May 7, and May 12.

Results and Discussion

Number of Applications and Additions of Soil-active Herbicides to the Micro-rate Herbicide Program

Three applications of the micro-rate herbicide treatment resulted in less kochia control compared to four applications, while control was similar for the other species evaluated (Table 1). Three applications of the micro-rate with Outlook included in the last application improved redroot pigweed and late season kochia control compared to three micro-rate applications alone. Late season pigweed control with the micro-rate/Outlook combination was greater than with four applications of the micro-rate. The standard treatment provided among the greatest kochia control. All treatments caused early season sugar beet injury, but injury had decreased by June 25 (Table 2). Sugar beet root and sugar yields correlated with weed control. Adding Outlook to the third application of the micro-rate increased root yields and estimated recoverable sucrose compared to three applications alone and provided yields similar to four applications of the micro-rate.

Micro-rate Treatments with Various Grass Herbicides and/or Outlook

All treatments caused significant sugar beet injury early in the season (Table 3). Similar to other trials, injury decreased by June 25. Few differences in broadleaf weed control were apparent. However, late season barnyardgrass control was greatest with treatment containing both Poast and Outlook. Treatments where Outlook was applied without Poast provided greater late season barnyardgrass control than treatments containing Poast. Outlook alone provided less control of wild oats than all other treatments except Assure II. Select and Assure II also had greater late season barnyardgrass control than Poast at either rate. Treatments containing Poast and Outlook or Select had increased yields compared to the treatment containing Assure II.

Table 1. Weed control with micro-rate herbicide treatments applied a different number of times and in various combinations and a standard herbicide program, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001.

Treatment	Rate oz ai/acre	Timing*	Weed control							
			Redroot pigweed		Common lambsquarters		Hairy nightshade		Kochia	
			6-25	8-23	6-25	8-23	6-25	8-23	6-25	8-23
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2,4,5	82	59	93	92	79	89	79	
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2,4	73	54	89	85	69	83	64	
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2	92	83	95	93	89	87	78	
Progress + Upbeet + Stinger + Select + MSO + Outlook	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v + 10.0	4								
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2	84	73	91	92	81	93	79	
Progress + Upbeet + Stinger + Select + MSO + Dual Magnum	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v + 21.0	4								
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2	78	50	98	100	86	87	79	
Progress + Upbeet + Stinger + Select + MSO + Nortron	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v + 16.0	4								
Progress + Upbeet + Stinger + MSO	2.0 + 0.125 + 0.75 + 1.5% v/v	1,3,5	62	43	92	93	79	96	90	
Progress + Upbeet + Stinger	4.0 + 0.25 + 1.5	1,3,5	86	66	100	100	98	96	92	
Untreated			0	0	0	0	0	0	0	
LSD (0.05)			17	20	13	11	27	5	11	

*Treatments were applied on April 24 (1), April 30 (2), May 4 (3), May 7 (4), and May 12 (5).

Table 2. Sugar beet injury and yield with micro-rate herbicide applications applied a different number of times and in various combinations, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001.

Treatment	Rate oz ai/acre	Timing*	Injury				Sugar beet†			ERS‡
			5-12	5-22	6-4	6-25	Root yield ton/acre	Sugar Extraction %-----	lb/acre	
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2,4,5	28	32	25	0	38.5	16.13	93.29	11,570
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2,4	24	28	21	0	31.9	16.69	93.15	9,931
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2	32	27	25	2	42.4	16.79	93.25	13,291
Progress + Upbeet + Stinger + Select + MSO + Outlook	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v + 10.0	4								
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2	33	23	23	3	39.3	16.33	93.14	11,973
Progress + Upbeet + Stinger + Select + MSO + Dual Magnum	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v + 21.0	4								
Progress + Upbeet + Stinger + Select + MSO	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v	1,2	35	28	16	3	37	15.75	92.83	10,837
Progress + Upbeet + Stinger + Select + MSO + Nortron	1.3 + 0.063 + 0.5 + 0.5 + 1.5% v/v + 16.0	4								
Progress + Upbeet + Stinger + MSO	2.0 + 0.125 + 0.75 + 1.5% v/v	1,3,5	18	18	18	0	34.6	16.36	92.73	10,488
Progress + Upbeet + Stinger	4.0 + 0.25 + 1.5	1,3,5	35	18	25	0	37.1	16.23	92.79	11,182
Untreated			0	0	0	0	9.1	16.66	92.67	2,781
LSD (0.05)			10	20	11	NS	9.4	0.56	NS	2,909

*Treatments were applied on April 24 (1), April 30 (2), May 4 (3), May 7 (4), and May 12 (5).

†Sugar beets were harvested on October 3.

‡ Estimated recoverable sucrose.

Table 3. Sugar beet injury, weed control, and sugar beet yield with micro-rate herbicide applications with various grass herbicides and/or Outlook, Malheur Experiment Station, Oregon State University, Ontario, OR, 2001.

Treatment*	Rate oz ai/acre	Timing†	Injury		Weed control‡					Late	Root yield§ ton/acre
			5-22	6-25	Redroot pigweed	Common lambsquarters	Hairy nightshade	Barnyard- grass	Wild oat	Barnyard- grass	
Poast	1.15	1,2,3,4	20	2	94	98	96	87	100	50	37.0
Poast	1.53	1,2,3,4	28	8	91	97	98	87	100	53	37.4
Poast	1.15	1,2,3,4	30	0	90	100	97	99	99	93	41.3
Outlook	11	3									
Poast	1.15	1,2,3,4	32	10	90	97	100	100	99	93	41.9
Outlook	11	3									
Outlook	11	4									
Outlook	11	3	24	5	98	100	100	96	85	79	38.5
Select	0.5	1,2,3,4	23	2	91	100	98	95	100	68	40.9
Assure II	0.44	1,2,3,4	21	0	83	100	95	83	97	67	34.1
Untreated			0	0	0	0	0	0	0	0	6.7
LSD (0.05)			13	8	9	4	4	4	14	12	5.7

*The herbicides listed were applied at the indicated times in combination with one of the four applications of the standard micro-rate of Progress (1.3 oz ai/acre), Upbeet (0.063 oz ai/acre), Stinger (0.5 oz ai/acre), and MSO (1.5% v/v).

†Treatments were applied on April 24 (1), April 30 (2), May 7 (3), and May 12 (4).

‡Weed control was evaluated on June 25. Late barnyardgrass control was evaluated on September 23.

§Sugar beets were harvested on October 3.