Evaluation of Pendimethalin (Prowl) Tank-Mixes on Roundup Ready Alfalfa

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Introduction

The non-selective herbicide glyphosate (Roundup PowerMAX®) can be used to selectively control weeds in Roundup Ready® alfalfa. Glyphosate has no soil residual activity and will only control weeds that have emerged at the time of application. Therefore, tank-mixing glyphosate with an herbicide that has soil residual activity to control multiple flushes of weeds may improve the utility of Roundup Ready technology.

Pendimethalin (Prowl H_2O®) is a soil-residual herbicide that inhibits cell division in emerging seedlings of susceptible species. Pendimethalin has recently been registered for use on alfalfa and could possibly reduce the number of glyphosate applications needed each growing season to control weeds in Roundup Ready alfalfa by providing residual control. The objective of this research was to evaluate weed control and alfalfa tolerance to pendimethalin when applied to Roundup Ready alfalfa.

Methods and Materials

Two field trials were conducted in commercial fields of Roundup Ready alfalfa; one near Culver, Oregon, and another near O'Neil, Oregon. The Culver trial consisted of 10- by 30-ft plots and the O'Neil trial consisted of 8.5- by 35-ft plots arranged in randomized complete blocks replicated four times. Herbicide treatments were applied on June 24, 2008 at Culver and on June 25, 2008 at O'Neil with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gal/acre at 40 psi at the rates shown in Table 1. The Culver trial was irrigated with center pivot sprinklers and the O'Neil trial was irrigated with wheel-line sprinklers.

Crop injury and weed control were evaluated visually with a 0 to 100 percent rating scale. Alfalfa yield was determined by harvesting a 3.5-ft strip from the middle of each plot. Fresh weights were measured in the field and a 1.0-lb sample was taken from each plot and dried at 145°F and then re-weighed to quantify percent dry matter. Additionally, two 2.69-ft^2 quadrats were harvested from each plot and the alfalfa and weed species were separated by hand. Each separated component was then dried and weighed to quantify relative alfalfa and weed species composition on a dry matter basis.

Results and Discussion

At the time of the herbicide applications both fields had already had the first cutting of alfalfa harvested and one sprinkler irrigation since harvest. At Culver there was 2 inches of new growth and at O'Neil there was 1 inch of new growth on the alfalfa. At Culver some witchgrass (*Panicum capillare*), yellow foxtail (*Setaria pumila*), and horseweed (*Conyza canadensis*) emerged at the time of application. The horseweed had been cut from first alfalfa harvest and was regrowing. No flush of weed germination occurred

between the second and third cutting of alfalfa at Culver. There was a very limited population of all weed species in the trial at O'Neil.

Pendimethalin and diuron applied alone resulted in very little crop injury (Table 1). At Culver, tank-mixes with imazamox (Raptor®), 2,4-DB (Butyrac 200®), or glyphosate (Roundup PowerMAX) with pendimethalin increased alfalfa injury; the injury was greatest with 2,4-DB tank-mixes. At O'Neil, only pendimethalin with 2,4-DB caused crop injury. Crop injury was greater at Culver probably because there was more alfalfa growth at the time of application. Alfalfa injury at Culver was still visible after the second alfalfa cutting. No treatment statistically reduced yield, but yields trended lower in tank-mixes with imazamox and glyphosate and this reduction might have been detected statistically with more than four replications in the trial. It was surprising that the tank-mix with glyphosate caused any injury on a Roundup Ready cultivar. We have no explanation for this. Unfortunately a treatment of glyphosate applied alone was not included in these trials; it may have been useful to quantify the overall tolerance of the Roundup Ready alfalfa cultivar.

Pendimethalin and diuron applied alone did not adequately control witchgrass, yellow foxtail, or horseweed at Culver. Most of the weeds had already emerged at the time of application and therefore control was not expected (Table 2). However, pendimethalin tank-mixed with glyphosate controlled all three weeds. As mentioned above, a treatment of glyphosate applied alone was not included and would have given a better indication of the usefulness of pendimethalin for residual weed control. Pendimethalin tank-mixed with imazamox controlled witchgrass and yellow foxtail but only suppressed horseweed. Based on weed control observed with pendimethalin applied alone, we conclude that pendimethalin did not contribute strongly to the observed weed control with glyphosate and imazamox tank-mixes.

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Table 1. Roundup Ready® alfalfa injury and yield following herbicide treatments near Culver and O'Neil, Oregon, 2008.

		Culver					O'Neal[4]			
Treatment[1]	Rate[2]	02/Jul/08 10-in ht	09/Jul/08 15-in ht	17/Jul/08 20-in ht	Yield[3]	07/Aug/08 8-in ht	02/Jul/08 10-in ht	10/Jul/08 14-in ht	22/Jul/08 e-bloom	Yield[3]
	lb/acre	---------- % injury ----------			lb/acre	% injury	---------- % injury ----------			lb/acre
Check	---	0	0	0	2,237[5]	0	0	0	0	3,774
Pendimethalin	1.9	5	6	6	2,196[5]	0	3	1	3	3,623
Pendimethalin	3.8	6	5	6	---	5	5	4	0	---
Pendimethalin + imazamox[6]	1.9 + 0.39	9	13	6	1,989	3	6	6	5	3,645
Pendimethalin + 2,4-DB[7]	1.9 + 0.5	15	26	23	---	8	18	21	9	---
Pendimethalin + glyphosate[8]	1.9 + 0.77	13	14	11	1,957	1	1	0	1	3,911
Diuron	0.6	0	1	4	---	5	5	5	1	---
LSD ($P = 0.05$)	---	---	---	---	NS	---	---	---	---	NS

Applied 24/Jun/08 near Culver and 25/Jun/08 near O'Neil after first cutting. Pendimethalin = Prowl H_2O 3.8 CS. Imazamox = Raptor 1 L. 2,4-DB = Butyrac 200 2.0 L. Glyphosate = Roundup PowerMAX 4.5 L. Diuron = Karmex 80 DF.

[2]Pendimethalin and diuron rates are pounds active ingredient/acre. Imazamox, 2,4-DB, and glyphosate rates are pounds acid equivalent/acre.

[3]Alfalfa yield on a dry matter basis.

[4]No injury was observed at O'Neil on 19 August 2008 with 12 inches of growth after second cutting (data not shown).

[5]Alfalfa yield contained 2 percent weeds on a dry matter basis as determined by hand-separations. All other yields reported contained 0 percent weeds.

[6]Included Hasten methylated seed oil at 1.0 percent v/v and 32 percent urea ammonium nitrate at 2.5 percent v/v.

[7]Included R-11 non-ionic surfactant at 0.25 percent v/v.

[8]Included R-11 non-ionic surfactant at 0.25 percent v/v and 8-0-0 liquid ammonium sulfate at 4.5 percent v/v.

Table 2. Weed control following herbicide treatments in Roundup Ready® alfalfa near Culver, Oregon, 2008.

		02/Jul/08			09/Jul/08			17/Jul/08			07/Aug/08[3]		
Treatment[1]	Rate[2]	Witch-grass	Yellow foxtail	Horse-weed	Witch-grass	Yellow foxtail	Horse-weed	Witch-grass	Yellow foxtail	Horse-weed	Witch-grass	Yellow foxtail	Horse-weed
	lb/acre	% injury											
Pendimethalin	1.9	5	5	0	33	33	30	24	24	25	40	40	0
Pendimethalin	3.8	30	30	3	40	40	38	38	38	5	65	65	25
Pendimethalin + imazamox[4]	1.9 + 0.39	73	73	50	97	97	93	98	98	98	99	99	25
Pendimethalin + 2,4-DB[5]	1.9 + 0.5	18	18	13	33	33	95	44	44	93	38	33	45
Pendimethalin + glyphosate[6]	1.9 + 0.77	97	98	73	97	97	97	98	98	100	95	94	100
Diuron	0.6	28	28	0	23	23	8	23	23	25	28	28	0

[1]Applied 24 Jun3 2008.
[2]Pendimethalin and diuron rates are pounds active ingredient/acre. Imazamox, 2,4-DB, and glyphosate rates are pounds acid equivalent/acre.
[3]Ratings were made after second cutting.
[4]Included Hasten methylated seed oil at 1.0 percent v/v and 32 percent urea ammonium nitrate at 2.5 percent v/v.
[5]Included R-11 non-ionic surfactant at 0.25 percent v/v.
[6]Included R-11 non-ionic surfactant at 0.25 percent v/v and 8-0-0 liquid ammonium sulfate at 4.5 percent v/v.