

EVALUATION OF PROGRESS® AND BETAMIX® FORMULATIONS FOR WEED CONTROL AND SUGAR BEET RESPONSE

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Ontario, OR, 2003

Introduction

Pressure from the U.S. Environmental Protection Agency to remove the carrier isophorone from the current formulations of Betamix (desmedipham + phenmedipham) and Progress (ethofumesate + desmedipham + phenmedipham) herbicides has lead Bayer CropScience to develop formulations of these products that use oil-based carriers. The objective of this trial was to determine if sugar beet tolerance and weed control efficacy with the experimental oil-based formulations of Progress (AE B049913) and Betamix (AE B038584) are similar to their respective commercial formulations.

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, weed 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) on April 11 prior to sugar beet emergence. 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 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.

Experimental and commercial formulations of Progress and Betamix were applied alone at 4.0 oz ai/acre and in a micro-rate at 1.28 and 2.56 oz ai/acre with UpBeet (triflusulfuron) at 0.063 oz ai/acre, Stinger (clopyralid) at 0.5 oz ai/acre, and Scoil (methylated seed oil) at 1.5 percent v/v. The experimental and commercial formulations were applied three times alone with the first application to cotyledon beets, the second to two-leaf beets, and the third to six-leaf beets. The three application dates were April 22, May 2, and May 13. The micro-rate treatments were applied four

times with applications to cotyledon beets on April 22, two-leaf beets on April 29, four-leaf beets on May 4, and six-leaf beets on May 13.

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 Hillebrand 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

In general, weed control was less with the experimental and commercial Progress and Betamix herbicides applied alone at standard rates compared with the micro-rate treatments (Table 1). On June 6, the experimental formulations, compared with their commercial equivalents, provided similar control of nightshade, common lambsquarters, and kochia. The only difference was observed with the experimental Progress formulation, which controlled pigweed less than its commercial formulation on June 16.

Sugar beet injury ranged from 12 to 22 percent on May 5 prior to the last herbicide application for both the micro and standard rate programs (Table 2). On June 2 (21 days after treatment), sugar beet injury had decreased with most treatments and was similar between the experimental and commercial formulations, whether applied alone at standard rates or in the micro-rate program. Sugar beet root and estimated recoverable sucrose yields were not different when comparing the experimental formulations with their respective commercial formulations applied alone at standard rates or as part of the micro-rate program (Table 2). There were no differences in percent sucrose or percent extraction among any of the treatments.

Table 1. Weed control with experimental and commercial Progress and Betamix formulations, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment*	Rate	Timing†	Weed control §					
			Pigweed spp‡		Night-shade	Lambs-quarters	Kochia	
			6-16	8-5	8-5	8-5	6-16	8-5
	oz ai/acre		-----%					
Exp. Progress	4.0	2	80	18	90	95	94	71
Exp. Progress	5.3	4						
Exp. Progress	5.3	6						
Progress	4.0	2	93	48	95	94	90	73
Progress	5.3	4						
Progress	5.3	6						
Exp. Progress + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	100	93	98	99	95	83
Exp. Progress + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Progress + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	99	91	100	100	100	94
Progress + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Exp. Betamix	4.0	2	84	30	88	98	74	49
Exp. Betamix	5.3	4						
Exp. Betamix	5.3	6						
Betamix	4.0	2	90	43	94	100	83	61
Betamix	5.3	4						
Betamix	5.3	6						
Exp. Betamix + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	100	74	100	100	96	88
Exp. Betamix + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Betamix + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	100	90	98	100	92	84
Betamix + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Untreated control	--	--	--	--	--	--	--	--
LSD (0.05)			11	34	8	NS	15	28

*Experimental Progress (AE B049913) and Betamix (AE B038584) formulations are oil-based.

†Applications were made (1) April 19 to cotyledon beets, (2) April 23 to full cotyledon beets, (3) April 26 to cotyledon to 2-leaf beets, (4) April 30 to 2-leaf beets, (5) May 1 to 2-leaf beets, and (6) May 12 to 8-leaf 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 experimental and commercial Progress and Betamix formulations, Malheur Experiment Station, Oregon State University, Ontario, OR, 2003.

Treatment	Rate	Timing*	Sugar beet					
			Injury [†]		Root yield	Yield [‡]		ERS [§]
			5-5	6-2		Sucrose	Extraction	
oz ai/acre	----- % -----	ton/acre	----- % -----	lb/acre				
Exp. Progress	4.0	2	12	16	42.1	16.5	92.7	12,917
Exp. Progress	5.3	4						
Exp. Progress	5.3	6						
Progress	4.0	2	16	13	44.7	16.5	92.9	13,670
Progress	5.3	4						
Progress	5.3	6						
Exp. Progress + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	19	9	46.6	16.1	92.6	13,966
Exp. Progress + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Progress + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	21	10	46.6	16.3	91.8	14,021
Progress + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Exp. Betamix	4.0	2	21	12	39.7	16.4	92.9	12,137
Exp. Betamix	5.3	4						
Exp. Betamix	5.3	6						
Betamix	4.0	2	17	7	43.5	16.1	92.5	12,965
Betamix	5.3	4						
Betamix	5.3	6						
Exp. Betamix + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	22	18	45.0	16.3	92.5	13,566
Exp. Betamix + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Betamix + UpBeet + Stinger + MSO	1.28 + 0.064 + 0.5 + 1.5% v/v	1, 3	22	14	45.6	16.1	92.2	13,561
Betamix + UpBeet + Stinger + MSO	2.56 + 0.064 + 0.5 + 1.5% v/v	5, 6						
Untreated control	--	--	--	--	26.5	16.1	92.7	7,878
LSD (0.05)			6	6	6.4	NS	NS	2,492

*Applications were made (1) April 19 to cotyledon beets, (2) April 23 to full cotyledon beets, (3) April 26 to cotyledon to 2-leaf beets, (4) April 30 to 2-leaf beets, (5) May 1 to 2-leaf beets, and (6) May 12 to 8-leaf beets.

[†]The untreated control was not included in the sugar beet injury analysis.

[‡]Sugar beets were harvested on October 7-8, 2003.

[§]ERS = Estimated recoverable sucrose.