

RESEARCH PROJECT TITLE: Vegetation management with herbicides during fallow periods in direct seed, dry land winter wheat (*Triticum aestivum*) cropping systems in the Pacific Northwest.

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INTERIM REPORT

PROJECT OBJECTIVES:

1. Determine the effect of four glyphosate herbicide formulations, applied at several rates with and without ammonium sulfate on control of volunteer winter wheat and weeds during the fallow period in dry land, direct seed cropping systems in the Pacific Northwest.
2. Determine the effect of glyphosate and paraquat + diuron, applied sequentially during fall and/or spring at different rate combinations, on control of volunteer winter wheat and weeds during the fallow period in direct-seed, dry land winter wheat cropping systems.
3. Determine the cost effectiveness of fall and/or spring applications of burn down herbicides.
4. Disseminate information to growers and crop consultants via field tours, extension presentations and practical publications.

KEY WORDS: ammonium sulfate (AMS), burn down herbicides, glyphosate

STATEMENT OF PROBLEM: Recently there has been increased interest in direct seeding crops in the dry land areas in the Pacific Northwest (PNW). Controlling annual and perennial weeds is difficult in direct seed systems, because it does not permit the use of tillage to control weeds during summer and winter fallow periods. Weed management in direct seed systems relies on the use of burn down herbicides during the fallow periods. Recently, growers have reported unsatisfactory grass control with glyphosate containing-products when used in chemical fallow. Ineffective weed control results in yield losses due to weed competition with the crop and moisture loss during fallow. Contamination of the harvested crop by weed seeds will reduce the grain quality and economic return of the harvested product. Ineffective weed control can cause disease carryover (greenbridge effect), which also results in reduced quality of the harvested product. Growers need improved information on glyphosate formulations, rates, application timing, and adjuvants to develop effective weed management programs for direct seed and chemical fallow systems.

ZONE OF INTEREST: High, intermediate and low rainfall regions in dry land productions areas in Idaho, Oregon, and Washington.

ABSTRACT OF RESEARCH FINDINGS: In spring 2002, trials were established near Davenport and Ralston, Washington; Moro and Pendleton, Oregon; and Lewiston and Moscow, Idaho to evaluate control of grass weeds with glyphosate-containing herbicides during fallow periods. The glyphosate products tested were Roundup Ultra, Roundup Original, Touchdown IQ, and Engame. Each product was applied at 0.281, 0.375, and 0.562 lb ae/A with and without ammonium sulfate (AMS). Engame provided equal or greater control of annual grass weeds than Roundup Ultra and Roundup Original and was usually better than Touchdown IQ at all

locations. High and medium herbicide rates and the addition of AMS usually improved weed control compared to low herbicide rates and treatments without AMS.

RESULTS AND INTERPRETATIONS: Trials were established in fields of standing wheat stubble near Davenport and Ritzville, Washington; Moro and Pendleton, Oregon; and Lewiston and Moscow, Idaho to evaluate weed control with glyphosate during fallow periods. The glyphosate products tested were Roundup Ultra, Roundup Original, Touchdown IQ, and Engame. Each product was applied at 0.281 lb ae/A (low), 0.375 lb ae/A (medium), and 0.562 lb ae/A (high) with and without 8.5 pounds ammonium sulfate (AMS) per 100 gallons of spray solution. Herbicide treatments were applied when the grasses were about six inches tall. Control was evaluated visually 7, 14, 21, and 28 days after treatment (DAT). Above ground biomass was collected from a 2.7ft² area in each plot 28 DAT. The experiment at each location was designed as split plot with a factorial arrangement of treatments. Only visual weed control 14 DAT and biomass 28 DAT data are presented.

In experiments near Lewiston and Moscow, ID there were no differences among treatments 14 and 28 DAT (data not shown). At Lewiston grass weed control was 100% 14 and 28 DAT. At Moscow grass weed control 14 DAT was 85% and biomass was reduced 89 to 100% 28 DAT. In experiments near Moro, OR and Ralston, WA there were no differences among treatments 28 DAT (data not shown). Control was 100% at Moro and ranged from 83 to 100% at Ralston.

In an experiment near Davenport, the herbicide by rate by ammonium sulfate interaction was significant for visual control 14 DAT and weed biomass 28 DAT (Table 1). All rates of Engame and Roundup Ultra and the high rate of Roundup Original and Touchdown IQ with and without AMS controlled annual grass weeds 100% 14 DAT. Low and medium rates of Roundup Original and Touchdown IQ with AMS controlled annual grass weeds 94 to 98%. Control was least (78 to 93%) when Roundup Original and Touchdown IQ were applied at the low rate without AMS. Biomass 28 DAT was reduced 100% by all treatments, except the low rate of Roundup Original without AMS (33%) and low and medium rates of Touchdown IQ without AMS (47 and 67%, respectively) (data not shown).

In an experiment near Moro, Engame with and without AMS controlled downy brome 87 to 89% (Table 2). Downy brome control with Roundup Ultra and Roundup Original with and without AMS and Touchdown IQ with AMS ranged from 79 to 83% and control was least (73%) with Touchdown IQ without AMS.

In an experiment near Pendleton, the rate by ammonium sulfate interaction was significant for dry weight 28 DAT (Table 3). The high herbicide rate with and without AMS reduced biomass 98 to 99%. Biomass was reduced 95 to 96% with the medium herbicide rate with and without AMS and the low herbicide rate with AMS. Biomass was reduced 92% at the low herbicide rate without AMS.

In experiments near Moro and Ralston, the herbicide main effect was significant 14 DAT (Table 4). At Moro, Engame and Roundup Original controlled annual grass weeds 94 and 89%, while treatments with Touchdown IQ and Roundup Ultra controlled weeds 83 and 81%. At Ralston,

control of annual grass weeds was 99% with Engame and 97% with Roundup Ultra and Touchdown IQ.

The herbicide rate effect was significant 14 DAT at Moro, Pendleton, and Ralston (Table 5). At each location, control increasing with increasing herbicide rate. Control ranged from 80 to 89, 73 to 75, and 97 to 99% at Moro, Pendleton, and Ralston, respectively.

In an experiment near Moro, all treatments with AMS controlled grass weeds 88%, while treatments without AMS controlled weeds 84% 14 DAT (data not shown).

Experiments under objective 2 (The effect of glyphosate and paraquat + diuron) were conducted near Ralston and Ritzville, Washington; Moro and Pendleton, Oregon; and Lewiston and Moscow, Idaho in 2001 and 2002. Data are being analyzed. The cost effectiveness of burn down herbicides will be determined this winter.

INTERACTION (COOPERATION) WITH OTHER SCIENTIST CONDUCTING RELATED ACTIVITY: none.

PUBLICATIONS AND PRESENTATIONS:

Ireland, T. M., D. C. Thill. 2002. Vegetation management with herbicides during fallow periods in direct seed, dry land winter wheat cropping systems in the Pacific Northwest. Research progress report. Western Soc. Weed Sci. p. 91-93.

Ireland, T. M., D. C. Thill, J. P. Yenish, and D. Ball. 2002. Annual grass weed control in the inland Northwest: A comparison of glyphosate containing herbicides. Poster. Pacific Northwest Direct Seed Cropping Systems Conference, Spokane, WA Jan. 16-18.

Ireland, T. M., D. C. Thill, J. P. Yenish, and D. Ball. 2002. Annual grass weed control in the inland Northwest: A comparison of glyphosate containing herbicides. Proc. West. Soc, Weed Sci. 55:9.

Table 1. Visual control of annual grass weeds with four glyphosate-containing herbicides with and without ammonium sulfate (AMS) at three herbicide rates near Davenport, WA in 2002.

Herbicide¹	Rate	AMS²	14 DAT³
	lb ae/A		-----%-----
Engame	0.281	W	100 a
Engame	0.375	W	100 a
Engame	0.281	WO	100 a
Engame	0.375	WO	100 a
Roundup Ultra	0.281	W	100 a
Roundup Ultra	0.375	W	100 a
Roundup Ultra	0.562	W	100 a
Roundup Ultra	0.281	WO	100 a
Roundup Ultra	0.375	WO	100 a
Roundup Ultra	0.562	WO	100 a
Roundup Original	0.281	W	96 bc
Roundup Original	0.375	W	96 bc
Roundup Original	0.562	W	100 a
Roundup Original	0.281	WO	78 d
Roundup Original	0.375	WO	94 bc
Roundup Original	0.562	WO	100 a
Touchdown	0.281	W	94 c
Touchdown	0.375	W	98 b
Touchdown	0.562	W	100 a
Touchdown	0.281	WO	80 d
Touchdown	0.375	WO	93 c
Touchdown	0.562	WO	100 a

¹ A 90% non-ionic surfactant (R-11) was added to Engame and Roundup at 0.5% v/v and Touchdown IQ at 0.25% v/v. The 0.562 lb ae/A rate of Engame was inadvertently omitted at this location.

² Ammonium sulfate (Bronc); W = AMS added to treatments at 8.5 lb/100 gal spray solution, WO = without AMS.

³ Days after treatment.

Table 2. Visual control of downy brome with four glyphosate-containing herbicides with and without ammonium sulfate (AMS) near Moro, OR in 2002. Data are average over herbicide rates.

Herbicide¹	AMS²	14 DAT³
		-----%-----
Engame	W	89 a
Engame	WO	87 a
Roundup Ultra	W	79 b
Roundup Ultra	WO	81 b
Roundup Original	W	83 b
Roundup Original	WO	80 b
Touchdown IQ	W	82 b
Touchdown IQ	WO	73 c

¹ A 90% non-ionic surfactant (R-11) was added to Engame and Roundup at 0.5% v/v and Touchdown IQ at 0.25% v/v.

² Ammonium sulfate (Bronc); W = AMS added to treatments at 8.5 lb/100 gal spray solution, WO = without AMS.

³ Days after treatment.

Table 3. Dry weight reduction of annual grass weeds controlled with glyphosate with and without ammonium sulfate (AMS) at three herbicide rates near Pendleton, OR in 2002. Data are averaged over glyphosate-containing herbicides.

Rate	AMS²	28 DAT¹
		biomass reduction³
		-----%-----
1b ae/A		
0.281	W	95 b
0.281	WO	92 c
0.375	W	96 b
0.375	WO	95 b
0.562	W	98 a
0.562	WO	99 a

¹ Days after treatment.

² Ammonium sulfate (Bronc); W = AMS added to treatments at 8.5 lb/100 gal spray solution, WO = without AMS.

³ Percent of untreated.

Table 4. Visual control of annual grass weeds 14 days after treatment with four glyphosate-containing herbicides near Moro, OR and Ralston, WA in 2002. Data are averaged over ammonium sulfate rates and herbicide rates.

Herbicide ¹	Moro	Ralston
	-----%-----	-----%-----
Engame	94 a	99 a
Roundup Ultra	81 b	97 b
Roundup Original	89 a	98 ab
Touchdown IQ	83 b	97 b

¹ A 90% non-ionic surfactant (R-11) was added to Engame and Roundup at 0.5% v/v and Touchdown IQ at 0.25% v/v.

Table 5. Visual control of annual grass weeds 14 days after treatment at low, medium, and high rates of glyphosate near Moro and Pendleton, OR and Ralston, WA in 2002. Data are averaged over ammonium sulfate rates and glyphosate-containing herbicides.

Rate	Moro		Pendleton	Ralston
	Wheat	Downy brome		
lb ae/A	-----%-----		-----%-----	-----%-----
0.281	84 b	80 b	73 b	97 b
0.375	88 a	81 b	75 a	98 ab
0.562	89 a	84 a	75 a	99 a