

LATE SEASON WEED CONTROL IN SUGAR BEETS WITH POSTEMERGENCE APPLICATIONS OF FRONTIER HERBICIDE

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Purpose

Weeds emerging with sugar beet seedlings and until sugar beets have six to eight leaves are controlled very effectively with repeated applications of Betamix, Betamix Progress, Stinger, and Upbeet herbicides. These herbicides are very active on seedling species of redroot pigweed, lambsquarters, hairy nightshade, kochia, buckwheat, annual sowthistle, and other species of broadleaf weeds. Most species of annual grasses can be controlled with Poast or Prism tank-mixed with the broadleaf herbicides. Weeds emerging under the leaves of sugar beets are not controlled by these herbicide treatments because of the canopy effect of the sugar beet leaves. Weeds emerging under sugar beet leaves must be controlled by herbicides with preemergence activity. The purpose of this trial was to evaluate Frontier for sugar beet tolerance and late season weed control when applied to sugar beets with two and four true leaves. Frontier was evaluated when applied at two rates with Poast herbicide and in tank-mix combinations with Betamix Progress and Poast.

Procedures

Frontier herbicide at rates of 0.5, 1.17, and 2.34 lb ai/ac and Poast at 0.3 lb ai/ac were applied with and without Betamix Progress at 0.25 lb ai/ac in tank-mixes to seedling sugar beets with two or four true leaves. Mono-Hy WS-PM9 sugar beet seeds were planted in silt loam with a Beck shoe type drill on June 6. Soil pH was 7.3 and the soil had 1.3 percent organic matter.

The previous crop had been Stephens winter wheat. Weeds had been controlled in the wheat with 1 qt/ac Bronate. Following wheat harvest, 100 lbs/ac of phosphate and 60/lbs/ac of nitrogen were broadcast and plowed down. An additional 100 lbs/ac of nitrogen were sidedressed when sugar beets had six leaves. Eighty lbs/ac of powdered sulfur was applied as a split application on July 5 and August 16 to control powdery mildew.

Herbicide application to 2-leaf sugar beets was made on June 29. Broadleaf weed species present included redroot pigweed, hairy nightshade, and lambsquarters. These weeds had two to six true leaves. Grass species were barnyardgrass and green foxtail. Grassy weeds ranged in size from 1-leaf to 1-tiller. Applications to 4-leaf sugar beets were applied on July 5. On June 29, the skies were sunny, the wind calm, air temperature 74°F with a high of 75°F. Soils were moist from an application of water by

furrow irrigation on June 26. On July 5 the skies were clear, air temperature 78°F, and wind calm. Soil temperatures on these two dates at the 4-inch depth were 72°F and 74°F, respectively.

Each herbicide treatment was applied using a single bicycle wheel plot sprayer. Individual plots were 4 rows wide and 25 feet long. The spray boom had four Teejet 6502 fan nozzles spaced 22 inches apart so a single nozzle was centered over each row of sugar beets. Spray pressure was 42 psi, and water as the herbicide carrier was applied at a volume of 19.5 gallons per acre. Each treatment in the trial was replicated three times using a randomized complete block experimental design.

Evaluations for crop injury and weed control from postemergence activity were evaluated on July 12. Weeds escaping the postemergence herbicide treatments were removed by hand-weeding on July 13. Final weed control evaluations were taken on September 20. These evaluations determined the effectiveness of Frontier herbicide for control of weeds emerging after lay-bye cultivation.

Sugar beets were harvested on October 12 to obtain root yield and root quality data including percent sucrose, conductivity readings, and root nitrate-N content. The percent extraction and estimated yield of recoverable sugar were calculated. All roots from the two center rows of each four-row plot (a total of 50 feet of row) were weighed to determine beet yield per acre. Root quality was obtained from two samples, each containing eight sugar beet roots taken from each plot. Beet quality measurements were determined at the Amalgamated Sugar Company tare laboratory in Nyssa, Oregon.

Results and Discussion

Sugar beets with two and four leaves were tolerant to Frontier at all rates (0.5, 1.17, and 2.34 lb ai/ac) when applied in tank-mix combination with Poast herbicide at 0.3 lb ai/ac (Tables 1 and 2). Frontier tank-mixed with Betamix Progress resulted in injury to the leaves of sugar beets in both the 2 and 4-leaf stages. The first injury noted was leaf chlorosis followed by severe burning of all leaves. In some cases the leaf tissue was burned back to the leaf midribs and petioles. In all cases new leaf tissue grew from the crown of all seedling sugar beets, and plant stands were not reduced. Solvents or emulsifiers used to formulate the Frontier increased the herbicidal activity of Betamix. Frontier by itself did not have herbicidal postemergence activity shown on the weed species or sugar beets at the rates evaluated.

Poast herbicide was compatible with Frontier, and excellent control of both barnyardgrass and green foxtail was obtained. Good to excellent late season weed control was obtained with Frontier. Weed control improved as the rate of Frontier was increased from 0.5 to 1.17 to 2.34 lb ai/ac. Frontier at 2.34 lb ai/ac resulted in complete control of redroot pigweed, lambsquarters, hairy nightshade, barnyardgrass, and green foxtail. Tank-mixing Frontier with Betamix Progress for early application would probably

be unacceptable to growers because of foliar damage even though the plants recovered and stand-reduction did not occur.

None of the treatments resulted in reduction of root yield, percent sucrose, or recoverable sugar per acre, nor did it reduce root quality by increasing conductivity readings or the amount of $\text{NO}_3\text{-N}$ in the root tissue (Table 3).

Based on the results of this trial, Frontier could have a place in sugar beet production when applied alone or in combination with Poast herbicide to seedling sugar beets for control of emerged grass and preemergence control of summer annual broadleaf and grassy weeds.

Table 1. Early ratings for crop injury and per cent weed control from Frontier herbicide applied in tank-mix combination with Betamix Progress and Poast herbicides to sugar beets with 2 or 4 true leaves. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1995.

Herbicides	Rate	Applied	Percent weed control																	
			Crop injury			Pigweed			H. nightshade			Lambsquarters			Barnyardgrass			Green foxtail		
			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	lb a/ac		— % —			%														
Frontier + Poast	0.5 + 0.3	2 leaves	0	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100
Frontier + Poast	1.17 + 0.3	2 leaves	0	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100
Frontier + Poast	2.34 + 0.3	2 leaves	0	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100
Frontier + Progress + Poast	0.5 + 0.25 + 0.3	2 leaves	5	5	5	90	90	90	90	90	90	95	95	95	100	100	100	100	100	100
Frontier + Progress + Poast	1.17 + 0.25 + 0.3	2 leaves	25	15	10	95	98	98	95	98	98	98	100	95	100	100	100	100	100	100
Frontier + Poast	1.17	4 leaves	0	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100
Frontier + Poast	2.34	4 leaves	0	0	0	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100
Frontier + Progress + Poast	0.5 + 0.25 + 0.3	4 leaves	20	20	25	85	85	85	80	80	80	85	80	80	100	100	100	100	100	100
Frontier + Progress + Poast	1.17 + 0.25 + 0.3	4 leaves	25	35	25	70	85	85	80	80	80	70	70	70	100	100	100	100	100	100
Untreated check	—	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Evaluated July 12, 1995.

Ratings: 0 = no herbicide effect. 50 = 1 percent stand loss and severe stunting and leaf necrosis. 100 = all plants killed.

Table 2. Late season ratings for crop injury and percent weed control from soil active preemergence activity of Frontier herbicide applied in tank-mix combinations with Betamix Progress and Poast herbicides to seedling sugar beets with 2 or 4 true leaves. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1995.

Herbicides	Rate	Applied	Percent weed control																	
			Crop injury			Pigweed			H. nightshade			Lambsquarters			Barnyardgrass			Green foxtail		
			1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
	lb a/ac		— % —			%														
Frontier + Poast	0.5 + 0.3	2 leaves	0	0	0	90	85	85	80	75	80	85	90	90	85	80	90	90	85	85
Frontier + Poast	1.17 + 0.3	2 leaves	0	0	0	98	100	98	95	90	95	95	90	95	98	98	98	98	98	98
Frontier + Poast	2.34 + 0.3	2 leaves	0	0	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Frontier + Progress + Poast	0.5 + 0.25 + 0.3	2 leaves	0	0	0	85	85	85	75	80	80	85	80	80	90	80	85	85	80	80
Frontier + Progress + Poast	1.17 + 0.25 + 0.3	2 leaves	0	0	0	98	95	98	95	90	95	95	95	90	98	98	98	98	98	98
Frontier + Poast	1.17 + 0.3	4 leaves	0	0	0	95	98	98	95	95	95	90	95	90	98	98	98	98	100	98
Frontier + Poast	2.34 + 0.3	4 leaves	0	0	0	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Frontier + Progress + Poast	0.5 + 0.25 + 0.3	4 leaves	0	0	0	80	85	85	80	85	75	80	85	80	85	80	85	85	90	85
Frontier + Progress + Poast	1.17 + 0.25 + 0.3	4 leaves	0	0	0	98	95	95	90	85	90	90	95	85	99	95	99	99	98	98
Untreated check	—	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Evaluated September 20. Harvested on October 13, 1995.

Herbicides activated by mechanical incorporation with sinner weeder, in row cultivating tools.

Table 3. Root yield, percent sucrose, sugar yield, and root quality data from sugar beets treated at the 2 and 4 true leaf stage with Frontier herbicide applied in tank-mixed combinations with Betamix Progress and Poast herbicides. Malheur Experiment Station, Oregon State University, Ontario, Oregon, 1995.

			Sugar beet yield and quality							
Herbicides	Rate	Applied	Root yield	Sucrose	Conductivity	Root NO ₃ N	Extraction	Gross sugar	Recoverable sugar	
	lb ai/ac		tons/ac	%	µmho	ppm	%	lb/ac	lb/ac	lb/ton
Frontier + Poast	0.5 + 0.3	2 leaves	43.4	15.59	885	417	82.9	13,250	11,210	258.5
Frontier + Poast	1.17 + 0.3	2 leaves	44.6	15.47	933	518	82.2	13,790	11,340	254.4
Frontier + Poast	2.34 + 0.3	2 leaves	43.4	15.89	892	415	82.88	13,790	11,440	263.4
Frontier + Progress + Poast	0.5 + 0.25 + 0.3	2 leaves	43.2	15.84	917	453	82.54	13,690	11,300	261.5
Frontier + Progress + Poast	1.17 + 0.25 + 0.3	2 leaves	43.4	15.52	923	517	82.38	13,470	11,100	255.7
Frontier + Poast	1.17 + 0.3	4 leaves	44.2	15.43	957	529	81.58	13,640	11,170	252.7
Frontier + Poast	2.34 + 0.3	4 leaves	44.2	15.45	936	468	82.28	13,657	11,102	251.2
Frontier + Progress + Poast	0.5 + 0.25 + 0.3	4 leaves	43.2	15.85	901	488	82.68	13,694	11,372	263.2
Frontier + Progress + Poast	1.17 + 0.25 + 0.3	4 leaves	43.6	15.65	921	477	82.45	13,646	11,268	258.4
Untreated check	—	—	43.6	15.77	896	456	82.83	13,751	11,540	264.7
Mean			43.7	15.65	918	478	82.48	13,670	11,270	258.1
LSD (0.05)			ns	ns	ns	ns	ns	ns	ns	ns
CV (%)			2.5	1.32	4	9	0.66	2.6	2.8	1.8