VARIABLE UPBEET® AND PROGRESS® RATES IN STANDARD AND MICRO-RATE HERBICIDE PROGRAMS IN SUGAR BEET

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Introduction

Obtaining satisfactory weed control using the micro-rate program in western sugar beet regions can be difficult when conditions of low humidity and/or a lack of spring precipitation events exist prior to or during herbicide applications. Spring precipitation can increase the efficacy of preemergence applications as well as produce weed flushes that can be controlled by postemergence applications. Weed seedlings growing under dry conditions can be stressed, making them harder to control. In addition, weeds growing under dry conditions often have a heavy wax cuticle on the leaf surface that reduces herbicide penetration. Difficulties in obtaining satisfactory weed control with the micro-rate herbicide program has sparked interest in evaluating weed control and crop response with increased Progress and/or UpBeet rates within the micro-rate program.

Methods

This trial was established at the Malheur Experiment Station under furrow irrigation on April 4, 2003. Sugar beets (Hilleshog 'PM-21') were planted in 22-inch rows at a 2-inch seed spacing. On April 3, kochia, pigweed, and common lambsquarters seed was spread over the entire experimental area to promote an even weed distribution. 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 spacing on May 13 and 14. Plots were sidedressed on June 3 with 176 lb nitrogen (urea), 96 lb phosphate, 100 lb potash, 38 lb sulfates, 62 lb elemental sulfur, 2 lb zinc, and 1 lb/acre boron. All plots were treated with Roundup (0.75 lb ai/acre) prior to sugar beet emergence on April 11. On May 16, Temik 15G (14 lb/acre) was applied for sugar beet root maggot control. For powdery mildew control, Headline (12 fl oz/acre) was applied on June 17 and again on July 2 with Super Six liquid sulfur (16 pt/acre). Topsin M (0.5 lb/acre) was applied on August 4. All fungicide treatments were applied by air. Herbicide treatments were broadcast-applied with a CO_2-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.

Treatments in this trial were designed to evaluate both weed control and crop response with increasing Progress (ethofumesate + desmedipham + phenmedipham) and/or UpBeet (triflusulfuron) rates within the standard and micro-rate weed control programs.

Progress rates ranged from 4.0 to 10.8 oz ai/acre in selected standard rate treatments and from 1.28 to 2.6 oz ai/acre with selected micro-rate treatments. UpBeet rates used in standard rate treatments ranged from 0.25 to 0.5 oz ai/acre and from 0.083 to 0.166 oz ai/acre with micro-rate treatments. Stinger (clopyralid) was applied at 0.5 oz ai/acre in the micro-rate program and at 1.5 oz ai/acre in the standard rate program. Outlook (dimethenamid-P) at 12.0 oz ai/acre was applied postemergence in either the second or third application of selected micro-rate treatments and in the second application of selected standard rate treatments. Nortron (ethofumesate) was applied preemergence at a rate of 18.0 oz ai/acre and postemergence at rates of 0.5, 2.0, and 3.0 oz ai/acre in selected treatments.

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 6 and 7. 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). The untreated control was not included in the analysis of variance for weed control or crop response.

Results and Discussion

There were no differences (P = 0.05) in weed control among the herbicide treatments on June 30 (46 days after treatment [DAT]) (Table 1). On August 5 (82 DAT), kochia control was similar among herbicide treatments ranging from 95 to 100 percent. Pigweed control was less, even at 94 percent control, with the traditional micro-rate than all other treatments on August 5. Herbicide treatments gave 100 percent control of hairy nightshade and 97 to 100 percent control of common lambsquarters on August 5. Barnyardgrass control was 98 percent or higher evaluated on June 16 (31 DAT). Weed control in this trial was excellent with all of the herbicide treatments, regardless of the Progress or UpBeet rates.

Sugar beet injury was observed on May 5, 5 days after the second standard rate and 4 days after the third micro-rate postemergence applications (Table 2). Injury ranged from 23 to 40 percent and was greatest with the standard rate treatment applied in combination with methylated seed oil (MSO). The protocol called for 0.5 percent v/v MSO but was inadvertently applied with the traditional micro-rate amount of 1.5 percent v/v. On June 2 (18 DAT), this treatment again displayed the greatest injury. On June 2, sugar beet injury with micro-rate treatments was greater when Outlook and/or Nortron were included in postemergence applications compared to micro-rate treatments alone. Increasing the rates of Progress and/or UpBeet in micro-rate treatments without postemergence Outlook or Nortron did not injure sugar beet more than the traditional micro-rate treatment. Increasing the rate of UpBeet from 0.25 to 0.374 oz ai/acre in the first 2 applications and from 0.25 to 0.5 oz ai/acre in the third application significantly

increased sugar beet injury on both May 5 and June 2 with the standard rate treatment with Outlook. By June 16 (31 DAT), differences in sugar beet injury were not detectable among treatments.

In spite of treatment differences with regard to crop injury, yields were not affected by herbicide treatments. Sugar beet root yields were similar among herbicide treatments, ranging from 42.8 to 47.1 tons/acre, all of which were significantly greater than the untreated control (Table 2). There were no differences in either sucrose content or extraction among any of the treatments. All herbicide treatments had estimated recoverable sucrose yields greater than the untreated control.

Table 1. Weed control with variable UpBeet and Progress rates in standard and micro-rate herbicide programs, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

			Weed control‡				
			Kochia	Pigweed spp.†	Lambs-quarters	Hairy nightshade	Barnyard-grass
Treatment	Rate	Timing*	8-5	8-5	8-5	8-5	6-16
	oz ai/acre % v/v		%				
Untreated control	--	--	--	--	--	--	--
Nortron	18.0	1	95	100	100	100	100
Progress + UpBeet + MSO	1.28 + 0.083 + 1.5	2					
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4,6,7					
Nortron	18.0	1	99	99	100	100	100
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2					
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4					
Progress + UpBeet + Stinger + MSO	2.6 + 0.166 + 0.5 + 1.5	6,7					
Nortron	18.0	1	100	100	97	100	100
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2					
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4					
Progress + UpBeet + Stinger + Outlook + MSO	2.6 + 0.166 + 0.5 + 12.0 + 1.5	6					
Progress + UpBeet + Stinger + MSO	2.6 + 0.166 + 0.5 + 1.5	7					
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2	100	100	100	100	100
Progress + UpBeet + Stinger + Nortron + MSO	2.6 + 0.125 + 0.5 + 1.5 + 1.5	4					
Progress + UpBeet + Stinger + Nortron + Outlook + MSO	2.6 + 0.166 + 0.5 + 2.0 + 12.0 + 1.5	6					
Progress + UpBeet + Stinger + Nortron + MSO	2.6 + 0.166 + 0.5 + 3.0 + 1.5	7					
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2	98	100	100	100	100
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4					
Progress + UpBeet + Stinger + Outlook + MSO	2.6 + 0.166 + 0.5 + 12.0 + 1.5	6					
Progress + UpBeet + Stinger + MSO	2.6 + 0.166 + 0.5 + 1.5	7					
Nortron	18.0	1	100	100	99	100	100
Progress + UpBeet	5.4 + 0.374	3					
Progress + UpBeet + Stinger + Outlook	8.1 + 0.374 + 1.5 + 12.0	5					
Progress + UpBeet + Stinger	10.8 + 0.5 + 1.5	7					
Nortron	18.0	1	99	100	100	100	100
Progress + UpBeet + MSO	5.4 + 0.374 + 1.5	3					
Progress + UpBeet+ Stinger + Outlook + MSO	8.1 + 0.374 + 1.5 + 12.0 + 0.5	5					
Progress + UpBeet+ Stinger + MSO	10.8 + 0.5 + 1.5 + 0.5	7					

Table 1. *(continued)* Weed control with variable UpBeet and Progress rates in standard and micro-rate herbicide programs, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

			Weed control‡				
			Kochia	Pigweed spp.†	Lambs-quarters	Hairy nightshade	Barnyard-grass
Treatment	Rate	Timing*	8-5	8-5	8-5	8-5	6-16
	oz ai/acre % v/v		%				
Nortron	18.0	1	100	100	100	100	100
Progress + UpBeet	4.0 + 0.25	3					
Progress + UpBeet + Stinger + Outlook	5.4 + 0.25 + 1.5 + 12.0	5					
Progress + UpBeet + Stinger	6.75 + 0.25 + 1.5	7					
Nortron	18.0	1	100	100	100	100	100
Progress + UpBeet	5.4 + 0.25	3					
Progress + UpBeet + Stinger + Outlook	8.1 + 0.25 + 1.5 + 12.0	5					
Progress + UpBeet + Stinger +	10.8 + 0.25 + 1.5	7					
Nortron	18.0	1	96	94	100	100	98
Progress + UpBeet + MSO	1.28 + 0.083 + 1.5	2					
Progress + UpBeet + Stinger + MSO	1.28 + 0.083 + 0.5 + 1.5	4					
Progress + UpBeet + Stinger + MSO	1.8 + 0.083 + 0.5 + 1.5	6,7					
Nortron	18.0	1	96	99	100	100	100
Progress + UpBeet + MSO	1.28 + 0.083 + 1.5	2					
Progress + UpBeet + Stinger + MSO	2.6 + 0.083 + 0.5 + 1.5	4,6,7					
LSD (0.05)			NS	3	2	NS	NS

*Application timings were (1) April 11 preemergence, (2) April 19 to cotyledon sugar beets, (3) April 23 to full cotyledon sugar beets, (4) April 26 to cotyledon to 2-leaf sugar beets, (5) April 30 to 2-leaf sugar beets, (6) May 1 to 2- to 4-leaf sugar beets, and (7) May 16 to 10-leaf sugar beets.

†Pigweed species included Powell amaranth and redroot pigweed.

‡The untreated control was not included in the weed control analysis.

Table 2. Sugar beet injury and yield with variable UpBeet and Progress rates in standard and micro-rate herbicide programs, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

			Sugar beet						
			Injury†			Yield‡			
Treatment	Rate	Timing*	5-5	6-2	6-16	Root yield	Sucrose	Extraction	ERS
	oz ai/acre % v/v		---------- % ----------			ton/acre	---------- % ----------		lb/acre
Untreated control	--	--	--	--	--	21.0	16.0	91.8	6,208
Nortron	18.0	1	29	13	0	46.4	16.4	91.9	13,977
Progress + UpBeet + MSO	1.28 + 0.083 + 1.5	2							
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4,6,7							
Nortron	18.0	1	27	11	0	45.5	16.4	92.1	13,749
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2							
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4							
Progress + UpBeet + Stinger + MSO	2.6 + 0.166 + 0.5 + 1.5	6,7							
Nortron	18.0	1	34	19	0	42.8	16.6	91.9	13,079
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2							
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4							
Progress + UpBeet + Stinger + Outlook + MSO	2.6 + 0.166 + 0.5 + 12.0 + 1.5	6							
Progress + UpBeet + Stinger + MSO	2.6 + 0.166 + 0.5 + 1.5	7							
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2	30	24	0	45.5	16.7	92.3	14,033
Progress + UpBeet + Stinger + Nortron + MSO	2.6 + 0.125 + 0.5 + 1.5 + 1.5	4							
Progress + UpBeet + Stinger + Nortron + Outlook + MSO	2.6 + 0.166 + 0.5 + 2.0 + 12.0 + 1.5	6							
Progress + UpBeet + Stinger + Nortron + MSO	2.6 + 0.166 + 0.5 + 3.0 + 1.5	7							
Progress + UpBeet + MSO	1.28 + 0.125 + 1.5	2	28	17	0	47.1	16.2	92.2	14,124
Progress + UpBeet + Stinger + MSO	2.6 + 0.125 + 0.5 + 1.5	4							
Progress + UpBeet + Stinger + Outlook + MSO	2.6 + 0.166 + 0.5 + 12.0 + 1.5	6							
Progress + UpBeet + Stinger + MSO	2.6 + 0.166 + 0.5 + 1.5	7							
Nortron	18.0	1	33	29	0	46.3	16.4	92.2	14,005
Progress + UpBeet	5.4 + 0.374	3							
Progress + UpBeet + Stinger + Outlook	8.1 + 0.374 + 1.5 + 12.0	5							
Progress + UpBeet + Stinger	10.8 + 0.5 + 1.5	7							
Nortron	18.0	1	40	31	2	46.3	16.4	92.2	13,985
Progress + UpBeet + MSO	5.4 + 0.374 + 1.5	3							
Progress + UpBeet+ Stinger + Outlook + MSO	8.1 + 0.374 + 1.5 + 12.0 + 0.5	5							
Progress + UpBeet+ Stinger + MSO	10.8 + 0.5 + 1.5 + 0.5	7							

Table 2. *(continued)* Sugar beet injury and yield with variable UpBeet and Progress rates in standard and micro-rate herbicide programs, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

			Sugar beet						
			Injury†			Yield‡			
Treatment	Rate	Timing*	5-5	6-2	6-16	Root yield	Sucrose	Extraction	ERS
	oz ai/acre % v/v		---------- % ----------			ton/acre	---------- % ----------		lb/acre
Nortron	18.0	1	23	17	0	44.6	16.8	92.6	13,841
Progress + UpBeet	4.0 + 0.25	3							
Progress + UpBeet + Stinger + Outlook	5.4 + 0.25 + 1.5 + 12.0	5							
Progress + UpBeet + Stinger	6.75 + 0.25 + 1.5	7							
Nortron	18.0	1	29	24	0	46.4	16.5	92.5	14,139
Progress + UpBeet	5.4 + 0.25	3							
Progress + UpBeet + Stinger + Outlook	8.1 + 0.25 + 1.5 + 12.0	5							
Progress + UpBeet + Stinger +	10.8 + 0.25 + 1.5	7							
Nortron	18.0	1	25	10	0	46.1	16	91.8	13,546
Progress + UpBeet + MSO	1.28 + 0.083 + 1.5	2							
Progress + UpBeet + Stinger + MSO	1.28 + 0.083 + 0.5 + 1.5	4							
Progress + UpBeet + Stinger + MSO	1.8 + 0.083 + 0.5 + 1.5	6,7							
Nortron	18.0	1	25	11	0	46.7	16.3	91.9	14,000
Progress + UpBeet + MSO	1.28 + 0.083 + 1.5	2							
Progress + UpBeet + Stinger + MSO	2.6 + 0.083 + 0.5 + 1.5	4,6,7							
LSD (0.05)			6	6	NS	4.4	NS	NS	1,341

*Application timings were (1) April 11 preemergence, (2) April 19 to cotyledon sugar beets, (3) April 23 to full cotyledon sugar beets, (4) April 26 to cotyledon to 2-leaf sugar beets, (5) April 30 to 2-leaf sugar beets, (6) May 1 to 2- to 4-leaf sugar beets, and (7) May 16 to 10-leaf sugar beets.
†The untreated control was not included in the sugar beet injury analysis.
‡Sugar beets were harvested on October 6 and 7, 2003.