MICRO-RATE HERBICIDE APPLICATIONS, DUAL II MAGNUM, AND BAS 656 07 H FOR WEED CONTROL IN SUGAR BEETS

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Introduction

Sugar beet producers have long applied sequential reduced-rate herbicide treatments in a timely manner to improve weed control and reduce sugar beet injury. Recently, in Minnesota and North Dakota, sugar beet herbicides have been effective applied as a broadcast treatment at the band application rate if a methylated seed oil (MSO) surfactant is added. These extremely low-rate treatments have been called "micro-rates". A trial was initiated to examine reduced rate and micro-rate herbicide treatments for weed control efficacy and sugar beet tolerance.

Techniques have been developed that allow chemical manufacturers to separate active and inactive components of herbicides during the production process. This results in a product that is active at lower total-use rates. These new herbicides are being developed for use in sugar beets and will provide additional herbicide options for weed control in the near future. These new products need to be incorporated into existing weed control programs to make their use most effective. Trials were established at the Malheur Experiment Station to evaluate Dual II Magnum (S-metolachlor) and Frontier X2 (BAS 656 07 H) for sugar beet tolerance and weed control efficacy.

Procedures

'WS PM-9' sugar beets were planted May 15 in 22-in rows. Plots were side-dressed on June 6 with 210 lb N/acre as urea. Herbicide treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi. Plots 4-rows wide and 30-ft long were arranged in a randomized complete block design. 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 14. All plots were severely damaged by hail on July 4.

Micro-rate Herbicides
Herbicide rates typically applied in a 7-in band were applied as a broadcast treatment with the addition of a methylated seed oil adjuvant. Broadcast micro-rate treatments were applied with 8002 flat-fan nozzles while standard band applications were applied with 8001 even flat-fan nozzles. Banded treatments were applied in a 7-in band over the row. Initial herbicide applications were made to cotyledon-stage sugar beets and then sequentially at 7-day intervals. Redroot pigweed, common lambsquarters, hairy nightshade, and barnyardgrass were less than 0.25-in tall at the time of the first

herbicide application. A total of four herbicide applications were made during the season. Cultivations did not remove all of the weeds outside of the herbicide band, resulting in less control in banded than in broadcast treatments.

BAS 656 07 H Tolerance and Weed Control
For the tolerance trial, all plots were maintained weed-free with standard herbicides and by hand labor. Sugar beet injury and yield was evaluated in response to postemergence applications of BAS 656 07 H at a typical use rate (0.64 lb ai/acre) and at rates 2 (1.28 lb ai/acre) and 4 (2.56 lb ai/acre) times the typical use rate. Combinations of BAS 656 07 H at 0.64 lb ai/acre with Betamix or Betamix plus Upbeet were also evaluated. Treatments were applied to 4-5 leaf sugar beets.

The weed control treatments consisted of BAS 656 07 H (0.64 lb ai/acre), Betamix (0.25 lb ai/acre), and Betamix plus Upbeet (0.0156 lb ai/acre) alone and in combinations applied to 2-leaf sugar beets. All plots except the untreated received Betamix (0.25 lb ia/acre) when sugar beets were in the cotyledon stage.

Dual II Magnum (S-metolachlor)
Dual II Magnum was evaluated for weed control in sugar beets, applied preplant incorporated (PPI), early postemergence (EPOST), and postemergence (POST) in combinations with other herbicides. Preplant incorporated treatments were applied April 3 and immediately incorporated with a 9-in row PTO power tiller. Early postemergence treatments were applied to cotyledon sugar beets April 27. Some treatments received a sequential postemergence herbicide application May 11 when sugar beets had 4 leaves. Treatments containing Dual II Magnum were compared to a PPI application of Nortron and one- and two-postemergence applications of Betamix, Upbeet, and Stinger. Sugar beet stands were determined by counting the number of plants per yard of row in the two center rows of each plot and averaging the two values.

Results and Discussion

Micro-rate Herbicides
Weed control with the broadcast micro-rate herbicide treatment was as good or better than the standard herbicide program applied in a band (Table 1). Sugar beet injury was not different among the different treatments. Root yields and estimated recoverable sugar were improved by all treatments compared to the untreated check, but were not different among the herbicide treatments. Using the micro-rates program requires more frequent herbicide applications, but would allow producers to broadcast-apply their herbicides and it may reduce the number of cultivations that would need to be made during the season. The addition of surfactants to Betamix Progress is not currently allowed by the herbicide label.

BAS 656 07 H Tolerance and Weed Control
In the tolerance trial, BAS 656 07 H at the 4× rate injured sugar beets and reduced yield 9 percent compared to the hand-weeded check (Table 2). BAS 656 07 H alone at the 1 or 2× rate or in combinations with other herbicides at the 1× rate did not reduce sugar beet root yields or estimated recoverable sugar.

Weed control with BAS 656 07 H was comparable to standard treatments if weeds were controlled before its application (Table 3). The addition of Betamix to BAS 656 07 H increased control of redroot pigweed, common lambsquarters, and hairy nightshade compared to BAS 656 07 H alone. BAS 656 07 H and Frontier applied alone to 2-leaf sugar beets did not control weeds effectively. This may have been due to weed emergence after the initial application of Betamix but before the BAS 656 07 H and Frontier applications. Late-season barnyardgrass control was greater for treatments containing BAS 656 07 H in comparison to sequential applications of Betamix or Betamix plus Upbeet. All treatments increased yields compared to the untreated plots, but yields with BAS 656 07 H and Frontier alone were lower than the other treatments because of poor weed control.

Dual II Magnum (S-metolachlor)
Preplant incorporated applications of Dual II Magnum injured sugar beets at both rates evaluated (18 to 32 percent), and PPI applications followed by early postemergence applications of Dual II Magnum resulted in greater injury (37 to 63 percent) than Dual II Magnum applied only PPI (Table 4). Nortron also had significant sugar beet injury on May 15 and June 12. By July 1 injury was indistinguishable for all treatments except Dual II Magnum applied PPI (1.27 lb ai/acre) followed by EPOST (2.48 lb ai/acre) in combination with Betamix, Upbeet, and Stinger. This treatment also had among the lowest stand count of any of the treatments. Dual II Magnum applied PPI provided control of redroot pigweed, common lambsquarters, and hairy nightshade similar to PPI applied Nortron. However, Dual II Magnum was more effective than Nortron in controlling annual sowthistle. Applications of Dual II Magnum before or in combination with Betamix, Upbeet, and Stinger resulted in greater than 85 percent control of all weed species. EPOST applications of Dual II Magnum alone did not control weeds that were emerged and resulted in poor control throughout the season. The addition of a herbicide with postemergence activity at this timing may have resulted in acceptable weed control. Sugar beet yields were increased in comparison to the untreated plot by all treatments except Dual II Magnum (1.59 lb ai/acre) applied alone at the early postemergence timing. In all cases, sugar beet yields corresponded with weed control evaluations and not with herbicide injury.

Table 1. Sugar beet injury and broadleaf weed control on July 1, and barnyardgrass control on August 8 with micro-rate herbicide applications, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment†	Rate	Application	Injury	Weed Control				Root yield	ERS
				Redroot pigweed	Common lambsquarters	Hairy nightshade	Barnyard -grass		
	oz ai/acre		----------%----------					tons/acre	lbs/acre
Progress + Upbeet + Stinger + MSO	1.3 + 0.083 + 0.5 + 1.5% v/v	Broadcast	0	91	95	91	93	42	10,896
Progress + Upbeet	4.0 + 0.25	Band	0	70	80	60	89	39	10,655
Progress + Upbeet + MSO	2.0 + 0.25 + 1.5 % v/v	Band	0	73	90	64	92	41	10,833
Untreated	-	-	0	0	0	0	0	21	5,850
LSD (0.05)			NS	12	9	9	8	4	973

†Treatments were applied April 27, May 4, May 11, and May 19.

Table 2. Sugar beet injury and root yields in response to applications of Frontier and BAS 656 07 H under weed free conditions, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment†	Rate	Crop injury				Root yield	Sugar	Estimated recoverable sugar
		5-29	6-11	7-1	8-3			
	lb ai/acre	----------%----------				tons/acre	%	lbs/acre
Handweeded	-	9	3	3	8	42	14.9	12,405
Frontier	1.17	6	6	5	5	42	15.3	12,809
BAS 656 07 H	0.64	14	9	4	5	42	14.9	12,419
BAS 656 07 H (2X)	1.28	15	14	11	0	42	15.0	12,637
BAS 656 07 H (4X)	2.56	29	21	29	0	38	14.8	11,243
BAS 656 07 H + Betamix	0.64 + 0.33	13	9	0	5	40	15.5	12,504
BAS 656 07 H + Betamix + Upbeet	0.64 + 0.33 + 0.0156	9	10	0	0	41	14.9	12,259
LSD (0.05)		11	11	8	11	2	0.4	700

†All plots received Betamix (0.25 lb ai/acre) at cotyledon and two leaf sugar beets. Treatments were applied to 4-leaf sugar beets.

Table 3. Sugar beet injury, weed control, and sugar beet root yields in response to applications of Frontier and BAS 656 07 H, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

Treatment†	Rate	Timing	Crop injury		Weed control				Sugar beet root yield
			6-20	7-1	Redroot pigweed	Lambs-quarters	Hairy nightshade	Barnyard-grass	
	lb ai/acre	leaf	----------			%----------			tons/acre
Untreated	-	-	0	0	0	0	0	0	10
Frontier	1.17	2	0	0	47	37	23	82	26
BAS 656 07 H	0.64	2	0	0	30	37	13	78	28
BAS 656 07 H + Betamix	0.64 + 0.25	2	7	0	92	92	95	95	40
Betamix	0.25	2	0	0	85	83	80	87	36
BAS 656 07 H + Betamix + Upbeet	0.64 + 0.25 + 0.0156	2	7	0	92	92	95	93	40
Betamix + Upbeet	0.25 + 0.0156	2	2	0	85	88	92	88	37
Betamix BAS 656 07 H + Poast	0.25 0.64 + 0.19	2 4	2	0	95	92	90	95	39
LSD (0.05)			5	NS	24	15	16	14	5

†All plots except the untreated received Betamix (0.25 lb ai/acre) at cotyledon sugar beets. The listed treatments were applied to 2-leaf or 4-leaf sugar beets.

Table 4. Sugar beet injury, stand, and root yields and weed control in response to Dual II Magnum applications, Malheur Experiment Station, Oregon State University, Ontario, OR, 1998.

			Crop injury				Stand count		Weed control				Sugar beet root yield
Treatment	Rate	Timing†	5-4	5-15	6-12	7-1	5-4	5-15	Redroot pigweed	Lambs-quarters	Hairy nightshade	Annual sowthistle	
	lb ai/acre		----------%----------				--plants/yd--		----------%----------				tons/acre
Untreated	-	-	0	0	7	0	12	11	0	0	0	0	16
Nortron	3.0	PPI	5	23	10	0	14	13	78	70	7	27	32
Dual II Magnum	1.27	PPI	18	28	3	0	12	10	65	42	10	95	30
Dual II Magnum	1.59	PPI	25	32	5	0	12	11	85	57	17	95	33
Dual II Magnum	1.59	EPOST	7	3	20	0	14	12	17	17	0	10	20
Dual II Magnum	2.48	EPOST	10	0	18	0	14	13	22	8	3	15	23
Betamix + Upbeet + Stinger	0.25 + 0.0156 + 0.06	EPOST	12	2	2	0	13	13	8	53	5	93	26
Dual II Magnum Dual II Magnum Betamix + Upbeet + Stinger	0.96 2.48 0.25 + 0.156 + 0.06	PPI EPOST EPOST + POST	37	58	15	0	12	12	95	95	95	95	38
Dual II Magnum Dual II Magnum Betamix + Upbeet + Stinger	1.27 2.48 0.25 + 0.0156 + 0.06	PPI EPOST EPOST + POST	47	63	12	8	9	9	95	95	95	95	38
Betamix + Upbeet + Stinger Dual II Magnum + Betamix + Stinger	0.25 + 0.0156 + 0.06 2.48 + 0.25 + 0.06	EPOST POST	10	12	0	0	13	12	85	95	95	95	39
Betamix + Upbeet + Stinger Betamix + Upbeet + Stinger	0.25 + 0.156 + 0.06 0.25 + 0.156 + 0.06	EPOST POST	10	12	0	0	13	11	55	90	95	95	39
LSD (0.05)			12	13	9	4	3	2	27	29	14	10	5

†PPI treatments were applied April 4, EPOST treatments were applied April 24, and POST treatments were applied May 11.