New Grass Herbicides and Weed Management Techniques in Sugarbeets

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INTRODUCTION

Advances in chemical weed control in sugarbeets have been rapid in the past decade. Herbicides with improved efficacy, selectivity, lower dosage and better consistancy have and continue to be developed and marketed. Even with such advancements, certain facets of chemical weed control in sugarbeets need further refinement.

Postemergence grass herbicides presently labeled do not give consistant grass control (3). Grass competition in sugarbeets can cause significant yield losses, for example, one barnyardgrass plant per meter of row reduces beet yield by 33% (5). Several candidate grass herbicides, currently in various stages of research and development, are being tested by workers in California (5), Michigan (4), North Dakota (3) and Wyoming (1).

Early weed flushes are troublesome in sugarbeet weed management. If weed emergence occurs before or at the same time as beet emergence, effective weed control with herbicides may be unreliable and injurious to the beet crop. A new application technique that is predicated on weed size rather than beet size may show promise in controlling early weeds and limiting crop injury. The technique utilizes a reduced rate of herbicide and repeat applications when weeds are in the cotyledon stage regardless of beet size (2).

The objective of this study was to determine if grass candidate herbicides show selectivity, efficacy, and consistancy in controlling grassy weeds in sugarbeets alone

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and in combination with registered broadleaf herbicides. Also, to see if the low dose/early weed flush method of application can be used successfully in sugarbeet culture in the high plains region of North America.

MATERIALS AND METHODS

Field trials were established during 1979-82 under commercial production conditions each year at Longmont, CO. Natural precipitation varied from year to year and was augmented with surface irrigation to ensure optimum beet growth and chemical activity.

Natural weed seed populations were enhanced with a weed seed mixture applied in an 18 cm band at planting. Predominant species present in the untreated controls included redroot pigweed (PW), *Amaranthus retroflexus* L.; common lambsquarters (LQ), *Chenopodium album* L.; kochia (KO), *Kochia scoparia* (L.) Schrad.; foxtail millet (G), *Setaria italica* L.; and green foxtail (G), *Setaria vividis* L. Weed densities averaged 285 weeds per sq. m with a botanical composition of 70% broadleaf species and 30% grass species.

Monogerm sugarbeet seed, MONO HY A4, was planted at 4 seeds per 30.6 cm of row at 2.5 cm soil depth.

Herbicides were applied postemergence with a tractor mounted or backpack sprayer when beets had 2-6 true leaves, except the low dose method which was applied when beets were in the cotyledon stage. Herbicides were applied either at logarithmic or constant rates. Both rates were applied at 132 l/ha with 80015E nozzle tips at 2.05 kg/cm^2 traveling at 3.54 km/hr. Logarithmic rates were applied in an 18 cm band, while the constant rates were applied in either an 18 or a 28 cm band. The low dose method was applied at 94 l/ha overall with 8001 nozzle tips at 2.05 kg/cm^2 traveling at 3.54 km/hr. logarithmic plot size consisted of 2 rows spaced 56 cm apart by 32.8 m with the original herbicide dosage being decreased every 7.2 m by 50%. The constant dosage plots were either 3 or 6 rows by 9.1 m and the low dose method plots were 6 rows by 9.1 m.

Herbicides evaluated were Poast, Fusilade, and HOE-00581 alone and in combination with Betamix, Betanex, and Nortron. Comparable active dosages were evaluated each year for the grass herbicides when tank-mixed with the other herbicides and applied either as constant or logarithmic rates. At herbicide application, ambient air temperatures ranged from 15°C to 26°C.

Treatments were arranged in randomized complete blocks with 2 or 3 replications for logarithmic plots, 3 or 4 replications for constant plots, and 3 replications for the low dose method. Sugarbeet and weed stand counts were taken approximately 15 days after application. Observations in logarithmic plots were taken in each row at a place estimated to have the greatest percentage weed control, with the least crop injury, and in the two or four innermost rows of each constant plot within a quadrat which measured 7.6 cm by 1.2 cm. Sugarbeet tolerance was estimated subjectively before sugarbeets were thinned.

Weed control and crop tolerance data from these trials were subjected to statistical analysis and the results are reported as percentage of the untreated controls. Results from constant-rate and logarithmic-rate plots are combined due to similarity of yearly and average responses between testing methods.

RESULTS AND DISCUSSION

Weed Control

Excellent control of grass species occurred with all three grass herbicides tested (1979-82). Combinations of grass candidates with broadleaf herbicides gave excellent broad-spectrum control. Average effective rate (Table 1) for Poast was 0.6 kg/ha alone, and grass control averaged 97%; combined with broadleaf herbicides, broad-spectrum weed control averaged 83-89%. Fusilade alone averaged 92% grass control at 0.7 kg/ha. In broadleaf herbicide + Fusilade combinations, average total weed control was 90-91%. In 1982, average effective rate for grass control from HOE-00581 was 0.2 kg/ha with 99% average grass control; combined with broadleaf materials, total weed

Table 1. Percent weed control and sugarbeet injury when three postemergence grass herbicides were applied alone and tank-mixed with broadleaf herbicides, 1979-82.

Years Tested	Treatment	Number of Comparisions	Avg. Dose (kg/ha)	Sugarbeet Injury	Sugarbeet Stand[a]	Weed Control PW	Weed Control KO	Weed Control LQ	Weed Control BL[b]	Weed Control G	Weed Control TOT
4	POAST, 1.5E plus	15	.6	05	108	--	--	--	--	97	--
	BETAMIX, 1.3E	14	.4+1.1	13	99	88	43	89	73	93	83
	NORTRON, 1.5E + BETANEX, 1.3E	5	.4+1.0+1.0	20	95	93	55	90	79	95	87
	NORTRON + BETAMIX	2	.5+1.0+1.0	21	100	95	49	98	81	98	89
2	FUSILADE, 4E plus	14	.7	07	98	--	--	--	--	92	--
	BETAMIX	5	.6+1.2	16	106	97	74	96	89	94	91
	NORTRON + BETAMIX	1	.2+.7+.7	18	103	89	56	93	83	97	90
1	HOE-00581, 1E plus	7	.2	02	99	--	--	--	--	99	--
	BETAMIX	1	.3+1.5	12	109	86	56	100	82	100	91
	NORTRON + BETAMIX	1	.6+1.2+1.2	12	138	94	75	100	88	100	94
Plant density/sq. m untreated				--	13.3	120.5	39.8	44.1	204.4	80.7	285.1

[a]Sugarbeet stand as percent of seedlings/m of untreated row.
[b]Average broadleaf weed control.

control averaged 91-94%.

The low dose/early weed flush method of herbicide application (hereafter referred to as low dose method) resulted in better weed control than normal postemergence spray (Table 2). Betamix applied at normal postemergence timing (2-4 true leaves, beets) at 1.12 kg/ha gave 77% weed control, and kochia, pigweed, and grassy weeds escaped. Weed control averaged 85% from using Betamix at .37/.37 kg/ha using the low dose method; however, kochia and grass species escaped, but were stunted. The combination of Betamix + Fusilade at .37+.22/.37+.22 kg/ha in sequence, gave 88% weed control using the low dose method with only a few stunted kochia remaining.

Sugarbeet Tolerance

Crop tolerance differences between grass candidate herbicides were absent. Crop injury estimates ranged from 2-7%. Grass herbicide candidates combined with broadleaf chemicals showed sugarbeet injury ranging from 12-21%, which is well within practical limits.

Sugarbeet injury using the low-dose postemergence method ranged from 23-38%. Injury level appeared limiting for commercial utilization at the rates used in 1982. However, rainfall subsequent to application and a coarse textured soil condition permitted some preemergence chemical activity to occur which suppressed crop growth further.

SUMMARY AND CONCLUSIONS

The three postemergence candidate grass herbicides tested all gave excellent grassy weed control and showed good crop tolerances. In addition, combinations with broadleaf herbicides gave excellent broad-spectrum control with no antagonism detected.

The low dose/early weed flush method of application gave superior weed control over the standard. Further refinement of dosages may help to reduce crop injury without lessening weed control.

The addition of postemergence grass herbicides and the low dose/early weed flush method of application both are

Table 2. Percent weed control and sugarbeet injury estimated when normal postemergence and low dose/early weed flush spray techniques were compared, 1982.

Treatment	Dose (kg/ha)	Sugarbeet Injury	Sugarbeet Stand	Total Weed Control	Weed Escapes
BETAMIX, 1.3E	1.12	32,[a]23[b]	90,104	87,77	KO, PW, G
BETAMIX/BETAMIX	.37/.37	30, 25	97, 94	88,85	KO, G burned and stunted
BETAMIX + FUSILADE, 4E/ BETAMIX + FUSILADE	.37+.22/ .37+.22	37, 23	93, 97	90,88	KO stunted
BETAMIX + NORTRON, 1.5E/ BETAMIX + NORTRON	.37+.37/ .37+.37	60, 38	85, 92	100,97	KO stunted
CHECK	0	0, 0	100,100	0, 0	PW, KO, LQ, G. moderate density

[a]Visual observations taken on May 18, 1982
[b]Visual observations taken on June 1, 1982

exciting new tools for chemical weed management in sugarbeets.

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