

MICRO-RATE HERBICIDE PROGRAMS FOR WEED CONTROL IN SUGAR BEETS

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Introduction

Sugar beet producers long have applied sequential applications of Progress, Upbeet, and Stinger at reduced rates and in a timely manner to improve weed control and reduce sugar beet injury. Recently, 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. These extremely low-rate treatments have been called "micro-rates". Trials were initiated to examine micro-rate herbicide treatments for weed control efficacy and sugar beet tolerance. One trial examined different micro-rate combinations. The second trial evaluated the effects of increasing the rate of Betamix or Progress in the third and fourth micro-rate applications.

Methods

General

Hilleshog 'WS PM-21' sugar beets were planted on April 11 in 22-inch rows. Plots were sidedressed on May 22 with 240 lb N/acre as urea. All plots were treated with Roundup (0.75 lb ai/acre) on April 18 prior to sugar beet emergence. 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. 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 3. Root yields were adjusted to account for a five percent tare. Data were analyzed using analysis of variance and means were separated using protected LSD at the 95 percent confidence interval ($P = 0.05$).

Micro-rate Herbicides

Micro-rate treatments were compared to standard rates and a treatment containing half the standard rate combined with MSO. Micro-rate treatments included Betamix (1.3 oz ai/acre) or Progress (1.3 oz ai/acre) in combination with Upbeet (0.063 oz ai/acre), Stinger (0.5 oz ai/acre), and MSO (1.5 percent v/v) compared to micro-rate treatments using experimental formulations of Betamix (BO38584) and Progress (BO49913). Comparisons were also made to micro-rate treatments with Stinger removed from the first application or removed completely. Other treatments included different rates of Upbeet or the addition of Select or Assure II for grass control. All treatments were applied broadcast with 8002 flat-fan nozzles. Treatments were replicated four times. All treatments including the standard were applied on April 21, April 27, May 4, and May 15. At the first application, sugar beets and weeds were in the cotyledon growth stage.

Micro-Rate Treatments with Increasing Rates

Micro-rate treatments with increasing rates of Betamix or Progress were applied broadcast or in a 10-inch band and compared to the standard herbicide program applied in a 7-inch band. Broadcast treatments were applied with 8002 flat-fan nozzles while band applications were applied with 8001 even flat-fan nozzles. Initial herbicide applications were made to cotyledon sugar beets and weeds and then sequentially at 7- to 10-day intervals. Treatments were replicated three times. Micro-rate treatments were applied on April 24, May 1, May 10, and May 18. The standard herbicide treatment was applied on April 24, May 10, and May 18 followed by an application of Assure II plus crop oil concentrate (COC) on May 31. Sixteen sugar beets from each plot were sent to Hillehog Mono-Hy Research Station in Nyssa, OR, to determine beet pulp sugar content and purity.

Results and Discussion

Micro-rate Herbicides

Because the standard herbicide program was applied four times beginning when sugar beets were in the cotyledon stage, injury with this treatment was greater than for any other treatment on May 23 and June 14 (Table 1). Injury with the reduced rate treatment was greater than the micro-rate treatments on May 23 but did not differ from many of the micro-rate treatments on June 14. The addition of Stinger to micro-rate treatments did not increase sugar beet injury compared to no Stinger. All treatments provided greater than 91 percent control of redroot pigweed, 94 percent control of common lambsquarters, and 92 percent control of hairy nightshade. Barnyardgrass control on July 3 was improved with the addition of Select or Assure II compared to most of the other treatments. Injury and weed control was not different with the experimental and commercial formulations of Betamix and Progress. Sugar beet yields ranged from 32 to 41 tons/acre. The combination of Progress, Upbeet, Stinger, MSO, and Assure II provided among the highest sugar beet yields, while the combination of Progress, Upbeet, and MSO provided among the lowest.

Micro-Rate Treatments with Increasing Rates

Injury was significant (31 percent) with the micro-rate treatment containing Nortron at 4 oz ai/acre on May 25 (data not shown). This is not surprising since the rate was significantly higher than intended. No significant injury was apparent for any treatment by June 14 (Table 2). On June 14, the combination of Progress, Upbeet, Stinger, MSO, and Assure II applied broadcast provided slightly greater redroot pigweed control than the 11-inch band application or the standard applied in a 7-inch band. The standard applied in a 7-inch band also provided among the least common lambsquarters and hairy nightshade control. All broadcast treatments provided 96-98 percent and 92-98 percent control of common lambsquarters and hairy nightshade, respectively. The micro-rate treatment without Assure II had among the lowest rate of barnyardgrass control. Barnyardgrass control with the combination of Progress, Upbeet, Stinger, MSO, and Assure II was greater when applied broadcast as compared to the same treatment applied in an 11-inch band. Differences in sugar beet yield

mirrored differences in barnyardgrass control, with treatments providing poor barnyardgrass control producing among the lowest yields.

Table 1. Sugar beet injury, weed control, and sugar beet yield with micro-rate herbicide applications, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Treatment*	Rate oz ai/acre	Injury		Weed control†				Root yield‡ ton/acre
		5-23	6-14	Redroot pigweed	Common lambsquarters	Hairy nightshade	Barnyard- grass	
Progress + Upbeet+ Stinger + MSO	1.3 + 0.063 + 0.5 + 1.5% v/v	8	1	98	97	96	88	38.3
Betamix + Upbeet + Stinger + MSO	1.3 + 0.063 + 0.5 + 1.5% v/v	7	6	98	98	94	84	34.7
BO49913 + Upbeet + Stinger + MSO + Assure II	1.3 + 0.063 + 0.5 + 1.5% v/v + 0.44	5	1	97	95	96	88	38.5
BO38584 + Upbeet + Stinger + MSO + Assure II	1.3 + 0.063 + 0.5 + 1.5% v/v + 0.44	9	4	96	98	94	79	32.2
Progress + Upbeet + MSO	1.3 + 0.063 + 1.5% v/v	8	5	94	96	94	84	35.1
Betamix + Upbeet + Stinger (2-4) + MSO	1.3 + 0.063 + 0.5 + 1.5% v/v	6	4	97	98	94	80	34.4
Progress + Upbeet+ Stinger + MSO	1.3 + 0.083 + 0.5 + 1.5% v/v	10	1	92	97	95	82	34.0
Progress + Upbeet+ Stinger + MSO + Select	1.3 + 0.063 + 0.5 + 1.5% v/v + 0.5	5	5	91	97	92	98	35.4
Progress + Upbeet+ Stinger + MSO + Assure II	1.3 + 0.063 + 0.5 + 1.5%v/v +0.44	6	4	95	97	96	92	40.5
Progress + Upbeet+ Stinger + MSO	2.0 + 0.125 + 0.75 + 1.5% v/v	19	9	97	95	95	87	38.6
Progress + Upbeet+ Stinger	4.0 + 0.25 + 1.5	28	16	93	94	95	81	34.8
Untreated		0	0	0	0	0	0	3.6
LSD (0.05)		7	6	6	3	5	7	5.1

*Treatments were applied on April 21, April 27, May 4, and May 15. The sixth treatment did not have Stinger in the first application but included Stinger in the second, third, and fourth applications.

†Weed control evaluations were taken on June 14, except barnyardgrass, which was evaluated on July 3.

‡Sugar beets were harvested on October 3.

Table 2. Sugar beet injury, weed control, and sugar beet yield with micro-rate herbicide applications with increasing Betamix rates, Malheur Experiment Station, Oregon State University, Ontario, OR, 2000.

Treatment	Rate*	Application	Timing†	Injury	Weed control‡				Root yield§
					Redroot pigweed	Common lambsquarters	Hairy nightshade	Barnyard-grass	
				%				ton/acre	
Betamix + Upbeet + MSO + Assure II	1.3 (2.0) + 0.083 + 1.5% v/v + 0.44	Broadcast	1,2,3,4	9	96	98	97	91	33.6
Progress + Upbeet + MSO + Assure II	1.3 (2.0) + 0.083 + 1.5% v/v + 0.44	Broadcast	1,2,3,4	5	94	97	92	91	33.2
Progress + Upbeet + Stinger + MSO + Assure II	1.3 (2.0) + 0.083 + 0.5 + 1.5% v/v + 0.44	Broadcast	1,2,3,4	0	98	96	97	95	38.7
Progress + Upbeet + Nortron + MSO + Assure II	1.3 (2.0) + 0.083 + 4.0 + 1.5% v/v + 0.44	Broadcast	1,2,3,4	9	97	96	95	87	35.4
Progress + Upbeet + Stinger + MSO + Assure II	4.0 + 0.25 + 1.5 + 1.5% v/v + 0.44	11" Band	1,2,3,4	5	92	93	93	89	31.5
Progress + Upbeet + Stinger Assure II + COC	1.3 + 0.083 + 0.5 1.1 + 1.0% v/v	7" Band	1,3,4 5	8	92	91	88	90	34.7
Progress + Upbeet + Stinger + MSO	2.0 + 0.25 + 0.75 + 1.5 % v/v	Broadcast	1,2,3,4	13	98	97	98	83	28.9
Untreated				0	0	0	0	0	3.5
LSD (0.05)				5	6	5	5	5	5.8

*In treatments where the Betamix rate was increased over time, the lowest rate was used for the first two applications and then increased for the third and fourth applications.

† Treatments were applied on April 24 (1), April 29 (2), May 4 (3), and May 15 (4), except the standard, which was applied on April 24 (1), May 4 (3), and May 15 (14) followed by Assure II plus COC applied on May 31 (5).

‡Weed control evaluations were taken on June 14.

§Sugar beets were harvested on October 3.