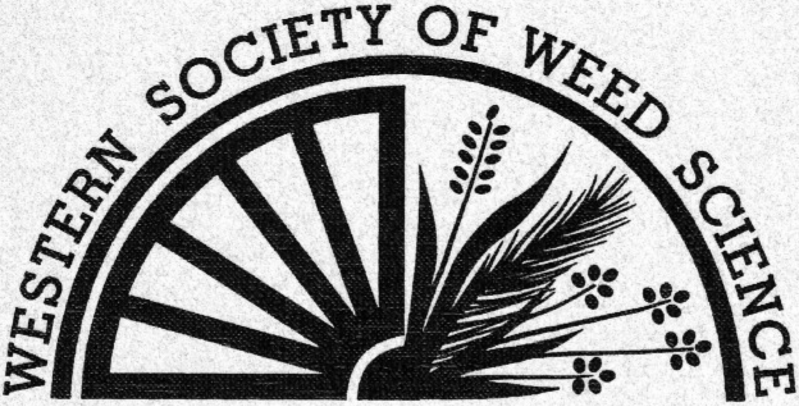

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FOREWORD

The 2008 Research Progress Report of the Western Society of Weed Science (WSWS) is a compilation of research investigations contributed by weed scientists in the western United States of America. The objective of the Research Progress Report is to provide an avenue for presentation and exchange of on-going research to the weed science community. The information in this report is preliminary; therefore, it is not for the development of endorsements or recommendations.

The reports contained herein and their respective content, format, and style are the responsibility of the author(s) who submitted them. Reports are printed as received from the authors.

WSWS appreciates the time and effort of the authors who shared their research results with the members of WSWS.

Traci Rauch and Joan Campbell
Co-editors, Research Progress Report
Western Society of Weed Science
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Clematis control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) CLEOR has extensive climbing vines that smother grass, shrubs, and trees. In recent times, CLEOR has rapidly expanded its range along the steep slopes and canyons of the Front Range in Colorado. Due to growth patterns and locations where CLEOR grows CLEOR is difficult to control. CLEOR often grows on trees and along ditches near water where many herbicides cannot be used and is often found in steep rough terrain making herbicide application very difficult.

An experiment was established near Georgetown, CO on August 3, 2006 to evaluate chemical control of CLEOR. The experiments were designed as randomized complete blocks with four replications. Herbicides were applied when CLEOR was in full bloom to late flower growth stage (Table 1). All treatments were applied with a CO_2-pressurized backpack sprayer using 11002LP flat fan nozzles at 20 gal/A and 30 psi. Plot size was 10 by 30 feet. Visual evaluations for control compared to non-treated plots and these data were collected in October 2006 and July 2007 (Table2).

Metsulfuron controlled CLEOR slowly. Metsulfuron controlled 29% CLEOR 2 months after treatment (MAT) and 80% CLEOR at 12 MAT. All other treatments controlled 79 to 100% CLEOR 2 and 12 MAT. CLEOR appears to be highly sensitive to aminopyralid (100% control with all rates 12 MAT). Applications of 2,4-D in this and other CLEOR studies have provided excellent long term control, but often cause unacceptable collateral damage to desirable native brush species. In this experiment, 2,4-D (16 or 32 oz ai/a) controlled 85 or 100% CLEOR approximately 12 MAT, respectively. Visual evaluations for residual control will be conducted in 2008 to determine long-term CLEOR control.

Table 1. Application data for clematis control in Colorado.

Environmental data	
Application date	August 3, 2006
Application time	9:30 am
Air temperature, F	67
Relative humidity, %	47
Wind speed, mph	5 to 7

Application date	Species	Common Name	Growth stage	Height
				--(in.)--
Auguest 3, 2006	CLEOR	Oriental clematis	Flower	24 to 36
	AGRSM	Western wheatgrass	Flower	10 to 14

Table 2. Clematis control in Colorado.

Herbicide[1]	Rate	Clematis control October 2006	 July 2007
	oz ai/a	(%)	
Metsulfuron	0.6	29	80
2,4-D Amine	16	79	85
2,4-D Amine	32	90	100
Aminopyralid	0.8	97	100
Aminopyralid	1.3	97	100
Aminopyralid	1.8	93	100
Aminopyralid + 2,4-D amine	0.8 + 16	98	100
Control		0	0
LSD (0.05)		11	26

[1] Non-ionic surfactant added to all treatments at 0.25% v/v.

Herbicide application timing for Russian knapweed control. Corey Ransom and Steven Dewey. (Plants, Soils, and Climate Department, Utah State University, Logan, UT 84322-4820) Herbicides were applied in a rangeland setting for control of Russian knapweed. Two trials were established to evaluate Russian knapweed control with various herbicides. One trial was established in the summer when Russian knapweed was in full bloom on July 20, 2006, and the second trial was established in the fall when Russian knapweed was dormant on October 24, 2006. Herbicide treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi. Research plots measured 10 by 30 feet and were arranged in a randomized complete block design with four replications. Russian knapweed control increased with increasing rates of imazapyr. When applied in the fall imazapyr at 0.063 lb/A provided 65% control while when applied at full bloom the same rate controlled Russian knapweed 6%. Imazapic also exhibited greater control in the fall trial than in the summer trial. Picloram, clopyralid, and aminopyralid provided 87% or greater control when applied in the summer or the fall. When applied in the fall, aminopyralid provided significantly higher control than picloram or clopyralid. It appears that imazapyr and imazapic are more effective at controlling Russian knapweed when applied in the fall, whereas picloram, clopyralid, and aminopyralid were not as responsive to application timing.

Table. Russian knapweed control with herbicides applied at full bloom or in late fall.

		Control[2]	
Herbicide[1]	Rate	Summer application	Fall application
	lb ai/A	-------------------------%-------------------------	
Untreated	--	--	--
Imazapyr	0.063	6 f	65 g
Imazapyr	0.094	23 e	72 fg
Imazapyr	0.125	29 de	79 ef
Imazapyr	0.187	50 d	88 cde
Imazapyr	0.25	78 c	94 abc
Imazapyr	0.375	85 abc	95 ab
Imazapyr	0.5	94 ab	96 a
Imazapic	0.125	14 ef	67 g
Imazapic	0.187	19 ef	81 def
Picloram	0.5	92 abc	89 bcd
Clopyralid	0.375	87 abc	87 cde
Aminopyralid	0.094	96 ab	97 a

[1] All herbicide treatments included methylated seed oil at 1.25% v/v.

[2] Mean separations for control ratings were performed on arcsine square root transformed data. Untransformed means are presented. Numbers followed by the same letter are not significantly different at the P=0.05 significance level.

Japanese knotweed control using invert emulsion techniques. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). A demonstration study was established near Lapwai, Idaho in the Lapwai Creek floodplain to evaluate the use of an invert emulsion carrier (Thinvert RTU) for foliar applications of imazapyr. Thinvert RTU is a formulation comprised of 31.58% paraffinic oil blend, and 1.72% emulsifier and surfactant blends. Treatments included imazapyr + Thinvert RTU at two rates, 1% and 5% v/v, and imazapyr + water at 1% v/v. Thinvert RTU treatments were applied using a Birchmeir backpack sprayer calibrated to deliver 5 gal/A. The water-carrier treatment was applied using a Solo backpack sprayer calibrated to deliver 35 gal/A. Two blocks of Japanese knotweed plots were established across the study site. Treatments were replicated twice in each block. Individual Japanese knotweed clumps were designated as plots (Table 1).

Table 1. Application and soil data.

Location	Lapwai, Idaho
Target weed	Japanese knotweed
Weed growth stage	Flowering
Application date	September 26, 2006
Air Temp (F)	84
Wind (mph, direction)	1 to 2, W
Cloud cover (%)	15
Soil Type	silt to sandy loam

Japanese knotweed control was evaluated on August 1, 2007, 10 months after treatment (MAT). The level of control was determined by the ratio of new shoots (POST-treatment) to old shoots (PRE-treatment). Each treatment resulted in greater control of Japanese knotweed in comparison to the control. Japanese knotweed control was not affected by the type of carrier, or the rate of imazapyr (Table 2). Vegetative cover within the drip-line of Japanese knotweed clumps significantly decreased following imazapyr treatments in comparison to the control. No differences between carrier types, or rates were detected.

Table 2. Japanese knotweed control with imazapyr near Lapwai, Idaho in 2006-2007.

				10 MAT	
Treatment	Carrier	Rate	Carrier vol.	Japanese knotweed control[1]	Vegetative cover[2]
		% v/v	gal/A	------------------%------------------	
Imazapyr (2 lb ai)	Water[3]	1	35	88	18
Imazapyr (2 lb ai)	Thinvert RTU	1	5	94	6
Imazapyr (2 lb ai)	Thinvert RTU	5	5	95	3
Control				5	72
Tukey's Studentized Range HSD (0.05)				24	33

[1] Control = [1 – (Number of new shoots – Number of old shoots)]*100

[2] Percent cover of total vegetation below drip-line of Japanese knotweed clumps.

[3] 100% methylated seed oil (Superspread MSO) applied at 1.0% v/v

Control of kochia in hybrid poplar. R.N. Arnold, Michael K. O'Neill, and Dan Smeal. (New Mexico State University Agricultural Science Center, Farmington, NM 87499) Research plots were established on November 20, 2006 at the Navajo Agricultural Products Industry hybrid poplar tree farm, Farmington, New Mexico, to evaluate the response of kochia and hybrid poplar to herbicides. Soil type was a Doak sandy loam with a pH of 7.8 and an organic matter content less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 12 by 25 feet. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Treatments were applied on December 20, 2006 and were evaluated on June 6, 2007.

Sulfometuron at 0.035, 0.07, 0.105, 0.06 and 0.09 lb ai/A in combination with either metsulfuron at 0.009, 0.018, 0.027, chlorosulfuron at 0.04 and diuron at 1.6 lb ai/A gave excellent control of kochia. No noticeable hybrid poplar injury was noticed with any of the treatments.

Table. Control of kochia in hybrid poplar.

		Weed control[1]
Treatments	Rate	KCHSC
	lb ai/A	------%-------
Sulfometuron + metsulfuron	0.035+0.009	95
Sulfometuron + metsulfuron	0.07+0.018	96
Sulfometuron + metsulfuron	0.105+0.027	94
Sulfometuron + chlorosulfuron	0.03+0.02	81
Sulfometuron + chlorosulfuron	0.06+0.04	99
Sulfometuron + chlorosulfuron	0.09+0.06	86
Sulfometuron + chlorosulfuron + diuron	0.06+0.04+1.6	100
Sulfometuron + chlorosulfuron + diuron	0.09+0.06+1.6	100
Terbacil + diuron	1.6+1.6	100
Simazine	1.6	98
Weedy check	0	0
LSD (0.05)		3

[1] Rated on a scale from 0 to 100 with 0 being no control and 100 being dead plants.

Control of rush skeletonweed with aminopyralid near Horseshoe Bend, Idaho. John Wallace and Tim Prather. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Horseshoe Bend, Idaho to evaluate the control of rush skeletonweed (*Chondrilla juncea* L.) using aminopyralid, clopyralid, and picloram. At the time of treatment application, 10 to 20% of rush skeletonweed plants had formed new rosettes. The experiment was designed as a randomized complete block with four replications. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gpa at 40 psi and 3 mph (Table 1).

Table 1. Application data

Location	Horeshoe Bend, ID
Target weed	rush skeletonweed
Weed growth stage	PRE / EARLY POST
Application date	February 2, 2006
Air Temp (F)	57
Relative humidity (%)	80
Wind (mph, direction)	0 to 2, W
Cloud cover (%)	50
Soil temp at 2 inches (F)	46
Soil Type	sandy to gravelly loam

Evaluations were conducted one, two and eighteen months after treatment (MAT). Herbicide injury symptoms (epinasty, chlorosis) were observed on rush skeletonweed rosettes 1 MAT, but did not differ across treatments (Table 2). Each aminopyralid rate and the picloram treatment resulted in greater rush skeletonweed injury than clopyralid 2 MAT. Micro-plots (1 m^2) were randomly located and permanently marked in each plot 2 MAT. Rush skeletonweed density was recorded 2 and 18 MAT to determine the effect of herbicide application on recolonization. Rush skeletonweed density increased across herbicide treatments 18 MAT, but did not statistically differ (Table 2).

Table 2. Rush skeletonweed control with aminopyralid, clopyralid, and picloram near Horseshoe Bend, Idaho.

		Rush skeletonweed control		Rush skeletonweed density	
Treatment[1]	Rate	1 MAT	2 MAT	2 MAT	18 MAT
	oz ae / A	---------------%	---------------	---------------plants/m^2	----------------
Aminopyralid	0.75	83	96	0.5	13.5
Aminopyralid	1	90	100	0.0	16.2
Aminopyralid	1.25	88	100	0.0	6.8
Aminopyralid	1.5	91	98	0.5	5.2
Aminopyralid	1.75	93	100	0.0	6.3
Clopyralid	6	84	50	0.8	11.3
Picloram	8	81	100	0.0	4.8
Untreated check		0	0	10.8	12.3
Tukey's studentized range HSD (0.05)		18	30	5.1	15

[1] 100% organo-silicone/MSO (Syl-Tac) at 0.50% v/v was applied with all treatments

Myrtle spurge control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) Myrtle spurge (EPHMY) is an invasive ornamental that has escaped into sensitive ecosystems, displaced native vegetation, and is noxious in Colorado. EPHMY is a tap-rooted perennial that produces a toxic, milky latex that causes blister-like burns if contacted by the skin and eyes.

An experiment was established near Golden, CO to evaluate EPHMY control. The experiment was designed as a randomized complete block with three replications. Herbicides (Table 2) were applied in the fall on October 18, 2005 when EPHMY was in vegetative growth stage or in the spring on April 20, 2006 when EPHMY was in vegetative to late flower growth stages. All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 21 gal/A at 14 psi. Other application information is presented in Table 1. Plot size was 10 by 20 feet. Methylated seed oil was added at 32 fl oz/a to all treatments.

Visual evaluations for control compared to non-treated plots were collected in May 2006, September 2006, and September 2007 (Table 2). Picloram or quinclorac sprayed alone (at either application timing) controlled EPHMY slowly in May 2006 (30 to 53% control). Both treatments sprayed alone controlled 89 to 96% EPHMY by the September 2006 evaluation. All treatments in this study controlled 88 to 100% of EPHMY in September 2006. Quinclorac, quinclorac plus 2,4-D acid, or dicamba plus 2,4-D amine controlled EPHMY similarly (91 to 100%) to picloram or picloram plus 2,4-D acid (89 to 100%).

All herbicides when combined with 2,4-D acid controlled 98 to 100% EPHMY in September, 2006 compared to 86 to 96% EPHMY control when the same herbicides were sprayed alone. The differences between treatments sprayed alone or 2,4-D tank mixed became even more apparent at the September 2007 evaluation. All herbicides when combined with 2,4-D acid controlled 95 to 100% EPHMY compared to 78 to 96% EPHMY control when the same herbicides were sprayed alone. Fall applications of 2,4-D acid controlled 81% of EPHMY compared to 97% EPHMY control with spring-applied 2,4-D acid (September 2007). EPHMY appears to be very sensitive to 2,4-D acid.

A similar study was established on an adjacent site in spring of 2005. Spring treatments (data not included in this report) did not control EPHMY as well as similar fall treatments in that study. Treatment rates were increased and EPHMY plants were smaller in size in this study.

Handpulling may be an alternative option to herbicides if entire root systems are pulled. There was 78 or 100% EPHMY control when pulled in fall or spring, respectively at the September 2007 evaluation. Soil moisture in the fall was dry and some of the EPHMY plants were dried out and broke off at the root crown when pulled. Entire EPHMY plants were easier to pull when soil moisture was high and EPHMY was green (spring timing in this study). EPHMY seedling plants emerged from seed and some plants broke off at the root crown so it may be necessary to handpull more than once. Gloves and protective eye wear should be used while handpulling to prevent getting toxic latex on skin or in eyes. Digging EPHMY plants would also work but it was too rocky at this particular site to dig.

Table 1. Application data for myrtle spurge control in Colorado.

Environmental data		
Application date	October 18, 2005	April 20, 2006
Application time	1:00 AM	9:00 AM
Air temperature, F	68	55
Relative humidity, %	35	20
Wind speed, mph	0	0 to 2

Application date	Species	Common name	Growth stage	Height
				---(in.)---
October 18, 2005	EPHMY	myrtle spurge	vegetative	4 to 7
April 20, 2006	EPHMY	myrtle spurge	late flower	2 to 10

Table 2. Myrtle spurge control in Colorado.

			Myrtle spurge control			
Herbicide[1,2,3]	Rate	Application timing	May 2006	September 2006	May 2007	September 2007
	oz/A		(%)			
Picloram	20	Fall 05	53	89	88	82
Picloram + 2,4-D acid	20 + 134	Fall 05	100	100	100	100
Quinclorac	16	Fall 05	50	91	85	80
Quinclorac + 2,4-D acid	16 + 134	Fall	100	100	100	100
2,4-D acid	134	Fall 05	90	90	91	81
Dicamba + 2,4-D amine	17 + 47	Fall 05	100	100	96	95
Dicamba + 2,4-D amine	34 + 94	Fall 05	100	100	97	95
Handpull		Fall 05	90	88	88	78
Picloram	20	Spring 06	30	86	89	79
Picloram + 2,4-D acid	2 + 134	Spring 06	82	100	100	100
Quinclorac	16	Spring 06	35	96	91	90
Quinclorac + 2,4-D acid	16 + 134	Spring 06	80	100	100	100
2,4-D acid	134	Spring 06	90	100	98	97
Dicamba + 2,4-D amine	17 + 47	Spring 06	85	100	100	100
Dicamba + 2,4-D amine	34 + 94	Spring 06	68	98	96	96
Handpull		Spring 06	100	99	100	100
LSD (P=.05)			11	8	9	13

[1] Methylated seed oil added to all imazapic treatments at 32 oz/A.

[2] Unison is the trade name for the 1.74 lb/ae formulation of 2,4-D acid.

[3] 1 lb ae + 2.87 ae formulation of dicamba plus 2,4-D amine (Weedmaster premix).

Yellow starthistle control with aminopyralid on Idaho rangeland. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Lewiston, ID in degraded annual grassland to evaluate yellow starthistle (*Centaurea solstitialis* L.) control with aminopyralid, clopyralid, and picloram at the rosette stage in late fall and spring, and the bolting stage. The experiment was designed as a randomized complete block with four replications. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer at 15 gpa (Table 1).

Table 1. Application and soil data.

Location	Lewiston, ID	Lewiston, ID	Lewiston, ID
Target weed	Yellow starthistle	Yellow starthistle	Yellow starthistle
Weed growth stage	Rosette - Fall	Rosette – Spring	Bolting
Application date	November 10, 2006	April 27, 2007	May 25, 2007
Air Temp (F)	43	63	68
Relative humidity (%)	87	25	33
Wind (mph, direction)	2 to 3, NW	3 to 4, NW	2 to 4, NW
Cloud cover (%)	85	15	15
Soil temp at 2 inches (F)	40	64	62
Soil Type	stony silt loam	stony silt loam	stony silt loam

Evaluations were conducted one month after treatment (MAT) for each treatment timing, and an evaluation was conducted on June 26, 2007 to determine species composition following yellow starthistle control (Table 2). Treatments did not differ within each growth stage timing 1 MAT. Spring-rosette and bolting treatments resulted in good yellow starthistle control. Fewer yellow starthistle plants showed significant herbicide symptoms 1 MAT following the fall-rosette treatment. However, all treatments prevented yellow starthistle seed production at the end of the growing season. Timing of herbicide treatments to the fall and spring rosette growth-stage resulted in significantly greater annual grass cover (75 to 98%) than the bolting timing (18 to 29%) at the end of the growing season. Annual grass cover increased following applications timed to the rosette stage, which controlled yellow starthistle and winter vetch, resulting in competitive exclusion of winter annual forbs. Treatments applied to the bolting stage prevented seed production of both yellow starthistle and winter vetch. However, results suggest that interspecific competition between winter annual grass and forb seedlings resulted in lower annual grass cover at the end of the growing season.

Table 2. Yellow starthistle control with various herbicides near Lewiston, ID in 2006-2007.

			YST control	June 26, 2007		
Treatment[1]	Rate	Growth Stage	1 MAT	YST control	Annual grass cover[2]	VIVI cover[3]
	oz ae / A		%	---------- % ----------		
Aminopyralid	0.75	spring-rosette	93	100	75	14
Aminopyralid	1	spring-rosette	97	100	93	1
Aminopyralid	1.25	spring-rosette	99	100	86	10
Aminopyralid	1.5	spring-rosette	100	100	95	3
Clopyralid	3.75	spring-rosette	100	100	94	1
Picloram	6	spring-rosette	100	100	93	3
Aminopyralid	1	bolting	90	90	18	43
Aminopyralid	1.5	bolting	100	100	23	48
Aminopyralid	1.75	bolting	98	98	28	49
Aminopyralid +2,4-D(A)	1 + 16	bolting	100	100	25	44
Aminopyralid +2,4-D(A)	1.5 + 16	bolting	96	96	24	43
Clopyralid	3.75	bolting	100	100	25	30
Picloram	6	bolting	98	98	29	26
Aminopyralid	0.75	fall-rosette	63	99	96	0
Aminopyralid	1.0	fall-rosette	63	100	96	0
Aminopyralid	1.25	fall-rosette	63	100	94	0
Aminopyralid	1.75	fall-rosette	63	100	96	0
Clopyralid	3.75	fall-rosette	58	100	93	0
Picloram	6	fall-rosette	63	100	98	0
Check			0	0	0	0
Tukeys Studentized Range HSD (0.05)			15	6	29	52

[1] 90% non-ionic surfactant (R-11) at 0.25% v/v was applied with all treatments

[2] Downy brome, Japanese brome, ventenata

[3] VIVI = winter vetch (*Vicia villosa*)

Canada thistle control with aminopyralid plus diflufenzopyr. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Aminopyralid is a member of the pyridinecarboxylic acid family of herbicides and controls several noxious weed species at lower use rates than other auxin-type herbicides. Diflufenzopyr is a semicarbazone herbicide which inhibits auxin transport in susceptible plants. The addition of diflufenzopyr has improved weed control of some species with certain herbicides. The purpose of this research was to evaluate aminopyralid alone or with diflufenzopyr for Canada thistle control.

Aminopyralid at 0.75 or 1.5 oz ae/A was applied alone or with diflufenzopyr at a 2.5:1 or 5:1 ratio (herbicide:diflufenzopyr) on Canada thistle at two locations in North Dakota. Picloram at 6 oz ae/A was included as a standard comparison. Treatments were applied June 12, 2006 near Fargo, ND on former crop-land and June 19, 2006 near Eckelson near a wind-break with a dense stand of perennial grasses using a hand-held boom sprayer delivering 17 gpa at 35 psi. Experimental plots were 10 by 30 feet with four replicates in a randomized complete block design. Canada thistle was in the bolt to early bud growth stage at both locations and varied in height from 6 to 24 inches at Fargo and 6 to 40 inches at Eckelson. Canada thistle stem density averaged 15 and 12 stems/m^2 at the Fargo and Eckelson locations, respectively. Control was visually evaluated using percent stand reduction compared to the untreated control.

Canada thistle control averaged 96% across all treatments and both locations 3 MAT (Table). However, long-term control declined rapidly at Fargo and only averaged 37% 12 MAT compared to 97% at Eckelson. Similarly, control with picloram averaged 92% 15 MAT at Eckelson but only 22% at Fargo. The increased long-term control at Eckelson compared to Fargo was likely due to the dense grass cover which competed with Canada thistle compared to little competition in the relatively bare ground at Fargo. Canada thistle control was similar whether aminopyralid was applied alone or with diflufenzopyr regardless of application rate at both locations. In summary, Canada thistle control with aminopyralid was similar whether applied at 0.75 or 1.5 oz/A and with or without diflufenzopyr. Long-term control was better when the site contained perennial grasses compared to generally bare ground.

Table. Aminopyralid plus diflufenzopyr applied for Canada thistle control in June 2006 at two locations in North Dakota.

		Fargo			Eckelson		
Treatment[1]	Rate	3[2]	12	15	3	12	15
	— oz/A —	% control					
Aminopyralid	0.75	92	29	19	90	96	70
Aminopyralid	1.5	96	31	24	98	97	88
Aminopyralid + diflufenzopyr	0.75 + 0.3	93	36	29	95	96	84
Aminopyralid + diflufenzopyr	0.75 + 0.15	92	41	28	98	97	88
Aminopyralid + diflufenzopyr	1.5 + 0.6	97	47	24	98	97	83
Aminopyralid + diflufenzopyr	1.5 + 0.3	97	33	26	98	99	86
Aminopyralid	1.75	96	43	35	98	99	93
Picloram	6	96	38	22	97	96	92
LSD (0.05)		NS	NS	NS	NS	NS	NS

[1] Surfactant Activator 90 at 0.25% was applied with all treatments, Loveland Products, Inc., Greeley, CO 80632-1286.

[2] Months after treatment.

Maximum use rates of aminopyralid for control of invasive species. Rodney G. Lym. (Plant Sciences Department, North Dakota State University, Fargo, ND 58105). Aminopyralid controls several noxious weed species and is generally applied at 0.75 to 1.75 oz ae/A. Aminopyralid is labeled for spot treatments at 3.5 oz /A and may provide better long-term control and/or a wider spectrum of weed control than the general application rate. The purpose of this research was to evaluate various timing and use rates of aminopyralid for control of Canada thistle, leafy spurge, and yellow toadflax.

For all studies, herbicides were applied using a hand-held boom sprayer delivering 17 gpa at 35 psi. Experimental plots were 10 by 30 feet and replicated four times in a randomized complete block design. Control of each species was evaluated visually using percent stand reduction compared to the untreated control. Results were compared to picloram applied at the general use rate for each weed species.

The first study evaluated the control of Canada thistle with aminopyralid applied alone or with diflufenzopyr in the spring or fall. The experiment was established near Eckelson and Fargo, ND and treatments were applied June 19 or September 20, 2007 at Eckelson and June 12 or October 2 in Fargo. Spring treatments were applied to actively growing Canada thistle in the bolt to bud stage and fall treatments were applied to Canada thistle rosettes.

Canada thistle control with aminopyralid at Eckelson and Fargo was similar regardless of application rate and averaged 94 and 99% in September 2006 when spring or fall applied, respectively (Table 1). No grass injury was observed from any treatment. Canada thistle control with aminopyralid was similar when applied alone or with diflufenzopyr.

A second study was established near Walcott, ND to evaluate aminopyralid applied alone or with picloram for leafy spurge control. Herbicides were applied as previously described on June 1 or September 6, 2006 when leafy spurge was in the true-flower or fall regrowth stage, respectively.

Aminopyralid provided short-term leafy spurge control when fall-applied at 3.5 oz/A (Table 2). Control averaged 79% in May 2007 but declined to 40% by September 2006. Aminopyralid did not control leafy spurge when spring-applied. Aminopyralid plus picloram at 3.5 + 8 oz/A tended to provided better leafy spurge control than picloram at 16 oz/A when spring- but not when fall-applied.

A third experiment was established to evaluate yellow toadflax control with aminopyralid applied alone or with picloram. The experiment was established on a wildlife production area near Valley City, ND which contained a dense stand of yellow toadflax and smooth bromegrass. Treatments were applied as previously described on July 5 or September 20, 2007 when yellow toadflax was in the vegetative to flowering or seed-set growth stage, respectively.

Aminopyralid applied alone or with picloram did not adequately control yellow toadflax regardless of application date or rate (Table 3). Smooth bromegrass was injured with treatments that contained picloram, especially when fall-applied. Grass injury exceeded 50% when picloram was applied in the fall at 16 oz/A alone or at 8 oz/A with aminopyralid at 3.5 oz/A.

In summary, Canada thistle control was similar when aminopyralid was applied at 1.75 or 3.5 oz/A, the year after treatment. Aminopyralid did not provide satisfactory control of leafy spurge or yellow toadflax when applied alone or with picloram regardless of application date or rate. Smooth bromegrass was injured when aminopyralid was applied with picloram.

Table 1. Aminopyralid applied at the maximum use rate in the spring or fall in for spot treatment of Canada thistle at two locations in North Dakota.

Treatment[1]	Rate	Evaluation date Aug 06	 June 07	 Sept 07
Spring applied	— oz/A —		%	
Aminopyralid	1.75	99	96	96
Aminopyralid	3.5	99	96	92
Picloram	8	98	96	93
Aminopyralid + diflufenzopyr	1.75 + 0.7	99	96	93
Fall applied				
Aminopyralid	1.75		99	99
Aminopyralid	3.5		100	99
Picloram	8		99	91
Aminopyralid + diflufenzopyr	1.75 + 0.7		100	99
LSD (0.05)		NS	2.5	4.5

[1] Activator 90 was applied at 0.25% with all treatments, Loveland Products, Inc., Greeley CO 80632-1286. Treatments were applied in mid-June or following a light frost in late-Sept or early Oct 06.

Table 2. Aminopyralid applied at the maximum use rate in the spring or fall for spot treatment of leafy spurge near Walcott, ND.

Treatment[1]	Rate	Evaluation date		
		6 Sept 06	31 May 07	5 Sept 07
Spring applied	— oz/A —		%	
Aminopyralid	1.75	3	8	0
Aminopyralid	3.5	18	8	3
Aminopyralid + picloram	1.75 + 8	92	53	31
Aminopyralid + picloram	3.5 + 8	98	80	64
Picloram	16	95	58	44
Fall applied				
Aminopyralid	1.75		26	0
Aminopyralid	3.5		79	40
Aminopyralid + picloram	1.75 + 8		99	52
Aminopyralid + picloram	3.5 + 8		99	64
Picloram	16		100	76
LSD (0.05)		6	22	32

[1] Activator 90 was applied at 0.25% with all treatments, Loveland Products, Inc., Greeley CO 80632-1286. Treatments were applied on 1 June 06 (spring) or 6 Sept 06 (fall).

Table 3. Aminopyralid applied at the maximum use rate in mid-summer or fall for spot treatment of yellow toadflax in Barnes County, ND.

		31 Aug 06		8 June 07	
Treatment[1]	Rate	Control	Grass injury	Control	Grass injury
Mid-summer applied	— oz/A —			%	
Aminopyralid	1.75	8	0	0	0
Aminopyralid	3.5	10	0	5	0
Aminopyralid + picloram	1.75 + 8	23	3	46	6
Aminopyralid + picloram	3.5 + 8	25	7	76	8
Picloram	16	26	13	46	18
Fall applied					
Aminopyralid	1.75			0	0
Aminopyralid	3.5			22	5
Aminopyralid + picloram	1.75 + 8			38	26
Aminopyralid + picloram	3.5 + 8			20	51
Picloram	16			15	55
LSD (0.05)		NS	5	22	11

[1] Activator 90 was applied at 0.25% with all treatments, Loveland Products, Inc., Greeley CO 80632-1286. Treatments were applied on 5 July 06 (mid-summer) or 20 Sept 06 (fall).

Dalmation toadflax control using low rates of chlorsulfuron and two surfactants. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Whitebird, ID to evaluate Dalmation toadflax (*Linaria dalmatica* (L.) P.Mill) control using low rates of chlorsulfuron with a methylated seed oil (MSO) or non-ionic surfactant (NIS) surfactant. The experiment was designed as a randomized complete block with four replications. Plot size was 10 by 20 feet. All treatments were applied with a CO_2-pressurized backpack sprayer at 15 gpa (Table 1).

Table 1. Application and soil data.

Location	Whitebird, ID
Target weed	Dalmation toadflax
Weed growth stage	Flower
Application date	May 15, 2007
Air temp (F)	87
Relative humidity (%)	17
Wind (mph, direction)	2 to 4, NE
Cloud cover (%)	0
Soil temp at 2 inches (F)	92
Soil type	Cobble loam

Evaluations were conducted 1 and 2 months after treatment (MAT). Dalmation toadflax control was based on the percentage of treated plants showing herbicidal symptoms (stunted growth and flowering, foliar chlorosis) in comparison to the untreated check (Table 2). A significant rate effect was detected 1 and 2 MAT. Chlorsulfuron at 0.50 and 0.75 oz ai/A did not differ in pairwise comparisons 1 and 2 MAT, but both rates resulted in greater Dalmation toadflax control than 0.38 oz ai/A 1 MAT. Chlorsulfuron at 0.75 oz ai/A resulted in greater control than 0.38 oz ai/A 2 MAT. A significant surfactant effect occurred 2 MAT. Chlorsulfuron + MSO applications resulted in greater Dalmation toadflax control than chlorsulfuron + NIS.

Table 2. Dalmation toadflax control following chlorsulfuron treatments and two surfactants near Whitebird, ID.

		Dalmation toadflax control	
Treatment	Rate	1 MAT	2 MAT
	oz ai/A	%	%
Chlorsulfuron + NIS[1]	0.38	58	41
Chlorsulfuron + NIS	0.50	80	71
Chlorsulfuron + NIS	0.75	78	86
Chlorsulfuron + MSO[2]	0.38	73	84
Chlorsulfuron + MSO	0.50	80	81
Chlorsulfuron + MSO	0.75	83	94
Untreated check		0	0
Tukey's Studentized Range HSD (0.05)		20	33

[1] 90% non-ionic surfactant (R-11) applied at 0.25% v/v

[2] 100% methylated seed oil (Superspread MSO) applied at 1.0% v/v

Control of *Ventenata dubia* using various selective herbicides. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was initiated near Moscow, Idaho on a Palouse Prairie restoration site to evaluate the efficacy of various herbicides at different timings for the control of ventenata (*Ventenata dubia* (Leers) Coss.). Herbicide injury symptoms on native perennial grasses (Idaho fescue, Bluebunch wheatgrass) were also evaluated. Triasulfuron was applied as a PRE-emergent treatment and as a late-POST treatment. Imazapic was applied as early and late-POST treatments and sulfosulfuron was applied as an early-POST treatment. The experiment was designed as a randomized complete block with four replications. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer at 15 gpa (Table 1).

Table 1. Application and soil data.

Location	Moscow, ID	Moscow, ID	Moscow, ID
Target weed	Ventenata	Ventenata	Ventenata
Weed growth stage	PRE	Early-POST (1-2 leaf)	Late-POST (2-3 inch)
Application date	October 3, 2006	November 8, 2006	March 22, 2007
Air temp (F)	64	44	46
Relative humidity (%)	42	85	49
Wind (mph, direction)	2 to 4, E	3 to 7, SW	1 to 3, E
Cloud cover (%)	80	80	90
Soil temp at 2 inches (F)	53	44	38
Soil type	silt loam	silt loam	silt loam

Treatments were visually evaluated for percent control of ventenata in comparison to the untreated check on April 24, 2007. Application of triasulfuron resulted in poor ventenata control following PRE- and POST-emergent treatments. Imazapic and sulfosulfuron treatments resulted in significantly greater control (>75%) than triasulfuron treatments. Imazapic treatments did not differ in comparisons between timing and rates.

Treatments were also visually evaluated for percent perennial grass injury in comparison to the untreated control on April 24, 2007. Perennial grass was rated on a scale of zero to five: 0 = no injury, 1 = <50% growth suppression, 2 = >50% growth suppression, 3 = >50% growth suppression + <50% injury symptoms, 4 = >50% growth suppression + >50% injury symptoms. Application of imazapic at the late-POST timing resulted in significantly greater perennial grass injury in comparison to early-POST treatments. This treatment resulted in greater than 50% growth suppression and injury symptoms (chlorosis) were present. All other treatments resulted in less than 50% growth suppression of perennial grasses. Perennial grass injury will be re-evaluated one year after treatment.

Table 2. Ventenata control with various herbicides near Moscow, Idaho in 2006-2007.

Treatment	Timing	Rate	VEDU control	Perennial grass injury
		oz ai/A[1]	%	Scale (0-5)
Imazapic + MSO[2]	Early-POST	1	82	0.63
Imazapic + MSO	Early-POST	2	93	1.40
Sulfosulfuron + NIS[3]	Early-POST	0.25	99	0.87
Triasulfuron + NIS	PRE	0.15	33	0.25
Imazapic + MSO	Late-POST	2	76	3.50
Triasulfuron + NIS	Late-POST	0.15	38	0.75
Untreated check			0	0.00
Tukey's Studentized Range HSD (0.05)			26	1.31

[1] Imazapic rates expressed in oz ae/A

[2] 100% methylated seed oil (Superspread MSO) applied at 1.0% v/v

[3] 90% non-ionic surfactant (R-11) applied at 0.25% v/v

Absinth wormwood control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) *Artemisia absinthium* (ARTAB) is an escaped ornamental that has spread rapidly in pasture and rangeland in Colorado. It is a herbaceous perennial that is a prolific seed producer and also spreads by short woody rhizomes. It is easily recognized by its strong odor. ARTAB is an ingredient in the liquor absinthe and is also used medically as a tonic, stomachic, febrifuge and anthelmintic.

This experiment was established near Gunnison, CO to evaluate chemical control of ARTAB. The experiment was designed as a randomized complete block with four replications. Herbicides were sprayed on July 12, 2006 at late bolt growth stage or September 25, 2006 at post seedset. All treatments were applied with a CO_2-pressurized backpack sprayer using 11002LP flat fan nozzles at 20 gal/A and 30 psi. Plot size was 10 by 20 feet. Application information for both studies is presented in Table 1.

Visual evaluations for control compared to non-treated plots were collected in August and September 2006, and September 2007 at approximately 1, 2, and 14 months after treatment (MAT), Table 2. All July 2006 treatments controlled 15 to 73% ARTAB approximately 1 MAT and 46 to 100% ARTAB 2 MAT. Metsulfuron plus chlorsulfuron tank mixed with picloram or 2,4-D controlled 46 to 69% ARTAB while picloram or aminopyralid sprayed alone or tank mixed with 2,4-D controlled 84 to 100% ARTAB 2 MAT.

Treatments applied in summer during the reproductive growth stage (14 to 100% control) tended to control ARTAB better than similar treatments sprayed in the fall (11 to 80% control). Picloram (8 oz ai/a), picloram plus 2,4-D, and aminopyralid plus 2,4-D sprayed in the spring controlled 100% of ARTAB while these same treatments sprayed in the fall controlled 65, 80, and 35% ARTAB control 14 MAT. The only treatment that improved when sprayed in the fall (compared to the summer) was metsulfuron plus chlorsulfuron plus 2,4-D (71% compared to 14% ARTAB control).

Treatments in this and an adjacent study have shown that 2,4-D ester added to picloram, aminopyralid, and metsulfuron plus chlorsulfuron increased control of ARTAB the year of treatment; however, this was not evident 14 MAT. There was no perennial grass injury observed with any of these treatments. Visual evaluations for residual control will be conducted in 2008 to determine long-term ARTAB control.

Table 1. Application data for absinth wormwood control in Colorado.

Environmental data		
Application date	July 12, 2006	September 25, 2006
Application time	11:30 am	1:00 pm
Air temperature, F	68	61
Relative humidity, %	46	58
Wind speed, mph	0 to 2	0 to 7

Application date	Species	Common Name	Growth stage	Height --(in.)--
July 12, 2006	ARTAB	Absinth wormwood	Late bud to early flower	14 to 36
September 25, 2006	ARTAB	Absinth wormwood	Post seedset	10 to 36

Table 2. Absinth wormwood control in Colorado.

Herbicide[1,2,3]	Rate	Absinth wormwood control August 2006	 September 2006	 September 2007
	oz ai/a	(%)		
Metsulfuron + chlorsulfuron + picloram	0.2 + 0.2 + 2	46	54	28
Metsulfuron + chlorsulfuron + picloram	0.6 + 0.8 + 2	43	55	24
Metsulfuron + chlorsulfuron + clopyralid	0.2 + 0.2 + 3	49	70	51
Metsulfuron + chlorsulfuron + clopyralid	0.6 + 0.8 + 3	51	82	63
Metsulfuron + chlorsulfuron + aminopyralid	0.2 + 0.2 + 1.5	40	58	46
Metsulfuron + chlorsulfuron + aminopyralid	0.6 + 0.8 + 1.5	65	80	70
Metsulfuron + chlorsulfuron + 2,4-D	0.2 + 0.2 + 16	66	83	40
Metsulfuron + chlorsulfuron + 2,4-D	0.6 + 0.8 + 16	71	88	74
Clopyralid + 2,4-D	13 + 48	63	94	68
LSD (0.05)		13	10	22

[1] Crop oil concentrate added to all treatments at 2% v/v.
[2] 2,4-D amine formulation.
[3] Clopyralid plus 2,4-D is the premix formulation of Curtail.

Absinth wormwood control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) *Artemisia absinthium* (ARTAB) is an escaped ornamental that has spread rapidly in pasture and rangeland in Colorado. It is a herbaceous perennial that is a prolific seed producer and also spreads by short woody rhizomes. It is easily recognized by its strong odor. ARTAB is an ingredient in the liquor absinthe and is also used medically as a tonic, stomachic, febrifuge and anthelmintic.

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September 25, 2006	ARTAB	Absinth wormwood	Post seedset	10 to 36

Table 2. Absinth wormwood control in Colorado.

		Absinth wormwood control			
Herbicide[1,2]	Rate	Treatment	August 2006	September 2006	September 2007
	oz ai/a	Timing	(%)		
Metsulfuron	0.2	Summer	15	46	43
+ chlorsulfuron	+ 0.2				
+ picloram	+ 2				
Metsulfuron	0.3	Summer	15	49	35
+ chlorsulfuron	+ 0.4				
+ picloram	+ 2				
Metsulfuron	0.6	Summer	20	50	31
+ chlorsulfuron	+ 0.8				
+ picloram	+ 2				
Metsulfuron	0.3	Summer	56	69	14
+ chlorsulfuron	+ 0.4				
+ 2,4-D	+ 16				
Picloram	4	Summer	41	87	97
Picloram	8	Summer	44	91	100
Picloram	8	Summer	70	100	100
+ 2,4-D	+ 16				
Aminopyralid	1.3	Summer	29	84	85
Aminopyralid	1.8	Summer	26	86	88
Aminopyralid	1.8	Summer	73	100	100
+ 2,4-D	+ 32				
Tripclopyr	12	Summer	73	84	39
+ 2,4-D	+ 32				
Metsulfuron	0.2	Fall			11
+ chlorsulfuron	+ 0.2				
+ picloram	+ 2				
Metsulfuron	0.3	Fall			18
+ chlorsulfuron	+ 0.4				
+ picloram	+ 2				
Metsulfuron	0.6	Fall			11
+ chlorsulfuron	+ 0.8				
+ picloram	+ 2				
Metsulfuron	0.3	Fall			16
+ chlorsulfuron	+ 0.4				
+ 2,4-D	+ 16				
Metsulfuron	0.6	Fall			71
+ chlorsulfuron	+ 0.8				
+ 2,4-D	+ 32				
Picloram	4	Fall			65
Picloram	8	Fall			80
Picloram	8	Fall			80
+ 2,4-D	+ 16				
Aminopyralid	1.3	Fall			35
Aminopyralid	1.8	Fall			49
Aminopyralid	1.8	Fall			35
+ 2,4-D	+ 32				
Tripclopyr	12	Fall			37
+ 2,4-D	+ 32				
LSD (0.05)			12	11	23

[1] Crop oil concentrate added to all treatments at 2% v/v.

[2] 2,4-D ester formulation.

Tolerance of ponderosa pine to aminopyralid applications. John Wallace and Tim Prather. (Crop & Weed Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Santa, ID in an abandoned pasture undergoing ponderosa pine (*Pinus ponderosa* Dougl.) encroachment. The objective of the study was to evaluate the tolerance of ponderosa pine to aminopyralid, aminopyralid + clopyralid, and picloram treatments underneath tree canopies. Ten ponderosa pine trees were tagged and treated per treatment. Tagged trees were blocked by approximate tree height, yielding six replications that ranged from 5 to 10 feet tall and four replications that ranged from 10 to 15 feet tall. All treatments were applied with a single off-center nozzle (OC-06) delivered by a backpack sprayer calibrated to 8.4 gpa (Table 1). A 12 by 8 ft swath was sprayed away from the trunk on the north and south side of each tree.

Table 1. Application data.

Location	Santa, ID
Target plant	Ponderosa Pine
Plant growth stage	5 to 15 ft tall
Application date	May 24, 2007
Air temp (F)	73
Relative humidity (%)	35
Wind (mph, direction)	3 to 5, NE
Cloud cover (%)	65
Soil temp at 2 inches (F)	78
Soil type	Helmer silt loam

Ponderosa pine trees were evaluated 1 and 2 months after treatment (MAT). Injury ratings were based on the percentage of the treated tree showing herbicide symptoms including twisting of lateral and terminal candles and delayed elongation of needles. Mortality of treated ponderosa pine was not observed. Aminopyralid at 1.75 oz ae/A resulted in greater injury than the untreated check 1 MAT (Table 2). Injury from either aminopyralid at 0.75 oz ae/A or aminopyralid + clopyralid was not significantly different from the untreated check 1 MAT. The picloram treatment did not differ in comparison to other treatments 1 MAT. A significant treatment by tree-size interaction occurred 1 MAT. Injury symptoms following aminopyralid at 1.75 oz ae/A were greater on 5 to 10 ft trees, whereas, injury symptoms following the picloram treatment were greater on 10 to 15 ft trees. Picloram treatments resulted in greater injury than the untreated check, aminopyralid at 0.75 oz ae/A, and aminopyralid + clopyralid 2 MAT. Aminopyralid at 1.75 oz ae/A did not differ in comparison to other treatments 2 MAT. Tree-size did not affect injury symptoms 2 MAT. Herbicide symptoms will be evaluated during the 2008 growing season.

Table 2. Percent ponderosa pine injury following herbicide treatments beneath the tree canopy near Santa, ID.

		Ponderosa pine injury	
Treatment[1]	Rate	1 MAT[2]	2 MAT
	oz ae/A	%	
Aminopyralid	0.75	5.2	4.0
Aminopyralid	1.75	16.9	10.5
Aminopyralid + clopyralid	0.75 + 1.5	4.6	3.5
Picloram	4	8.7	18.5
Untreated check		1.0	0.3
Tukey's Studentized Range HSD (0.05)		9.7	12.7

[1] 90% non-ionic surfactant (R-11) at 0.25% v/v was applied with all treatments

[2] Months after treatment

<u>CD-II crested wheatgrass tolerance to ALS herbicides</u>. Karl Israelsen, Corey Ransom, and Thomas Monaco. (Plants, Soils, and Climate Department and USDA-ARS, Forage and Range Research Lab, Utah State University, Logan, UT 84322-4820) A study was conducted to examine CD-II crested wheatgrass tolerance to ALS herbicides in 2007. Grasses were established three years before herbicide treatments were applied on April 13, 2007. Plots were 10 by 30 feet arranged in a randomized complete block design with four replications. All herbicide treatments were applied using a CO_2^- pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi. The wheatgrass averaged 11 inches tall when herbicide treatments were applied. Herbicide injury and plant height were evaluated on May 30, 2007. Plant biomass was harvested on August 28, 2007. Herbicide treatments showed visible differences in injury, plant height, and biomass (Table). Treatments of sulfosulfuron showed no visual injury, whereas imazapic showed the highest injury at 72%. Imazapic and propoxycarbozone treatments significantly decreased plant height and biomass. Evaluations showed imazapic and propoxycarbazone caused significantly higher visual injury and reduced grass height and biomass compared to sulfosulfuron and flucarbazone.

Table. Visual injury, height, and biomass of CD-II Crested Wheatgrass in response to herbicide treatments[1].

Herbicide	Injury	Plant height	Dry weight/biomass
	--%--	--cm--	--kg/ha--
Untreated		82	6898
Imazapic	72	33	1515
Propoxycarbazone	65	37	2188
Sulfosulfuron	0	77	6780
Flucarbazone	31	63	5790
LSD (0.05)	5.65	5.75	844

[1] Herbicide treatments were applied at the following rates: imazapic at 0.125 lb ai/A, propoxycarbazone at 0.053 lb ai/A, sulfosulfuron at 0.047 lb ai/A, and flucarbazone at 0.026 lb ai/A. All treatments included a non-ionic surfactant at 0.25% v/v.

Perennial grass tolerance to ALS herbicides. Karl Israelsen, Corey Ransom, and Thomas Monaco. (Plants, Soils, and Climate Department and USDA-ARS Forage and Range Research Lab, Utah State University, Logan, UT 84322-4820) A study was conducted to examine perennial grass tolerance to ALS herbicides in 2007. Grasses were established three years before herbicide treatments were applied on April 13, 2007. Grass varieties and herbicide treatments were arranged in a strip plot design, with individual plots measuring 5 by 6 feet, with four replications. All herbicide treatments were applied using a CO_2^- pressurized backpack sprayer calibrated to deliver 20 gpa at 30 psi. Grass varieties varied in their tolerance to each of the herbicides tested (Table). Hybrid wheatgrass varieties showed higher tolerance to imazapic compared to propoxycarbazone and sulfosulfuron. Intermediate wheatgrasses treated with propoxycarbazone and sulfosulfuron showed lower injury, whereas imazapic treatments showed higher injury. Crested wheatgrass varieties showed greater tolerance to sulfosulfuron treatments and were less tolerant of imazapic and propoxycarbazone treatments. Herbicide treatments caused 39 to 59% injury and reduced height 39 to 52% when averaged across all grass varieties. When averaged across all grass varieties imazapic caused significantly higher visual injury and reduced grass height compared to propoxycarbazone and sulfosulfuron.

Table. Visual injury and height of selected grass varieties in response to herbicide treatments[1].

Variety	Injury			Plant height			
	Imazapic	Propoxycarbozone	Sulfosulfuron	Untreated	Imazapic	Propoxycarbozone	Sulfosulfuron
	----------%		----------	----------cm			----------
Newhy-Salt Hybrid Wheatgrass	45	65	61	61	36	26	24
Garrison-Meadow Foxtail	58	62	65	75	24	21	22
UT-MB-Meadow Brome	47	53	38	74	33	28	40
Fawn-Tall Fescue	82	45	71	66	21	41	24
Ginger-Kentucky Bluegrass	65	42	43	50	19	37	33
Cool-season-Crested Wheatgrass	53	58	10	52	28	25	52
Hycrest-Crested Wheatgrass	47	48	10	57	29	22	40
Regar-Meadow Brome	61	52	56	73	25	35	31
AT cycle 2-Orchardgrass	57	25	21	58	26	45	47
CDII-Crested Wheatgrass	55	57	9	57	28	28	53
Climax-Timothy	83	44	41	51	19	40	40
Sherman-Big Bluegrass	49	17	36	66	36	60	45
Alkar-Tall Wheatgrass	63	63	58	65	31	31	31
Manchar-Smooth Brome	67	43	63	64	24	36	25
Potomac-Orchardgrass	65	15	46	71	28	56	41
Greenar-Intermediate Wheatgrass	52	18	6	54	29	40	50
Rush-Intermediate Wheatgrass	53	23	8	56	32	42	49
Newhy-Hybrid Wheatgrass	33	61	60	63	50	27	25
Sleepy Grass	69	12	35	53	32	49	41
LSD (0.05)	----------12		----------	----------7			----------

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[1] Herbicide treatments were applied at the following rates: imazapic at 0.125 lb ai/A, propoxycarbazone at 0.053 lb ai/A, sulfosulfuron at 0.047 lb ai/A. All treatments included a non-ionic surfactant at 0.25 % v/v.

Hairy nightshade control with tankmix combinations of S-metolachlor and ethofumesate in table beets. Ed Peachey. (Horticulture Dept, Oregon State University, Corvallis, OR 97330) The objective of this experiment was to determine the potential of improving hairy nightshade control with s-metolachlor by tankmixing with ethofumesate. Table beets were planted on beds with 3-26 inch rows on May 15, 2007. Herbicides were applied the next day with a hand-held boom sprayer with 3-8002 nozzles (20 inch spacing on the boom), at 30 PSI, and with 20 GPA of water. Herbicides were incorporated with irrigation water shortly after planting. The predominant weed at the field site was hairy nightshade. Crop injury and hairy nightshade density were evaluated at 3 WAP, and weed control evaluated at harvest. All plots were cultivated once. Beets were harvested on August 2 from one 8.2 ft section of each row in the middle of the plot, graded, and weighed.

The overall weed control estimate at harvest accounted for approximately 88% of the yield variability. Neither S-metolachlor nor ethofumesate applied alone provided adequate hairy nightshade control. However, S-metolachlor tankmixed with ethofumesate at the lowest rate of 0.47 lbs ai/A (15 oz/A) reduced hairy nightshade density by 5-fold compared to ethofumesate alone at the same rate. Hairy nightshade density was reduced to only 5/yd^2 when s-metolachlor was tankmixed with the highest rate of ethofumesate. The two higher rates of ethofumesate stunted crop growth when applied with S-metolachlor, but did reduce plant stand. The best yields were with ethofumesate at 1.88 lbs ai/A or when any rate of ethofumesate was tankmixed with S-metolachlor. Future research should examine the synergism between these two herbicides for hairy nightshade control, particularly with reduced rates of S-metolachlor. S-metolachlor will occasionally reduce table beet stands under unfavorable environmental conditions. Lowering the S-metolachlor rate and tank mixing with ethofumesate may reduce the potential of crop injury yet maintain acceptable levels of hairy nightshade control.

Table. Effect of S-metolachlor and ethofumesate on hairy nightshade control and table beet yield.

			Stand	Phytotoxicity	Stunting	Hairy nightshade		Overall weed control	Beet root harvest 21-Aug	
						Density	Control			
	Herbicide	Rate	13-Jun	7-Jun	13-Jun	13-Jun	21-Aug	21-Aug	Yield	Grade
		lbs ai/A	*no/4 ft of row*	*0-10*	*0-100 %*	*no./yd^2*	*%*	*%*	*t/A*	*% 1-2*
1	S-metolachlor	0.64	34	0.0	3	27	63	46	15.3	83
2	Ethofumesate	0.47	34	0.0	0	58	23	23	9.4	77
3	Ethofumesate	0.94	37	0.0	4	40	61	60	20.4	69
4	Ethofumesate	1.88	36	0.5	10	19	96	91	27.5	49
5	Ethofumesate S-metolachlor	0.47 0.64	41	0.0	3	10	81	71	27.1	61
6	Ethofumesate S-metolachlor	0.95 0.64	36	0.4	20	11	95	81	28.4	48
7	Ethofumesate S-metolachlor	1.88 0.64	38	0.1	18	5	94	87	29.8	49
8	Check	-	35	0	0	83	0	0	0	-
	FPLSD (0.05)		ns	0.7	12	34	22	27	9.1	26

Comparison of bispyribac rates with multiple applications for *Poa annua* control in turf. Kai Umeda. (University of Arizona, Maricopa County Cooperative Extension, Phoenix, AZ 85040) A small plot field experiment was conducted at the Arizona Biltmore Country Club in Phoenix, AZ. Bermudagrass turf was winter overseeded with perennial ryegrass in the test site that was heavily infested with *Poa annua*. Individual plots measured 5 ft by 25 ft and treatments were replicated four times in a randomized complete block design. Herbicide treatments were sprayed using a backpack CO_2 sprayer equipped with a hand-held boom with three 8003 flat-fan nozzles spaced 20 inches apart. Sprays were delivered with 28 gpa water and included a non-ionic surfactant, Latron CS-7 at 0.25% v/v pressurized to 30 psi. The first of five applications was initiated on 9 March 2007 when the *P. annua* was flowering and the turf mowing height was about 1.5 inches. The air temperature was 60°F, clear sky, and no wind during applications. Two weeks later, on 23 March, the temperature was 68°F, rain during the night before, very slight breeze, and developing clouds. The third application was on 6 April on a clear, sunny day that reached a high of 90°F, and fourth application was 20 April with temperature at 70°F during spraying, high overcast sky with rain in the forecast. The fifth application on 4 May was made when temperature was 70°F, calm air, with scattered clouds. The turf was mowed weekly and dew was present during all of the morning applications. The *P. annua* control was evaluated at intervals following applications. Bispyribac at 40 gm a.i./A was more active than 20 gm a.i./A which was more active than 10 gm a.i./A. Bispyribac at 40 gm a.i./A consistently gave better than 74% *P. annua* control but less than commercially acceptable levels. Bispyribac at 20 gm a.i./A gave between 50 to less than 70% control. Bispyribac at 10 gm a.i./A was marginally active against *P. annua* giving less than 60% control.

Table. Comparison of bispyribac rates for *Poa annua* control in turf.

		Poa annua control			
Treatment[1]	Rate	23 Mar	06 Apr	04 May	01 Jun
	gm a.i./A	%	%	%	%
Untreated check		0	0	0	0
Bispyribac	10	45	60	38	40
Bispyribac	20	50	66	61	68
Bispyribac	40	74	76	76	80
LSD (p=0.05)		8.2	14.4	17.4	13.7

[1] Application dates – 9, 23 March, 6, 20 Apr, 4 May 2007.
Latron CS-7 at 0.25% v/v added to each treatment at all applications.

Evaluation of penoxsulam rates and multiple applications for nutsedge control in turf. Kai Umeda. (University of Arizona, Maricopa County Cooperative Extension, Phoenix, AZ 85040) A small plot experiment was conducted at the Mesa Country Club, Mesa, AZ in common bermudagrass turf infested with purple nutsedge. Plots measured 5 ft by 10 ft and treatments were replicated three times in a randomized complete block design. Herbicides were applied with a CO_2 backpack sprayer equipped with hand-held boom equipped with three 8003 flat fan nozzles spaced 20 inches apart. All sprays were applied in 30 gpa water pressurized to 30 psi and included a non-ionic surfactant, Latron CS-7 at 0.25% v/v. The first application date was 05 July 2007 when the air temperature was 100°F, clear sky, with a very slight breeze. The second application date for all herbicides was 02 August with air temperature at 92°F, high clouds, no wind and very humid. The third application date for the lowest rates of penoxsulam was 30 August with temperature at 90°F, clear and very humid with no wind. Penoxsulam treated nutsedge exhibited variable results. Nutsedge was not adequately controlled by penoxsulam and the efficacy of single versus multiple applications was not consistently discernable. Penoxsulam did not perform as comparable as the standard commercial products for nutsedge control.

Table. Evaluation of penoxsulam rates and multiple applications for nutsedge control in turf

		Purple nutsedge control			
Treatment[4]	Rate	15 Jul	20 Jul	30 Aug	05 Oct
	lb a.i./A	-----------------------	%		-----------------------------
Untreated check		0	0	0	0
Penoxsulam	0.04[1]	7	33	7	17
Penoxsulam	0.06[1]	0	63	0	0
Penoxsulam	0.02[1] + 0.02[2]	53	33	32	60
Penoxsulam	0.03[1] + 0.03[2]	78	33	25	73
Penoxsulam	0.04[1] + 0.04[2]	78	63	37	67
Penoxsulam	0.02[1] + 0.02[2] + 0.02[3]	57	0	43	63
Penoxsulam	0.03[1] + 0.03[2] + 0.03[3]	80	57	47	65
Imazaquin	0.5 [1]+ 0.5[2]	87	85	88	68
Trifloxysulfuron	0.026[1] + 0.026[2]	98	87	73	85
Halosulfuron	0.062 [1]+ 0.062[2]	90	88	75	82
Sulfosulfuron	0.094[1] + 0.094[2]	96	88	80	80
Flazasulfuron	0.047 [1]+ 0.047[2]	91	87	73	80
LSD (p=0.05)		24.2	27.2	21.2	19.5

[1] Application 1 on 05 July 2007

[2] Application 2 on 02 August 2007

[3] Application 3 on 30 August 2007

[4] Latron CS-7 at 0.25% v/v added to all treatments

Weed control in an established chardonnay vineyard. Mick Canevari, Paul Verdegaal, Don Colbert, Randall Wittie and Scott Whiteley. (Cooperative Extension, University of California, Stockton, CA 95205). A field study was established to evaluate postemergence herbicide applications for weed control in an established vineyard located near Lodi, California. Plots were 4.5 by 24 ft arranged in a randomized complete block design with four replications. All herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 40 gpa (Table 1). Grape injury and weed control was visually evaluated 14, 38, 58, 122 and 144 days after treatment (Table 2 and 3).

Table 1. Application information and rainfall data.

Application date	January 8, 2007
Rainfall data	January 8th 12 hrs after application 0.04 inch. January 9 to February 7th 0.15 inch. February 8th to February 12th 1.91 inch
Growth stages:	
Grape	dormant
Annual bluegrass (POAAN)	1 to 4 tiller, 1 to 2 inch height
Shepherdspurse (CAPBP)	4 to 8 lf, 1 to 2 inch diameter
Common chickweed (STEME)	1 to 3 inch diameter
Italian ryegrass (LOLMU)	50% = 1 to 3 tiller, 2 to 4 inch height 50% = fully tillered, 10 to 14 inch height
Prickly lettuce (LACSE)	2 to 5 lf, 0.25 to 2 inch diameter
Willowweed (EPIPC)	Cotyledon to 5 lf, 1.5 to 2 inch height
Annual Sowthistle (SONOL)	2 to 12 lf, 1 to 10 inch diameter
Horseweed (ERICA)	Small = 80% 2 to 5 lf, 0.25 inch diameter Medium = 10% 6 to 8 lf, 1 to 2 inch diameter Large = 10% 15 to 16 lf, 3 to 7 inch diameter
Spotted spurge (EPHMA)	preemergence
Air temperature (F)	53
Relative humidity	60
Wind (mph)	6
Cloud cover (%)	0
Texture	sandy loam

All treatments showed no grape injury (data not shown). Paraquat tank mixed with flumioxazin or flumioxazin + pendimethalin gave 86 to 100% control of all weed species. Paraquat gave 97 to 100% control on all horseweed growth stages. Flumioxazin gave excellent soil residual control of ERICA and EPHMA. Rimsulfuron tank mixed with glufosinate-ammonium resulted in 83 to 100% control of the above weed species except for 27 to 77% preemergence control of EPHMA. The higher rate of rimsulfuron gave better control on LOLMU and SONOL, 10% and 14% respectively. All ERICA growth stages were controlled with glufosinate-ammonium. Rimsulfuron gave excellent soil residual control of ERICA. Rimsulfuron tank mixed with glyphosate gave similar results as above with 70% control of SONOL and 53% EPHMA control. A few large horseweed plants escaped the glyphosate application. Rimsulfuron + flumioxazin gave 88 to 100% control of all weed species with poor ERICA control. Flumioxazin + glufosinate-ammonium gave excellent overall weed control 87 to 100%. Flumioxazin + glyphosate 98-100% control of the above weeds with 75% ERICA control. Glyphosate left a few medium and large ERICA. Imazosulfuron + glufosinate-ammonium 84 to 100% control of all weed species except for 60% LOLMU control. Imazosulfuron + flumioxazin + glufosinate-ammonium 87-100% overall weed control. Glyphosate + oxyfluorfen + pendimethalin 94 to 100 % control of LOLMU, POAAN, STEME and CAPBP with 82% EPHMA, 78% EPIPC, 77% LACSE, 70% SONOL, and 0% ERICA control. Glyphosate gave poor control of the medium and large ERICA. Glufosinate-ammonium + pendimethalin tank mixed with either carfentrazone-ethyl or oxyfluorfen gave similar weed control; excellent control of EPIPC, SONOL, STEME, POAAN and CAPBP with fair to average control of LOLUM, EPHMA and LASCE. Both treatments gave complete control of all ERICA growth stages but soil residual control was only 0-40% on the final rating date.

Table 2. Weed control in an established chardonnay vineyard near Lodi, CA.

		Control – Days After Treatment[1]											
		LOLMU		LACSE		EPIPC		SONOL		POAAN		STEME	CAPBP
Treatment[2]	Rate	38	144	38	144	38	144	38	144	38	58	38	38
	lb ai/A	……………………………………% Control……………………………………											
Paraquat + flumioxazin	1.0 + 0.375	93	94	100	100	100	100	97	100	100	100	100	100
Paraquat + flumioxazin + pendimethalin	1.0 + 0.375 + 3.8	96	99	100	100	100	98	96	97	100	100	100	100
Rimsulfuron + glufosinate	0.0625 + 1.0	87	85	100	97	100	99	100	83	87	92	100	100
Rimsulfuron + glufosinate	0.125 + 1.0	87	95	100	100	100	100	100	97	87	90	100	100
Rimsulfuron + Glyphosate	0.625 + 1.0	82	97	100	97	92	96	95	70	97	100	99	96
Rimsulfuron + flumioxazin	0.625 + 0.375	68	96	100	100	100	100	100	100	84	93	100	88
Flumioxazin + glufosinate	0.375 + 1.0	80	93	100	100	100	97	100	100	100	100	100	100
Flumioxazin + glyphosate	0.375 + 1.0	95	99	100	100	99	100	100	100	100	100	100	99
Imazosulfuron + glufosinate	0.5 + 1.0	70	60	100	84	100	99	100	100	82	85	100	100
Imazosulfuron + flumioxazin + glufosinate	0.5 + 0.375 + 1.0	82	87	100	100	100	100	100	100	93	93	100	100
Glyphosate + oxyfluorfen + pendimethalin	1.0 + 1.0 + 3.8	89	94	100	77	85	78	100	70	100	100	100	99
Carfentrazone + Glufosinate + pendimethalin	0.031 + 1.0 3.8	75	63	100	72	100	96	100	87	94	87	100	100
Glufosinate + oxyfluorfen + pendimethalin	1.0 + 1.0 + 3.8	77	58	100	79	100	93	100	97	90	93	100	100
Untreated	-	0	0	0	0	0	0	0	0	0	0	0	0
LSD (05)		9	8	0	15	2	6	6	20	5	8	0	6

[1] Weed control ratings taken 38, 58 and 144 days after treatment.

[2] 90% nonionic surfactant (No Foam A) at 0.25% v/v applied with all treatments.

Table 3. Horseweed and spotted spurge control in an established chardonnay vineyard near Lodi, CA.

		Control – Days After Treatment[1]									
		Horseweed Growth Stage									
		Small		Medium		Large		Final Horseweed		Spotted spurge	
Treatment[2]	Rate	14	38	14	38	14	38	89	144	122	144
	lb ai/A	% Control									
Paraquat + flumioxazin	1.0 + 0.375	100	97	98	100	90	100	91	88	99	99
Paraquat + flumioxazin + pendimethalin	1.0 + 0.375 + 3.8	97	97	95	95	90	100	85	86	93	93
Rimsulfuron + glufosinate	0.0625 + 1.0	100	100	98	100	90	100	93	86	57	27
Rimsulfuron + glufosinate	0.125 + 1.0	97	100	97	100	90	100	99	95	85	77
Rimsulfuron + Glyphosate	0.625 + 1.0	27	100	25	100	27	97	93	83	68	53
Rimsulfuron + flumioxazin	0.625 + 0.375	58	88	37	57	23	43	65	65	99	98
Flumioxazin + glufosinate	0.375 + 1.0	100	100	100	100	90	100	92	87	100	98
Flumioxazin + glyphosate	0.375 + 1.0	40	100	40	87	40	80	85	78	100	98
Imazosulfuron + glufosinate	0.5 + 1.0	99	100	88	100	80	100	93	89	99	97
Imazosulfuron + flumioxazin + glufosinate	0.5 + 0.375 + 1.0	100	100	98	100	90	100	100	99	99	99
Glyphosate + oxyfluorfen + pendimethalin	1.0 + 1.0 + 3.8	27	100	25	78	28	63	17	0	84	82
Carfentrazone + Glufosinate + pendimethalin	0.031 + 1.0 + 3.8	100	100	100	100	95	100	17	0	65	63
Glufosinate + oxyfluorfen + pendimethalin	1.0 + 1.0 + 3.8	99	100	93	100	90	100	63	40	77	73
Untreated	-	0	0	0	0	0	0	0	0	0	0
LSD (05)		17	6	10	5	9	4	18	20	20	23

[1] Weed control ratings taken 14, 38, 89, 122 and 144 days after treatment.

[2] 90% nonionic surfactant (No Foam A) at 0.25% v/v applied with all treatments.

Yellow nutsedge control in wine grapes with rimsulfuron, glyphosate and imazosulfuron. Mick Canevari, Paul Verdegaal, Don Colbert, Scott Whiteley and Randall Wittie. (Cooperative Extension, University of California, Stockton, CA 95205). A field study was established to evaluate rimsulfuron, imazosulfuron and glyphosate applications for controlling yellow nutsedge (CYPES) in an established merlot vineyard located near Lodi, California. Plots were 6 by 21 ft arranged in a randomized complete block design with three replications. All herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 36 gpa (Table 1). Herbicide treatments were applied on January 26 and April 3, 2007. Existing weeds were controlled with a burndown herbicide; oxyfluorfen or glufosinate-ammonium. Yellow nutsedge control was visually evaluated March 22, April 19, May 31 and June 20, 2007 (Table 2). Grapes were harvested on August 30, 2007.

Table 1. Application information

	January 26, 2007	April 3, 2007
Crop stage	Dormant	2 to 7 inch shoot
Yellow nutsedge stage	Preemergence	2 to 5 lf, 0.5 to 4.5 inch
Air temperature (F)	60	80
Cloud cover (%)	0	0
Wind (mph)	5	1
Relative humidity (%)	66	31

No treatment visibly injured the wine grapes (data not shown). A single preemergence application of rimsulfuron at both rates gave 78-97% yellow nutsedge control on March 3, but on the final rating date June 20 the nutsedge control was reduced to 37-63%. A split application of rimsulfuron; 0.0625 lb ai/A preemergence followed by 0.0625 lb ai/A postemergence gave excellent early nutsedge control with only 68% control on June 20. All preemergence applications of imazosulfuron applied alone or tank mixed with flumioxazin gave 82-91% control of yellow nutsedge. A single postemergence application of imazosulfuron gave 67% control of nutsedge. Postemergence glyphosate gave 70% yellow nutsedge control. All herbicide treatment grape yields were higher than the untreated check.

Table 2. Yellow nutsedge control and grape yield near Lodi, California in 2007.

		Application	Yellow nutsedge control				
Treatment	Rate	date	3/22	4/19	5/31	6/20	Yield
	lb ai/A		%				lb/vine
Rimsulfuron +	0.0625	1/26/07	78	75	57	37	32.9
Rimsulfuron	0.125	1/26/07	97	87	70	63	32.4
Rimsulfuron + Rimsulfuron	0.0625 + 0.0625	1/26/07 4/3/07[1]	90	85	77	68	33.0
Imazosulfuron	0.5 +	1/26/07	100	92	88	88	40.9
Imazosulfuron	0.75	1/26/07	100	100	92	91	37.3
Imazosulfuron + flumioxazin	0.5 + 0.375	1/26/07	100	98	87	82	31.5
Imazosulfuron + flumioxazin	0.75 + 0.375	1/26/07	100	100	90	88	37.0
Imazosulfuron	0.5	4/3/07[1]	-	27	50	67	30.6
Glyphosate	1.5	4/3/07[1]	-	50	63	70	30.1
Untreated	-	-	0	0	0	0	25.7
LSD (0.05)			9	19	17	21	10.1

[1] 100% esterified vegetable oil/nonionic surfactant blend (Hasten) at 1 pt/A and 32% urea ammonium nitrate at 1 qt/A were applied with treatment.

A comparison of season-long weed control in potatoes with three rates of dimethenamid-p applied preemergence alone and in two-way tank mixtures and dimethenamid-p three-way tank mixtures compared with metolachlor or s-metolachlor three-way tank mixtures.

Pamela J.S. Hutchinson and JaNan Farr. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.)

The objectives of this study was to compare weed control with dimethenamid-p at three rates alone or in tank mixtures as well as control with dimethenamid-p, metolachlor, or s-metolachlor in three-way tank mixtures in a field trial conducted during 2006 at the Aberdeen Research and Extension Center. The same field trial had been conducted in 2005.

The experimental area was fertilized on April 19, 2006 with 120 lb N, 200 lb P_2O_5, 75 K and 50 lb S /A based on soil tests, before planting 'Russet Burbank' potatoes on May 2, 2006. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.8 % organic matter and pH 8.2. The experimental design was a randomized complete block with three replications and plot size was 9 by 30 ft.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 17, 2006, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 19, 2006 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. Treatments included 0.64, 0.84, or 1.0 lb ai/A dimethenamid-p applied alone or in two-way tank mixtures with EPTC at 3.9, ethalfluralin at 0.94, flumioxazin at 0.047, metribuzin at 0.5, pendimethalin at 1.0, or sulfentrazone at 0.047 lb ai/A; and dimethenamid-p at 0.64, or s-metolachlor or metolachlor at 1.34 lb ai/A in three-way tank mixtures with metribuzin + pendimethalin or EPTC, or EPTC + pendimethalin. Three-way tank mixtures of dimethenamid-p at 0.64lb/A with ethalfluralin + metribuzin or EPTC and s-metolachlor with metribuzin + ethalfluralin also were included. PRE treatments were incorporated with 0.4-inch sprinkler irrigation immediately after application. No potato or weed plants were exposed at the time of application. Weed densities in the untreated checks were 90 redroot pigweed (AMARE), 40 common lambsquarters (CHEAL), 75 hairy nightshade (SOLSA), and 9 green foxtail (SETVI) per sq m by row closure approximately July 1, 2006.

An intense rainfall event occurred 1 wk after treatment (WAT) June 8th with approximately 0.8 inches precipitation received during a 25 min period and 1 inch received in a 24 h period. As a result, emerged weeds in the furrows between potato rows were covered by washing soil and only began re-emergence approximately 1 to 2 wks later.

Visual weed control was assessed at row closure 4 WAT and just prior to harvest on a scale of 0 = no control to 100 = complete control. Visual potato crop injury was rated 2 WAT and at row closure on a scale of 0 = no injury to 100 = complete death. Potatoes were sprinkler irrigated as needed throughout the growing season and received additional N based on petiole test results, through the irrigation system. Potato vines were desiccated with 0.375 lb/A diquat on September 5, 2006. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on September 27, 2006 and graded according to USDA standards.

Weed control and crop injury treatment means were separated with a Duncan's New Multiple Range Test (P=0.05) and nontreated weedy and weed-free control means were not included in those analyses. A Fisher's Protected LSD at P = 0.05 was used to separate U.S. No. 1 and total tuber yield treatment means and the nontreated control yields were included in those analyses.

Weed control data from the pre-harvest rating are reported as they represent season-long control. Regardless of rate, redroot pigweed control with dimethenamid-p alone was comparable to control with any two-way tank mixture and was greater than 92% (Table1a). Common lambsquarters control by dimethenamid-p alone at 0.64, 0.84, or 1.0 lb/A was 78, 88, and 93%, respectively, and improved significantly as the rate increased (Table 1a). All two-way mixtures with dimethenamid-p at 0.64 or 0.84 lb/A provided 93 to 100% common lambsquarters control, and this control was greater than control by the respective rates applied alone. Control by dimethenamid-p alone at 1.0 lb/A was similar to control with that rate in any two-way tank mixture, which ranged from 93 to 100%

Hairy nightshade control by the lowest dimethenamid-p rate applied PRE alone was 82% and less than the 91 to 92% control by the two highest rates applied alone (Table 1a). All of the two-way dimethenamid-p tank mixtures provided greater than 91% hairy nightshade control and control with the mixtures including the lowest rate improved control compared with control by that rate applied alone (Table 1a). The 97 to 100% green foxtail control by dimethenamid-p applied alone or in two-way tank mixtures was similar regardless of treatment (Table 1a).

Redroot pigweed, common lambsquarters, and green foxtail control by any of the three-way dimethenamid-p, s-metolachlor, or metolachlor three-way tank mixtures ranged from 93 to 100% (Table 1b). While all of the dimethenamid-p three-way tank mixtures controlled hairy nightshade 98% or better, only one of the s-metolachlor or metolachlor three-way mixtures: s-metolachlor + metribuzin + EPTC, provided similar control at 93% (Table 1b). In general, overall weed control in 2006 was relatively greater than control in 2005 most likely due to the washed soil covering emerged weeds in the trial area during the intense rainfall event 1 WAT in 2006. By the time the uncontrolled weeds had re-emerged, the potato rows were near complete row closure and the crop competition enabled relatively greater season-long weed control by the treatments in 2006.

The only treatments resulting in significant potato injury 2 WAT and at row closure were any of the dimethenamid-p + flumioxazin two-way tank mixtures (data not shown). Injury from these treatments consisted mainly of stunting and ranged from 8 to 13% while injury caused by any other treatment was5% or less. The treatments were applied and sprinkler-incorporated when the advancing potato sprouts were within 1 inch or less of the soil surface, however, the flumioxazin label requires at least two inches of settled soil covering any vegetative portion of the sprouting potato at application time.

Treatments which did not provide adequate hairy nightshade control usually did not result in U.S. No 1 tuber yields greater than the nontreated, weedy control yield (Table 2). Crop injury caused by the flumioxazin two-way tank mixtures applied when sprouting potatoes were one inch or less from the soil surface seemingly translated to U.S. No. 1 tuber yields also not different than the weedy control yield. Although 6 of the 7 s-metolachlor and metolachlor three-way tank mixtures did not control hairy nightshade as well as the dimethenamid-p three-way tank mixtures, a few of the latter and only some of the former resulted in U.S. No. 1 tuber yields which were not greater than the weedy control yields (Table 2). All treatment total tuber yields were greater than the weedy control yields except for two of the two-way tank mixtures (Table 2).

Table 1a. A comparison of season-long weed control with three rates of dimethenamid-p applied preemergence alone and in two-way tank mixtures at Aberdeen, ID in 2006.

		Control[a]			
		AMARE	CHEAL	SOLSA	SETVI
Treatment	Rate	Sep 9	Sep 9	Sep 9	Sep 9
	lb ai/A	%			
Dimethenamid-p	**0.64**	97 abc	78 c	82 e	100 a
+ EPTC	3.9	100 a	95 a	93 a-d	100 a
+ metribuzin	0.5	100 a	100 a	92 bcd	98 a
+ pendimethalin	1.0	100 a	100 a	98 abc	100 a
+ ethalfluralin	0.94	93 bc	93 ab	92 bcd	97 a
+ sulfentrazone	0.047	95 abc	100 a	93 a-d	97 a
+ flumioxazin	0.047	100 a	100 a	100 a	97 a
Dimethenamid-p	**0.84**	97 abc	88 b	91 cd	100 a
+ EPTC	3.9	93 c	97 a	96 a-d	97 a
+ metribuzin	0.5	100 a	100 a	98 abc	100 a
+ pendimethalin	1.0	100 a	100 a	97 a-d	100 a
+ ethalfluralin	0.94	100 a	95 a	99 ab	97 a
+ sulfentrazone	0.047	100 a	100 a	90 d	100 a
+ flumioxazin	0.047	100 a	100 a	100 a	98 a
Dimethenamid-p	**1.0**	98 ab	93 ab	92 bcd	100 a
+ EPTC	3.9	100 a	93 ab	98 abc	98 a
+ metribuzin	0.5	98 ab	100 a	100 a	100 a
+ pendimethalin	1.0	100 a	100 a	100 a	100 a
+ ethalfluralin	0.94	95 abc	96 a	91 cd	100 a
+ sulfentrazone	0.047	100 a	100 a	98 abc	100 a
+ flumioxazin	0.047	100 a	100 a	100 a	100 a

Table 1b. A comparison of season-long weed control with dimethenamid-p, metolachlor, or s-metolachlor three-way tank mixtures applied preemergence at Aberdeen, ID in 2006.

		Control[a]			
		AMARE	CHEAL	SOLSA	SETVI
Treatment	Rate	Sep 9	Sep 9	Sep 9	Sep 9
	lb ai/A	%			
Dimethenamid-p	**0.64**				
+ metribuzin + pendimethalin	0.5 + 1.0	100 a	100 a	100 a	100 a
+ metribuzin + ethalfluralin	0.5 + 0.94	100 a	100 a	98 a	100 a
+ metribuzin + EPTC	0.5 + 3.9	98 a	98 a	100 a	100 a
+ EPTC + pendimethalin	3.9 + 1.0	100 a	100 a	98 a	100 a
+ EPTC + ethalfluralin	3.9 + 0.94	100 a	100 a	100 a	100 a
s-metolachlor	**1.34**				
+ metribuzin + pendimethalin	0.5 + 1.0	98 a	98 a	80 d	100 a
+ metribuzin + ethalfluralin	0.5 + 0.94	100 a	100 a	78 d	100 a
+ metribuzin + EPTC	0.5 + 3.9	100 a	98 a	93 ab	100 a
+ EPTC + pendimethalin	3.9 + 1.0	98 a	100 a	88 bc	100 a
Metolachlor	**1.34**				
+ metribuzin + pendimethalin	0.5 + 1.0	100 a	100 a	85 cd	100 a
+ metribuzin + EPTC	0.5 + 3.9	100 a	100 a	80 d	100 a
+ EPTC + pendimethalin	3.9 + 1.0	93 b	98 a	90 bc	100 a

[a] AMARE redroot pigweed; CHEAL common lambsquarters; SOLSA hairy nightshade; SETVI foxtail. Means in the same column in the same table followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (P=0.05). Nontreated control means were not included in the mean separation analyses.

Table 2. Potato tuber yields with three rates of dimethenamid-p applied preemergence alone and in two-way tank mixtures and dimethenamid-p three-way tank mixtures compared with metolachlor or s-metolachlor three-way tank mixtures at Aberdeen, ID in 2006.

Treatment	Rate	Potato Tuber yield[a] U.S. No. 1	Potato Tuber yield[a] Total
	lb ai/A	---------- cwt/A ----------	
Weedy check	-	240.2	336.1
Weed-free control	-	279.8	423.7
Dimethenamid-p	**0.64**	309.5	413.2
+ EPTC	3.9	344.1	447.3
+ metribuzin	0.5	311.7	421.8
+ pendimethalin	1.0	361.8	481.1
+ ethalfluralin	0.94	267.5	387.0
+ sulfentrazone	0.047	337.1	474.7
+ flumioxazin	0.047	256.2	409.8
Dimethenamid-p	**0.84**	346.3	454.2
+ EPTC	3.9	309.2	455.9
+ metribuzin	0.5	309.8	441.0
+ pendimethalin	1.0	279.3	404.0
+ ethalfluralin	0.94	285.6	419.5
+ sulfentrazone	0.047	244.3	382.4
+ flumioxazin	0.047	248.9	400.1
Dimethenamid-p	**1.0**	306.7	446.0
+ EPTC	3.9	277.4	413.0
+ metribuzin	0.5	341.5	434.6
+ pendimethalin	1.0	273.6	410.9
+ ethalfluralin	0.94	283.0	420.7
+ sulfentrazone	0.047	312.3	447.9
+ flumioxazin	0.047	297.7	429.1
Dimethenamid-p	0.64		
+ metribuzin + pendimethalin	0.5 + 1.0	313.1	406.7
+ metribuzin + ethalfluralin	0.5 + 0.94	318.1	430.0
+ metribuzin + EPTC	0.5 + 3.9	303.7	419.3
+ EPTC + pendimethalin	3.9 + 1.0	300.4	437.3
+ EPTC + ethalfluralin	3.9 + 0.94	331.5	447.9
s-metolachlor	1.34		
+ metribuzin + pendimethalin	0.5 + 1.0	307.5	450.0
+ metribuzin + ethalfluralin	0.5 + 0.94	349.4	447.7
+ metribuzin + EPTC	0.5 + 3.9	285.1	419.1
+ EPTC + pendimethalin	3.9 + 1.0	292.5	424.1
Metolachlor	1.34		
+ metribuzin + pendimethalin	0.5 + 1.0	290.5	439.6
+ metribuzin + EPTC	0.5 + 3.9	310.7	439.5
+ EPTC + pendimethalin	3.9 + 1.0	287.1	424.1
LSD (0.05)	-	65	65

[a] U.S. No. 1 tubers are > 4 oz and have no defects. Total tuber weight includes process culls (< 4 oz with no defects), U.S. No. 1, U.S. No. 2 (> 4oz with 1 to 2 slight defects), and malformed cull tubers (any size).

Efficacy of three EPTC rates used alone and in tank mixtures for weed control in potatoes. Pamela J.S. Hutchinson, Justin Wheeler, and JaNan Farr. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objective of this study was to compare weed control with three rates of EPTC alone and in two way tank mixtures applied preemergence in a field trial conducted in 2006 at the Aberdeen Research and Extension Center in Aberdeen, ID.

The experimental area was fertilized on April 19. 2006 with 120 lb N, 200 lb P_2O_5, 75 K and 50 lb S /A based on soil tests, before planting 'Russet Burbank' potatoes on May 3, 2006. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.8% organic matter and pH 8.2. Treatments were in a factorial arrangement of three EPTC rates (3.0, 4.0, or 5.25 lb ai/A) by four tank-mix partners (dimethenamid-p at 0.64, flumioxazin at 0.047, rimsulfuron at 0.023, or metribuzin at 0.5 lb ai/A) applied preemergence in a randomized complete block design with three replications and a plot size of 9 by 30 ft. Nontreated, weedy and weed-free controls were included in the trial for tuber yield comparisons.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 17, 2006, just prior to potato emergence. Herbicide treatments were applied May 19, 2006 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi and were incorporated with 0.4-inch sprinkler irrigation immediately after application. No potato or weed plants were exposed at time of application. Weed densities in the untreated checks were 40 redroot pigweed (AMARE), 100 common lambsquarters (CHEAL), 90 hairy nightshade (SOLSA), and 18 green foxtail (SETVI) per sq m by row closure the first week in July, 2006.

An intense rainfall event occurred 1 wk after treatment (WAT) June 8th with approximately 0.8 inches precipitation received during a 25 min period and 1 inch received in a 24 h period. As a result, emerged weeds in the furrows between potato rows were covered by washing soil and only began re-emergence approximately 1 to 2 wks later.

Percent visual weed control was assessed 4 wks after treatment (WAT) and at the end of the growing season prior to harvest on a scale of 0 = no control to 100 = complete control. Percent visual crop injury was assessed 2 and 4 WAT on a scale of 0 = no injury and 100 = complete death. Potatoes were sprinkler irrigated as needed throughout the growing season and received additional N based on petiole test results, through the irrigation system. Potato vines were desiccated with 0.375 lb/A diquat September 5, 2006. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on September 28, 2006 and graded according to USDA standards.

An ANOVA was performed on the data using PROC GLM (PC-SAS software®, SAS Institute, Cary, NC 27511). Percent weed control and crop injury data were arcsine square root transformed to mitigate the skewness of the data. If there was no EPTC rate by tank-mix partner interaction, and the tank-mix partner effect was significant, a Fisher's Protected LSD test at the 0.05 probability level was performed on data averaged over EPTC rates. If the interaction was not significant, orthogonal contrasts were performed on data averaged over tank-mix partners to determine the EPTC rate effect and when significant, trend contrasts were performed to determine if the response was linear or quadratic. Non-transformed means are shown in the table with transformed mean separations.

Single-degree of freedom contrasts were used to compare U.S. No. 1 and total tuber yield treatment means to the nontreated weed-free and weedy control yields.

Weed control data from the pre-harvest rating are reported as they represent season-long control. The EPTC rate by tank-mix partner interaction was not significant for redroot pigweed, common lambsquarters, or hairy nightshade control (data not shown). There were no differences among treatments for redroot pigweed control which ranged from 97 to 100% (data not shown). The tank-mix partner effect was significant for common lambsquarters control although averaged over all EPTC rates, these tank mixtures provided 93% or greater control (Table). Both the EPTC rate and the tank-mix partner effects were significant for hairy nightshade control (Table). As the EPTC rate increased, hairy nightshade control increased in a linear fashion from 83 to 92%. Averaged over EPTC rates, tank mixtures with dimethenamid-p or flumioxazin provided 97 to 99% control which was greater than the 88% control by the rimsulfuron mixtures, while all three mixtures provided greater control than the 67% by the metribuzin mixtures.

The EPTC rate by tank-mix partner interaction was significant for green foxtail control (data not shown). When sorted by EPTC rate, the tank-mix partner control ranking was the same and the dimethenamid-p, metribuzin, or rimsulfuron tank mixtures provided 100% green foxtail control regardless of EPTC rate, however, control by the flumioxazin mixtures was 50, 53, or 87% when the EPTC rate was 3.0, 4.0, or 5.25 lb/A, respectively (data not shown).

With the exception of the EPTC + flumioxazin combinations, visual crop injury was never greater than 2% (data not shown). The flumioxazin tank mixtures caused 8 to 13% injury consisting mainly of stunting and some leaf necrosis. However, the treatments all were applied and sprinkler incorporated when the advanced potato sprouts were within 0.5 to 1 inch of the soil surface while the EPA-approved flumioxazin label requires at least 2 inches of settled soil covering any vegetative portion of the sprouting potato plant. Even though some treatments did not provide effective hairy nightshade or green foxtail control, all treatment U.S. No. 1 and total tuber yields were greater than the weedy control yields and comparable to the weed-free yields (data not shown). Treatment and weed-free control U.S. No. 1 and total yields ranged from 256 to 313 and 399 to 447 cwt/A, respectively, while weedy control yields were 221 and 347 cwt/A, respectively. Treatment yields may not have been impacted by weed control differences since the intense rainfall 1 WAT covered emerged weeds, and by the time these uncontrolled weeds had re-emerged, the potato rows were near complete row closure and the crop competition enabled yields to be unaffected.

Table. A comparison of season-long common lambsquarters and hairy nightshade control with three rates of EPTC tank-mixed with four different tank-mix partners at Aberdeen, ID in 2006.

			Control[a]	
			CHEAL	SOLSA
Treatment[b]	Rate		Sep 12	Sep 12
	lb ai/A		%	
EPTC	3.0		97	83
	4.0		96	88
	5.25		96	92
			Pr > F	
		Rate effect	NS	<0.0001
		Linear effect	NS	0.03
		Quadratic effect	NS	NS
+ dimethenamid-p	0.64		93 b	99 a
+ flumioxazin	0.047		94 b	97 a
+ metribuzin	0.5		100 a	88 b
+ rimsulfuron	0.023		99 a	67 c

[a] CHEAL, common lambsquarters; SOLSA, hairy nightshade; NS, non significant. Arcsine square root transformed data were used for analyses and nontransformed treatment means are shown in this table. The EPTC rate by tank-mix partner interaction was not significant for CHEAL or SOLSA control.

[b] Orthogonal contrasts were used to determine if the EPTC rate effect was significant, and if it was, trend contrasts were performed to determine if the response was linear or quadratic. EPTC treatment means are averaged over tank-mix partners. If the tank-mix partner effect was significant, a Fisher's Protected LSD test was performed at the 0.05 probability level to separate treatment means. Tank-mix partner treatment means are averaged over EPTC rates. Means in the same column followed by the same letter(s) are not significantly different.

The effects of 1X and 2X flumioxazin rates applied alone preemergence compared with metribuzin and EPTC with and without 1X flumioxazin on potato crop safety and weed control. Pamela J.S. Hutchinson, JaNan Farr, and Justin Wheeler, (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210). The objectives of this trial were to 1) compare crop response and weed control with flumioxazin at 1 and 2X the labeled 0.47 lb ai/A rate alone and metribuzin + EPTC with and without 1X flumioxazin in 2006, and 2) compare daughter tuber germination in 2007 from these treatments and from a nontreated, weed-free control.

The experimental area was fertilized on April 19, 2006 with 120 lb N, 200 lb P_2O_5, 75 K and 50 lb S /A based on soil tests, before planting 'Russet Burbank' potatoes on May 2, 2006. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.8 % organic matter and pH 8.2. The experimental design was a randomized complete block with three replications and plot size was 9 by 30 ft.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 17, 2006, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 22, 2006 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. PRE treatments were incorporated with 0.4-inch sprinkler irrigation immediately after application. No potato or weed plants were exposed at time of the PRE application, however, sprouting potato plants were only 0.5 to 1 inch below the soil surface at application time. The EPA approved Chateau label requires at least 2 inches of settled soil covering any vegetative portion of the sprouting potato plant at application time. Weed densities in the untreated checks were 54 redroot pigweed (AMARE), 36 common lambsquarters (CHEAL), 45 hairy nightshade (SOLSA) per sq m by row closure the first week of July, 2006.

An intense rainfall event occurred June 8 with approximately 0.8 inches precipitation received during a 25 min period and 1 inch received in a 24 h period. As a result, emerged weeds in the furrows between potato rows were covered by washing soil and only began re-emergence approximately 1 to 2 wks later.

Percent visual potato crop injury was assessed at 2 and 4 wks after treatment (WAT) on a scale of 0 = no injury to 100 = complete death. Potato plant height measurements were conducted on 5 randomly-selected potato plants each in the two center rows 4, 6, and 8 WAT, and % canopy cover between the two middle rows was assessed 6 WAT. Percent visual weed control was assessed 4 WAT and just prior to harvest on a scale of 0 = no control to 100 = complete control. Potatoes were sprinkler irrigated as needed throughout the growing season and received additional N based on petiole test results, through the irrigation system. Potato vines were desiccated with 0.375 lb/A diquat on September 5, 2006. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Sept 26, 2006 and graded according to USDA standards.

Treatment means were separated with a Duncan's New Multiple Range Test (P=0.05). Nontreated, weedy and weed-free control means were not included in the % weed control and injury analyses; weed-free control means were included in the % crop canopy and plant height analyses, and the weed-free and weedy control means were included in the tuber yield analyses. Weed control data from the pre-harvest date are reported as they represent season-long control.

Season-long redroot pigweed control by the 1X flumioxazin rate applied alone was 85% and less than the 95 to 100% by the other treatments (Table). All treatments provided similar common lambsquarters control which ranged from 95 to 100%. Hairy nightshade control by any treatment including flumioxazin was greater at 97 to 100% than the 83% control provided by the metribuzin + EPTC treatment without flumioxazin.

Visual crop injury consisted mainly of stunting and some leaf necrosis at 2 WAT while necrosis was not evident 4 WAT. The intense rainfall 1 WAT caused some splash-back injury resulting in necrotic spots on lower leaves evident at the first visual injury rating time. Overall injury at 2 and 4 WAT caused by the 2X flumioxazin treatment was 50 and 43%, respectively and greater than injury by the other treatments which ranged from 0 to 22% (Table). At 6 WAT, the potato rows were fully closed in all plots except the 2X flumioxazin treatment, which only had 83% canopy cover between the two middle rows (Table). Plant height in any plot treated with flumioxazin was less than height in the weed-free control and metribuzin + EPTC without flumioxazin plots at 4 and 6 WAT while heights were similar in all plots 8 WAT (Table).

U.S. No. 1 and total tuber yields resulting from any treatment including flumioxazin were less than the weed-free control yield and not different than the weedy control yield (Table). Metribuzin + EPTC without flumioxazin produced U.S. No. 1 and total tuber yields similar to the weed-free yields, however, U.S. No. 1 yields from this treatment were not different than weedy control U.S. No. 1 yields. Injury caused by the treatments including flumioxazin seems to be the main factor detrimentally impacting yields since all of these treatments yielded less than the weed-free control but similar to the weedy control yields even though all controlled common lambsquarters and hairy nightshade 95% or higher. In contrast, the reduced hairy nightshade control by the metribuzin + EPTC treatment without flumioxazin may have caused the U.S. No. 1 yield from that treatment to be no greater than the weedy control yield.

Tubers from each treatment were stored in appropriate conditions and then planted spring 2007 to determine if flumioxazin at 1 or 2X the labeled rate affects germination. There was no difference between the herbicide and weed-free control treatments for potato sprouting, emergence, vegetative growth, or tuber yields of tubers kept from the 2006 trial and planted in 2007.

Table. Season-long weed control and crop response 2, 4, 6, and 8 WAT with 1X and 2X flumioxazin applied preemergence alone compared with metribuzin and EPTC with and without 1X flumioxazin in 2006 at Aberdeen, ID.

		Weed control[a]			Crop response[b]							
		AMARE	CHEAL	SOLSA	Visual injury		Canopy cover	Plant height			Tuber yield[c]	
Treatment	Rate	Sep 12	Sep 12	Sep 12	2WAT	4 WAT	6 WAT	4 WAT	6 WAT	8 WAT	U.S. No. 1	Total
	lb ai /A	---------------	---------------	--------------- %	---------------	---------------	---------------		inches		cwt/A	
Weed-free control	-	-	-	-	-	-	100 a	17 a	27 a	24 a	304.2 a	424.6 a
Weedy control	-	-	-	-	-	-	-	-	-	-	202.2 bc	324.8 b
Flumioxazin	0.047	85 b	95 a	97 a	20 b	22 b	100 a	11 b	19 b	24 a	179.4 c	340.4 b
Flumioxazin	0.096	95 a	100 a	98 a	50 a	43 a	83 b	10 b	16 b	24 a	198.0 bc	341.6 b
Flumioxazin + metribuzin + EPTC	0.047 + 0.5 + 3.0	100 a	100 a	100 a	17 bc	18 bc	100 a	12 b	19 b	25 a	199.7 bc	353.2 b
Metribuzin + EPTC	0.5 + 3.0	98 a	100 a	83 b	5 c	0 c	100 a	15 a	25 a	23 a	247.6 ab	404.6 a

[a] AMARE redroot pigweed; CHEAL common lambsquarters; SOLSA hairy nightshade. Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (P=0.05). Nontreated, weed-free and weedy control means were not included in the treatment mean separation analyses.

[b] Canopy cover % was measured in between the two middle potato rows and plant height measurements were conducted on 5 randomly-selected potato plants each in the two center rows – the average of the 10 plants measured per plot is shown. Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (P=0.05). Nontreated, weed-free and weedy control means were not included in the percent visual injury and weed-free control means were included in the canopy cover and height treatment mean separation analyses.

[c] U.S. No. 1 tubers weigh >4 oz and have no defects. Total tuber weight includes process culls (< 4oz with no defects), U.S. No. 1, U.S. No 2 (>4oz with 1 to 2 slight defects), and malformed cull tubers. Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (P=0.05). Nontreated, weed-free and weedy control means were included in the means separation analyses.

Potato crop response to sulfentrazone applied immediately after planting or just prior to emergence and receiving one inch of simulated rainfall one week after treatment. Pamela J.S. Hutchinson, JaNan Farr, and Justin J. Wheeler (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210). The objectives of this study was to compare potato crop response to sulfentrazone applied preemergence immediately after planting with response to application just prior to emergence and one inch of simulated rainfall or no simulated rainfall 1 week after treatment (WAT) in field trials conducted at the Aberdeen Research and Extension Center in 2005 and 2006.

In 2004, S.E. Idaho growers experienced unusual rainfall events of 1 to 2 inches a few days after to 3 weeks after application. Crop injury was observed in some fields as the potatoes were emerging, but the injury usually was not evident at row closure 3 to 5 weeks after emergence. However, yields losses were perceived by some growers so field trials were conducted at Aberdeen R&E Center in SE Idaho in 2005 and 2006 to determine the effect on potato crop safety of one inch simulated rainfall occurring one wk after preemergence sulfentrazone application.

The experimental areas were fertilized each year based on soil tests. Potatoes were planted 6 inches deep at 12 inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.3 to 1.4% organic matter and pH 8.3 to 8.5. Sulfentrazone was applied at 0, 0.047, 0.07, 0.094, 0.14, or 0.21 lb ai/A 12 to 24 h after a hilling operation and application of 0.27 lb/A imidacloprid. All treatments were sprinkler incorporated immediately after application with 0.4 inches irrigation water. The treatments were arranged in a split block design – with one inch simulated rainfall applied to all rates 1 wk via sprinkler irrigation vs no simulated rainfall applied no all rates. Plot size was 12 by 30 ft. After the simulated rainfall occurred, all plots received regularly scheduled irrigation throughout the rest of the season and received additional N and P_2O_5, based on petiole test results, through the irrigation system.
Trials were kept weed free during each growing season.

Two trials with different application time relative to planting time were conducted each year. In the first trial in 2005, sulfentrazone application was made immediately after potato planting and in the second 2005 trial, application was delayed until 3 to 4 days before emergence began. Approximately 3 wks separated application time in the two trials.

In 2006, potato plant sprouts were growing faster underground than in 2005 resulting in only a 1 wk difference in application time between the two trials. Also, an intense rainfall event occurred in 2006 2 days after the 1 inch simulated rainfall was applied in the first trial and 2 days after herbicide application had been made in the second trial. Approximately 0.85 inches occurred within a 25 min period. The total rainfall amount for the day's 24 h period was 0.97 inches with another 0.22 inches occurring after midnight.

Although natural rainfall exceeding 1 inch had fallen on the total area of the second trial before the simulated rainfall could be applied, the rainfall had occurred 2 days after rather than 1 WAT. Simulated rainfall was not applied in addition to the natural rainfall and results from this second 2006 trial are not included in this report. As for the first 2006 trial, sulfentrazone was applied immediately after planting, and 1 inch simulated rainfall was applied 1 WAT. However, another inch or more natural rain occurred 9 days after application, so in reality, the rainfall treatments were 1 or 2 inches approximately 1 WAT rather than 0 or 1 inch.

Visual injury (0 = no injury, 100 = complete death) was rated at emergence, 3 to 5 WAT, and at potato row closure occurring 4 to 7 WAT depending upon the year and herbicide timing relative to emergence. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester 2 to 3 wks after desiccation with 0.375 lb/A diquat and tubers were graded according to USDA standards.

An ANOVA was performed with PROC GLM and significant year x trial x rainfall, and/or rate interactions occurred so data were analyzed separately by year and by trial within a year. Orthogonal contrasts were performed to detect significant rainfall, rate, and rainfall x rate effects in each trial. If the rainfall x rate interaction was not significant, trend contrasts were performed when the rate effect was significant to determine linear or quadratic responses. A Fisher's Protected LSD (P = 0.05) was performed when the rainfall effect significant to separate treatment means.

In 2005, potato crop injury was mainly stunting when sulfentrazone was applied immediately after planting, however, injury consisted of chlorosis, necrosis, leaf malformation, and stunting when application was made just prior to potato emergence. In 2006, injury consisted mainly of stunting and slight leaf malformation.

When application was made just after planting, there were no rainfall x rate interactions for injury data either year (data not shown). The rate effect was significant each year and as the herbicide rate increased, injury averaged over rainfall treatments increased in a linear fashion at each of the three rating times both years. In 2005, injury was 10% to 18, 9 to 27, or 18 to 59% at emergence, 3 WAT, or row closure, respectively (Figure 1). Injury in 2006 was not greater than 10% at emergence or row closure, and only reached 28% with the highest rate 5 WAT (Figure 1). When application was made just prior to emergence in 2005, the injury response to increasing rates also was linear. In general, however, the injury response observed at potato emergence in the second, 2005 trial was greater in magnitude and increased more dramatically as rate increased relative to the injury response over time in the first 2005 trial (Figure 1).

In 2005, the rainfall effect was significant for injury data when application was made immediately after planting (data not shown). At the three rating times, injury averaged across rates was 15, 19, or 50% and greater when one inch simulated rainfall was received 1 WAT compared with injury of 10, 14, or 27% at the three rating times when no simulated rainfall was received (Table 1). The rainfall effect was not significant for injury data when application was made just prior to potato emergence, however, injury was as high as 33% (Table 1). In2006, the rainfall effect only was significant for injury at the 5 WAT rating when 16 or 11% occurred with or without rainfall (data not shown).

U.S. No. 1 and total tuber yield reduction as a percentage of the nontreated, weed-free control yields increased in a linear fashion as the rate increased in both 2005 timing trials (Table 2). U.S. No. 1 tuber yield reduction increased from 7 to 53 or 3 to 23% and total tuber yield decreased from 7 to 35% or 1 to 16% in the first or second 2005 trial, respectively, as the herbicide rate increased. When application was made immediately after planting in 2005, total tuber yield reduction was 27% when rain occurred 1 WAT and greater compared with the 14% reduction when no rainfall was applied 1 WAT (Table 1). U.S. No. 1 tuber yield reduction in the area where simulated rainfall was applied was 25% of the control yields and less at $P = 0.08$ than the yield reduction of 21% where the rainfall was not applied in the first trial. U.S. No. 1 and total tuber yields were similar regardless of rainfall treatment in the second trial when herbicide application was made just prior to emergence.

In 2006, the rainfall by rate interaction was significant for U.S. No. 1 tuber yield data, and when the data were sorted by rainfall, yield reduction when rainfall occurred was affected by rate in a quadratic fashion with reductions remaining above 5% until the highest rate, when a 27% reduction occurred (data not shown). No effect was significant for 2006 total tuber yields although a 15% reduction occurred with the highest rate when rainfall occurred (data not shown).

Soil samples were collected 0-day, and just before and after the simulated rainfall event and scheduled irrigations during both trial years. Since these samples have not yet been analyzed, we can only speculated that in 2005, when sulfentrazone was applied immediately after planting, the greater injury at all rating times and greater % total tuber yield reduction when rainfall occurred 1 WAT compared with when no rainfall occurred may be due to quickly occurring herbicide movement with the simulated rainfall close to root uptake zone. The herbicide was most likely in this area for at least 3 wk before potato plants started to emerge and begin above-ground growth. Greater numeric injury at row closure than at emergence and 5 WAT probably occurred when the already herbicide-stressed plants encountered more and more herbicide moving down with scheduled irrigation.

In contrast, when the sulfentrazone was applied just prior to potato emergence in 2005, there were no real significant differences between injury or tuber yield reduction when comparing results in the simulated rainfall vs the no-simulated rainfall. Injury was numerically greater at emergence and row closure 5 WAT than at 3 WAT possibly because vegetative plant parts close to the surface when the herbicide was applied may have encountered enough herbicide to be initially injured. As stated previously, injury at emergence in this trial was more dramatic and consisted of more vegetative symptoms than injury in the first trial when application was made long before emergence. At 3 WAT in the second trial, injury was relatively less than injury at emergence possibly because the plants may have been large enough to safely metabolize the herbicide taken up into the plant at that point. By row closure, 5 WAT, the relatively large root system probably had encountered more herbicide which had moved down with scheduled irrigation, resulting in numerically more injury than at 3 WAT.

In 2006, injury was relatively low at emergence and row closure and at 5 WAT, was as high as 28% averaged across rainfall. Since the treatments received either 1 or 2+ inches of rainfall in 2006, the herbicide probably moved to below the root and shoot uptake zone immediately, the potato roots had encountered the herbicide by 5 WAT, however, the herbicide moved below the uptake zone with scheduled irrigation by the time of row closure.

Overall, potato yields in the first 2005 trial - when sulfentrazone application was made immediately after planting, were affected detrimentally by the simulated rainfall 1 WAT. Yields may not have been significantly impacted in the 2006 trial where application was made immediately after planting, or in the 2005 trial where sulfentrazone was applied just prior to potato emergence, even though significant injury occurred, because the potato plants were more developed when encountering the herbicide, and more able to overcome any early injury.

Figure 1. Sulfentrazone rate effect on potato crop injury when application was made immediately after planting in 2005 (A) and 2006 (B), and in 2005 when sulfentrazone was applied just prior to planting (C) in Aberdeen, ID. Simulated rainfall – 1 inch occurred 1 WAT in 2005 and simulated + natural rainfall = 2 inches occurred 7 to 9 days after treatment in 2006. The rate effect was significant for all injury ratings both years and the response was linear.

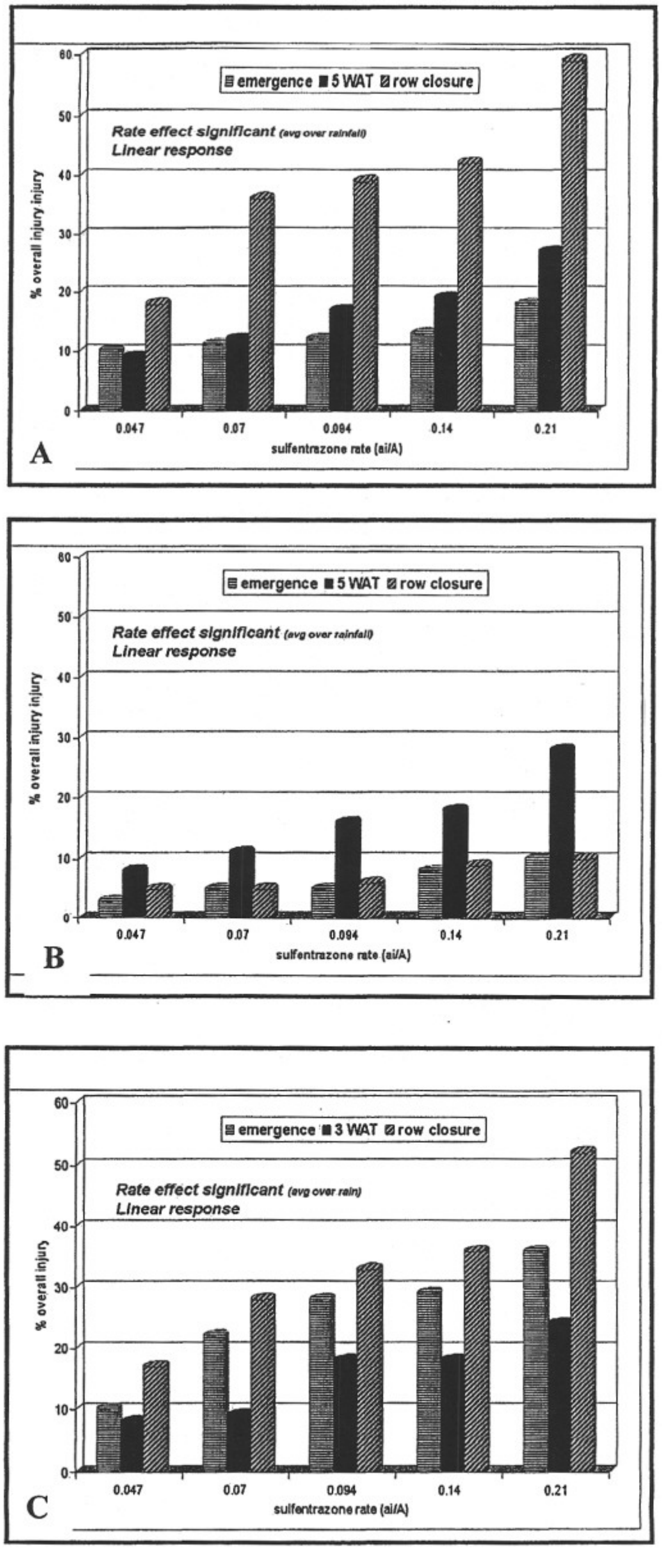

Table 1. Potato crop response to simulated or no simulated rainfall occurring 1 WAT of sulfentrazone applied preemergence at 0.047 to 0.21 lb ai/A immediately after planting or just prior to emergence in 2005 at Aberdeen, ID[a].

	Overall crop injury						Tuber yield reduction			
Herbicide timing[b]	A			B			A		B	
Rating time	Emergence	3 to 5 WAT	Row closure	Emergence	3 to 5 WAT	Row closure	U.S. No. 1	Total	U.S. No. 1	Total
Rain[c]	---------------------------- % --------------------------------						---- percentage of nontreated control ----			
No	10 b	14 b	27 b	28 a	15 a	33 a	21 a	14 a	13 a	11 a
Yes	15 a	19 a	50 a	23 a	16 a	33 a	25 a	27 a	13 a	9 a

[a] Means in the same column followed by the same letter(s) are not significantly different according to a Fisher's Protected LSD test was performed at the 0.05 probability level. Rainfall effect means are averaged of sulfentrazone rate.

[b] A, application was made immediately after planting; B, application was made just prior to emergence.

[c] In 2005, 1 inch simulated rainfall was applied with irrigation 1 WAT. In 2006, simulated rainfall also was applied 1 WAT, however, natural rainfall of 1+ inches occurred 9 days after treatment (2 days after the simulated rainfall application).

Table 2. Effect of sulfentrazone rate on tuber yields when applied immediately after planting or just prior to emergence and followed by 1 inch simulated or no simulated rainfall 1 WAT in 2005 at Aberdeen, ID.

	Tuber yield reduction[a]			
Application timing[b]	A		B	
Sulfentrazone rate	U.S. No. 1	Total	U.S. No. 1	Total
lb ai/A	---------------- % of nontreated control-----------------			
0.047	93	93	97	99
0.7	92	88	94	92
0.094	84	78	87	90
0.14	69	75	80	86
0.21	47	65	78	84

[a] The rate effect averaged over simulated or no-simulated rainfall was significant for U.S. No. 1 and total tuber yields at either herbicide application timing and the response was linear according to orthogonal and trend contrast performed on yield data averaged over rainfall.

[b] A, application was made immediately after planting; B, application was made just prior to emergence.

Evaluation of herbicides applied to dormant rhubarb for two consecutive growing seasons. Gina Koskela and Robert B. McReynolds. (North Willamette Research & Extension Center, Oregon State University, Aurora, OR 97002) An experiment was conducted to determine the efficacy and crop safety of potential alternative herbicides in rhubarb because of the poor efficacy of currently registered herbicides. Herbicide treatments were applied in 2006 and 2007 to plots at the North Willamette Research & Extension Center near Aurora, OR that had been established on May 30, 2003 with crown pieces. The site was used from 2003 to 2005 to measure rhubarb tolerance to several herbicides. Only one of the herbicide treatments applied between 2003 and 2005 appeared to reduce yield (s-metolachlor). Therefore, all of the 2006 treatments except s-metolachlor were randomly assigned to plots. The s-metolachlor treatment was applied to plots that had received this herbicide for the last 3 years so that we could test the hypothesis that s-metolachlor was reducing crop vigor when applied for several consecutive years. Treatments applied in 2006 and 2007 were applied directly over a single row of rhubarb 20 ft by 5.5 ft using a CO_2 pressurized backpack sprayer equipped with a 3-nozzle (TeeJet SS8002 flat fan) boom delivering 40 gals water/A at 30 psi with four replications. Herbicides were applied on Feb. 1, 2006 when rhubarb plants were dormant, before leaves had emerged from the crown. The following year, on Jan. 24, 2007 the treatments were re-applied. Weeds present in the plots included annual bluegrass, common groundsel, common chickweed, dandelion, white clover, common vetch, and red deadnettle. Evaluations of weed control and crop tolerance were made in 2006 and 2007. Phytotoxicity evaluations rated the general appearance and vigor of each plant in a plot and specific injuries such as leaf burn. Yield data were collected on May 3, 2006 and April 26, 2007 by pulling all the petioles from each crown in the plots and breaking the leaves off the petioles at their bases. Petioles for each plot were counted and weighed.

Analysis of variance indicated that there were statistically significant differences in yield/plant between the herbicide treatments, but none are statistically different from the untreated control. There was an overall yield/plant increase from 2006 to 2007 across all treatments, except halosulfuron-methyl. Additionally, the s-metolachlor treatment that had been applied to the same plot for four years resulted in a yield increase of 41% from 2006 to 2007, eliminating concern that s-metolachlor applied for 4 consecutive years was reducing crop vigor.

Table. Effect of dormant applied preemergence herbicides on yield of rhubarb.

		Yield	
Treatments applied 2006-07	Rate	2006	2007
	lbs ai/acre	---------------- lbs/plant	--------------
Dimethenamid-P	0.75	11.0	11.7
Oxyfluorfen	2.00	10.6	17.6
Clomazone	1.50	10.9	15.4
Linuron	3.00	12.3	18.4
s-Metolachlor[a]	2.00	9.5	13.4
s-Metolachlor	2.00	---	10.6
Pronamide + napropamide	2.00 + 2.00	14.2	14.4
Prometryn	2.00	13.1	21.2
Pendimethalin	1.60	14.5	17.0
Halosulfuron-methyl	0.094	14.1	10.0
Sulfentrazone	0.25	12.5	12.9
Hand-weeded		10.6	15.6
LSD ($P \leq 0.05$)		NS	4.3

[a] S-metolachlor was applied to this plot in the 3 years prior (2003-05) to application of this treatment in 2006 and 2007.

Weed control in strawberries with sequentially applied pre-emergence herbicides over two years. Diane Kaufman and Ed Peachey. (North Willamette Research and Extension Center, Oregon State University, 15210 NE Miley Rd., Aurora, OR 97002) . A study was conducted in a planting of 'Firecracker' strawberry established on June 21, 2006 at the North Willamette Research and Extension Center to determine weed control efficacy of sequential applications of recently registered and potential new herbicides and mustard seed meal (MSM). The soil at the site is a Quatama silt loam with 4% organic matter. Plots 4 rows wide (13.33 feet) by 25 feet long were arranged in a randomized complete block design with four replications. Herbicides were applied over the top of strawberry plants one day after planting in June, 2006 (Table). Plots were evaluated over the summer of 2006 for strawberry plant tolerance to herbicides and percent weed control compared to an untreated control. All weeds were removed from all plots after each weed control evaluation. A fall and winter herbicide was applied over the tops of strawberry plants on September 26, 2006 and February 2, 2007, respectively. Herbicide applications were made using a CO_2 pressurized backpack sprayer with a 4-nozzle boom (TeeJet 8002, flat fan) set at 40 psi and a rate of 20 gallons of spray per acre. In the organically managed plots, mustard seed meal (MSM) was applied in the berry row one day after planting and subsequent weed control during the summer was accomplished through the use of cultivation and hand weed removal. Although five application of 5% acetic acid (vinegar) were applied to organically managed plots established in 2004, in the 2006 planting, acetic acid was not included among weed control options. Barkdust (4 to 6 inches deep) was applied between organically managed strawberry rows on September 27, 2006. MSM (S. alba 'IdaGold') was applied in the berry row only at a rate of 1,000 lbs per banded acre. Fruit was harvested from a 5-foot length of row per plot on June 14, 21, and 28, 2007.

Weed control on 18-Jul was best with sulf + pend at 97% and least for s-met and MSM on 2-Aug at 86 and 79%, respectively (table). There were no differences in weed control among treatments on 14-Sept. Weed control from March through July of 2007 was consistently low for Tr5 (sulf+pend followed by sulf + nap) and ranged from 72 to 78%. Weed control ranged from 66 to 83% in Tr8, which differed from Tr5 only in fall herbicide applied. At harvest, s-met followed by sulf nap (Tr1), sulf + pend followed by rim (Tr3), and sulf + s-met followed by sulf + nap (Tr6) provided 86, 82, and 88% weed control, respectively. Weed control was best with sulf + pend applied in each year. Weed control ranged between fair and good in the organically managed plots in 2007. Although it is difficult to make valid comparisons from one year to the next, it appears as if vinegar played a key role in controlling seedling dandelion plants. Organic plots treated with acetic acid in spring and early summer, 2004 had no dandelions and overall quality of weed control was consistently good throughout the growing season (WSWS Research Progress Reports, 2005).

Table. Effect of sequential preemergence herbicides and mustard seed meal on weed control and yield in strawberries.

	At planting		Weed control in 2006[a]			Fall application		Winter application		Weed control and yield in 2007[a]					
	22-Jun-06		18-Jul	2-Aug	14-Sept	26-Sep-06		2-Feb-07		29-Mar	26-Apr	7-Jun	13-Jul	Yield	Avg. fruit wt.
	Herb[a]	Rate				Herb[b]	Rate	Herb[b]	Rate						
		lbs ai/A			*%*		*lbs ai/A*		*lbs ai/A*	*%*				*t/a*	*g*
1	s-met	1	86	79	83	sim	1	sulf+nap	0.2+2.0	92	90	94	86	6.8	12.2
2	sulf+pend	0.15+1	97[c]	96[c]	88[c]	sim	1	s-met	1	94	92	84	79	8.3	12.6
3	sulf+pend	0.15+1	-			sim	1	rim	0.28	97	89	85	82	6.8	12.3
4	sulf+pend	0.15+1	-			sim	1	rim	0.50	94	92	91	80	7.7	11.8
5	sulf+pend	0.15+1	-			sim	1	sulf+nap	0.2+2.0	73	76	78	72	7.1	11.4
6	sulf+s-met	0.15+1	91	90	90	sim	1	sulf+nap	0.2+2.0	93	92	88	88	7.1	11.8
7	sulf+pend	0.15+1	-			sim	1	sulf+pend	0.2+1.0	90	90	94	95	8.0	11.9
8	sulf+pend	0.15+1	-			s-met	1	sulf+nap	0.2+2.0	66	76	83	75	7.1	11.6
9	MSM		-	86	85	barkdust				79	85	86	69	7.8	12.9
10	Unweeded		-	-	-					-	-	-	-	6.7	11.6
FPLSD (0.05)			6	10	ns					13	13	15	23	ns	ns

[a] Primary weeds 7/18 – 9/14/06 = barnyardgrass; crabgrass; nightshade; pigweed; pineappleweed. 3/29 – 7/13/07 = annual bluegrass; chickweed; dandelion; henbit; pineappleweed.

[b] s-met (s-metolachlor), sulf (sulfentrazone), pend (pendimethalin), sim (simazine), rim (rimsulfuron) and nap (napropamide)

[c] Average of all 'sulf+pend' plots, n=24.

Evaluation of selected post-emergence herbicides for use in strawberries. Diane Kaufman and Ed Peachey. (North Willamette Research and Extension Center, Oregon State University, 15210 NE Miley Rd, Aurora, OR 97002). The study was conducted in a planting of 'Firecracker' strawberry established on June 21, 2006 at the North Willamette Research and Extension Center. The soil is a Quatama silt loam with 4% organic matter. Plots 4 rows wide (13.33 feet) by 15 feet long were arranged in a randomized complete block design with four replications. Pre-emergence herbicides sulfentrazone + pendimethalin (grower standard at-planting treatment) were applied over the top of strawberry plants one day after planting. Post-emergence herbicides were applied over the top of strawberry plants either 9 weeks after planting (August 22, 2006) or in early spring (March 28, 2007) shortly after strawberry plants had resumed growth. Herbicide applications were made using a CO_2 pressurized backpack sprayer with a 4-nozzle boom (TeeJet 8002, flat fan) set at 40 psi and a rate if 20 gallons of spray per acre. Strawberry plants were monitored for phytotoxicity for several weeks following each post-emergence herbicide application. Fruit was hand-harvested three times from a 5-foot length of row per plot in June, 2007. Plots were kept weed-free.

The only phytotoxicity observed in the experiment nine weeks after planting in 2006 was caused by topramezone. New leaves of recently transplanted strawberries treated with topramezone turned yellow around the margins within six days of treatment. The yellow leaf margins persisted for several weeks, but there were no reductions in leaf number or plant size (data not shown). However, topramezone reduced strawberry yield by 40% compared to the mean yield of plots treated with KIH 435, foramsulfuron, and the untreated control. None of the herbicide treatments applied in the Spring of 2007 caused visual injury to the strawberries, and there were no herbicide effects on yield or berry size. Treatments of phenmedipham+ desmedipham, foramsulfuron and KIH 435 merit further evaluation for post-transplant weed control, and phenmedipham+desmedipham, topramezone, and foramsulfuron merit further evaluation for weed control after strawberries resume growth in the spring.

Table. Effect of herbicide and application timing on strawberry yield in 2006 and 2007, Aurora, OR.

Herbicide	Date	Rate *(lb ai/A)*	Total Marketable Yield *(t/A)*	Adjusted Fruit Size *(oz/berry)*
After transplanting, 2006				
KIH 435	22-Aug-06	0.094	8.5	0.41
Foramsulfuron	22-Aug-06	0.27	7.8	0.42
Untreated control	22-Aug-06	-	8.2	0.38
Significance			ns	ns
Mean			8.2	0.41
Topramezone [a]	22-Aug-06	0.016	4.9	0.43
Spring 2007				
Phenmedipham + Desmedipham	28-March-07	0.49	7.0	0.40
Foramsulfuron	28-March-07	0.27	6.9	0.37
Topramezone	28-March-07	0.016	6.5	0.40
Untreated Control	28-March-07	-	7.3	0.37
Significance			ns	ns
Mean			6.9	0.39

[1] topramezone treatments were only replicated 2 times.

Yellow nutsedge control in Roundup Ready alfalfa. Mick Canevari, Don Colbert, Scott Whiteley and Randall Wittie. (Cooperative Extension, University of California, Stockton, CA 95205). A field study was established to evaluate glyphosate applications for controlling yellow nutsedge (CYPES) in glyphosate resistant alfalfa. Alfalfa was seeded February 26, 2006. Plots were 10 by 25 ft arranged in a randomized complete block design with four replications. All herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 20 gpa. Treatments were applied after the first cutting June 15, 2006, after the second cutting July 17, 2006 and after the third cutting on August 10, 2006 (Table 1). In 2007 treatments were applied after the third cutting June 18, 2007, fourth cutting July 17, 2007, fifth cutting August 16, 2007 and after the sixth cutting September 17, 2007 (Table2). Visual evaluations and CYPES plant counts were taken at various times throughout the growing season.

Table 1. Application information 2006.

	June 15, 2006	July 17, 2006	August 10, 2006
Timing	First cutting	Second cutting	Third cutting
Crop stage	7-12 inch	6-18 inch	3-8 inch
Yellow nutsedge stage	3 to 4 lf, 3 to 10 inch	3 to 5 lf, 6 to 8 inch	3-5 lf, 3 to 8 inch
Air temperature (F)	68	76	81
Relative humidity (%)	58	55	47
Wind (mph)	5	5	1
Cloud cover (%)	0	0	0

Table 2. Application information 2007.

	June 18, 2007	July17, 2007	August 16, 2007	September 17, 2007
Timing	Third cutting	Fourth cutting	Fifth cutting	Sixth cutting
Crop stage	6 to 9 inch	4 to 12 inch	4-10 inch	5 to 8 inch
Yellow nutsedge stage	2 to 6 lf 3 to 7 inch	3 to 7 lf, 3 to 11 inch	2 to 12 lf, 1 to 10 inch	2 to 8 lf, 2 to 7 inch
Air temperature (F)	66	74	68	76
Relative humidity (%)	54	66	71	47
Wind (mph)	1	5	4	4
Cloud cover (%)	0	10	0	0

All treatments showed no alfalfa injury except for halosulfuron-methyl which caused some early moderate growth reduction and chlorosis. Alfalfa recovered five weeks after application (data not shown). Multiple applications of glyphosate significantly reduced the CYPES population compared to the untreated control (Table 3). A single 1.5 or 2.0 lb ai/A glyphosate treatment applied after a cutting in July or August gave similar CYPES control from multiple applications of glyphosate. Glyphosate is most effective when applied after irrigation. Halosulfuron-methyl gave poor CYPES control.

Table 3. Yellow nutsedge control in glyphosate resistant alfalfa.

Treatment	Rate	Application timing[1]		Yellow nutsedge control					
				9/18/06	6/18/07	7/10/07	8/13/07	9/17/07	10/22/07
	lb ai/A	2006	2007	……%……	………………………………	………………………………	………plant count/plot………	………………………………	………………………………
Glyphosate	1.0	1st,2nd,3rd	3rd,4th,5th	98	35	35	9	1	1
Glyphosate	1.5	1st	3rd	85	28	22	11	12	18
Glyphosate +	2.0	1st		97	23	22	7	1	1
Glyphosate	1.0	2nd,3rd	3rd,4th,5th						
Glyphosate +	1.5	1st		98	22	14	6	0	2
glyphosate +	1.0	2nd,3rd							
glyphosate	1.5		3rd,4th,5th						
Glyphosate +	1.5	1st		87	42	70	45	28	5
BB5 natural +	.25%	1st							
glyphosate	1.5		6th						
Glyphosate	2.0		5th	0	79	120	99	4	5
Glyphosate	1.5	2nd	4th	96	24	46	9	9	7
Halosulfuron-Methyl +	0.047		3rd	0	59	24	53	42	38
No foam A	.25%								
Untreated	-	-	-	0	68	93	82	52	27
LSD (05)				4	26	37	16	11	13

[1] Application after cutting

Removal of a glyphosate-resistant alfalfa stand. Ralph E. Whitesides and Corey V. Ransom. (Plants, Soils, and Climate Department, Utah State University, Logan, UT 84322-4820) Glyphosate has been used extensively for removing established but declining stands of alfalfa in Utah. As glyphosate-resistant varieties of alfalfa have been planted throughout the crop producing regions of the western United States options for removing an alfalfa stand prior to crop rotation can no longer effectively incorporate glyphosate. Following alfalfa crop production in 2006 an established stand of alfalfa, seeded spring 2004, was treated with herbicides and then plowed 8 inches deep two weeks later with a traditional moldboard plow. The research site was located at the Utah State University Kaysville Research Farm, located near Kaysville, Utah. Herbicides were applied using a CO2 compressed-air backpack sprayer calibrated to deliver 20 gallons of spray solution per acre. Plots design was a randomized complete block with three replications. Alfalfa was treated October 10, 2006 when alfalfa was 8-10 inches tall and in the vegetative stage of growth. Visual evaluations and stand counts were completed in 2007 on April 2, May 31, August 10, and October 23. The test site was disked with an off-set tandem disk on August 16 and October 25, 2007. All herbicide treatments followed by plowing provided significantly better control than plowing alone. Dicamba and dicamba tank-mixed with 2,4-D provided better control than 2,4-D alone but were not significantly different. On the final two evaluations there were no alfalfa plants in any of the treatments, including the plowed only treatment.

Table. Glyphosate-resistant alfalfa control following herbicides and plowing.

		Alfalfa control		Alfalfa counts	
Herbicide	Rate	Apr 2, 07	May 31, 07	Apr 2, 07	May 31, 07
	lb ai/a	----------%	----------	------plants/yd²	-----
Plowed October 24, 2006	--	65	65	20	18
2,4-D amine	2.0	98	90	2	2
dicamba	0.5	100	97	0	1
2,4-D + dicamba	1.0 + 0.25	100	96	0	1
LSD (0.05)		5	9	3	10

Broadleaf weed control in spring barley with pyrasulfotole/bromoxynil. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in 'Metcalf' spring barley near Moscow and Melrose, Idaho to evaluate broadleaf weed control and barley response with pyrasulfotole/bromoxynil, a herbicide with a new mode of action for cereals. Studies were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). The entire Melrose site was sprayed with pinoxaden at 0.0534 lb ai/A on June 19, 2007 to control grass weeds. Barley response and broadleaf weed control were evaluated visually. Barley seed was harvested at the Moscow and Melrose sites with a small plot combine on August 14 and 15, 2007, respectively.

Table 1. Application and soil data.

Location	Moscow, Idaho	Melrose, Idaho
Application date	June 4, 2007	June 8, 2007
Growth stage		
Spring barley	4 tiller	3 tiller
Field pennycress (THLAR)	--	4 inches tall
Common lambsquarters (CHEAL)	5 inches tall	4 inches tall
Catchweed bedstraw (GALAP)	--	3 inches tall
Mayweed chamomile (ANTCO)	--	2 inches tall
Air temperature (F)	79	76
Relative humidity (%)	52	50
Wind (mph, direction)	3, ESE	2, E
Cloud cover (%)	100	70
Soil moisture	inadequate	excessive
Soil temperature at 2 in (F)	68	58
pH	6.4	5.2
OM (%)	6.9	4.8
CEC (meq/100g)	27	28
Texture	silt loam	silt loam

At Moscow, no treatment visually injured spring barley (data not shown). All treatments controlled common lambsquarters (CHEAL) 86 to 99%, except fluroxypyr/clopyralid (45%) (Table 2). Common lambsquarters control tended to increase with increasing rate of pyrasulfotole/bromoxynil. Spring barley seed yield tended to be higher for all treated plots compared to the untreated check.

At Melrose, no treatment visually injured spring barley (data not shown). All treatments controlled field pennycress (THLAR) 99% (Table 3). Common lambsquarters and mayweed chamomile (ANTCO) control was 92% or greater with all treatments, except MCPA amine and fluroxypyr/clopyralid. All treatments controlled catchweed bedstraw (GALAP) 92% or greater except MCPA amine (83%). Spring barley seed yield did not differ among treatments or the untreated check.

Table 2. Common lambsquarters control and spring barley response with pyrasulfotole/bromoxynil near Moscow, ID in 2007.

Treatment	Rate[1]	CHEAL control	Spring barley yield
	lb ai/A	%	lb/A
Pyrasulfotole/bromoxynil	0.145	88	4054
Pyrasulfotole/bromoxynil	0.18	86	4475
Pyrasulfotole/bromoxynil	0.22	94	4530
Pyrasulfotole/bromoxynil	0.24	94	3703
Pyrasulfotole/bromoxynil + bromoxynil/MCPA	0.18 0.5	99	4310
Pyrasulfotole/bromoxynil + thifensulfuron/tribenuron	0.18 0.0188	94	4663
Pyrasulfotole/bromoxynil + MCPA amine	0.18 0.5	98	4169
Pyrasulfotole/bromoxynil + fluroxypyr/bromoxynil	0.18 0.477	99	4042
Pyrasulfotole/bromoxynil + fluroxypyr/clopyralid	0.18 0.25	97	3804
Bromoxynil/MCPA	0.5	98	3928
Thifensulfuron/tribenuron	0.0188	90	3848
MCPA amine	0.5	86	3848
Fluroxypyr/bromoxynil	0.477	99	4056
Fluroxypyr/clopyralid	0.25	45	4468
Untreated check	--	--	3388
LSD (0.05)		7	NS
Density (plants/ft[2])		13	

[1] Rate is in lb ae/A for bromoxynil/MCPA, MCPA amine and all treatments containing fluroxypyr.

[2] June 27, 2007 evaluation.

Table 3. Broadleaf weed control and spring barley response with pyrasulfotole/bromoxynil near Melrose, ID in 2007.

Treatment	Rate[1]	Weed control[2]				Spring barley yield
		THLAR	CHEAL	GALAP	ANTCO	
	lb ai/A	---	---	%	---	lb/A
Pyrasulfotole/bromoxynil	0.145	99	99	99	96	5354
Pyrasulfotole/bromoxynil	0.18	99	99	93	99	4536
Pyrasulfotole/bromoxynil	0.22	99	99	99	99	4925
Pyrasulfotole/bromoxynil	0.24	99	99	97	96	5523
Pyrasulfotole/bromoxynil +	0.18					
bromoxynil/MCPA	0.5	99	99	99	99	5060
Pyrasulfotole/bromoxynil +	0.18					
thifensulfuron/tribenuron	0.0188	99	99	99	99	5241
Pyrasulfotole/bromoxynil +	0.18					
MCPA amine	0.5	99	99	99	92	4037
Pyrasulfotole/bromoxynil +	0.18					
fluroxypyr/bromoxynil	0.477	99	99	99	99	3958
Pyrasulfotole/bromoxynil +	0.18					
fluroxypyr/clopyralid	0.25	99	99	99	99	3746
Bromoxynil/MCPA	0.5	99	99	92	92	4690
Thifensulfuron/tribenuron	0.0188	99	97	99	99	4498
MCPA amine	0.5	99	84	83	70	5164
Fluroxypyr/bromoxynil	0.477	99	96	96	96	3574
Fluroxypyr/clopyralid	0.25	99	56	99	77	4364
Untreated check	--	--	--	--	--	5462
LSD (0.10)		NS	10	10	15	NS
Density (plants/ft^2)		1	2	0.5	1	

[1] Rate is in lb ae/A for bromoxynil/MCPA, MCPA amine and all treatments containing fluroxypyr.

[2] June 27, 2007 evaluation.

Barley seed size, seeding rate, and pinoxaden rate affect wild oat control in malting barley. Don W. Morishita, J. Daniel Henningsen, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to investigate the effects of malt barley seed size, seeding rate, and pinoxaden rate on wild oat control and spring barley yield. 'Moravian 37' was planted April 4, 2007 with a cone planter to obtain different plant populations with the different seed sizes. Experimental design was a two by three by four factorial randomized complete block with four replications. Individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (20.4% sand, 71% silt, and 8.6% clay) with a pH of 8.1, 1.5% organic matter, and CEC of 15-meq/100 g soil. Pinoxaden was applied May 10, with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 22 psi. Environmental conditions at application were as follows: air temperature 78 F, soil temperature 78 F, relative humidity 44%, wind speed 1 mph, and 10% cloud cover. Application began at 1945. Wild oat densities averaged 67 plants/ft^2. Broadleaf weeds in the study area were controlled by applying bromoxynil & MCPA + fluroxypyr at 0.5 + 0.188 lb ai/A May 17, 2007. Wild oat control was evaluated visually 43 days after application (DAA) on June 22. Grain was harvested July 30 with a small-plot combine.

Barley yield increased 10% between the small seed and the large seed pooled across seeding rate and pinoxaden rate (Table 1). The small seed average 78% plumps and 7% thins compared to 84 and 4%, respectively of the medium sized seed. However, there was no difference in plump and thin kernels between the small and large sized barley seed treatments. Barley yield increased from 92 to 104 bu/A between the 1 million and 1.5 million seed/A planting rates, although there was no difference between the 0.75 million, 1.25, and 1.5 million seed/A planting rates (Table 2). Similar results were observed with the percentage of plump and thin kernels. As expected, herbicide rate affected grain yield and quality (Table 3). Averaged across seed size and seeding rate, pinoxaden applied at 0.054 lb ai/A plus 9.6 fl oz/A Adigor (proprietary adjuvant) increased barley yield and plump kernels 16 and 5%, respectively while reducing plump kernels by 29%. Barley protein content ranged from 13 to 14% among all treatment combinations (data not shown). However, there was no definitive response to indicate change in protein was affected by any particular treatment. Barley plant height nor barley color, a grain quality parameter, was not affected by any of the treatments (data not shown). A significant three-way interaction of barley seed size, seeding rate, and pinoxaden rate did not clearly show any difference in wild oat control with pinoxaden applied at 0.054 lb ai/A among the different seed size and seeding rate combinations (Table 4). Wild oat control with pinoxaden pooled across all seed size and seeding rate treatments averaged 99%. Wild oat control without pinoxaden ranged from 0 to 39%. The treatments with the best wild oat control included large seed at 1.5 million seed/A (39%), small seed at 1.25 million seed/A (36%), and medium seed at 1 million seed/A (27%). Barley head length was reduced in some treatments without pinoxaden compared to treatments with pinoxaden, although this was not consistent with seed size or seeding rate. These results do not conclusively show that large seed size and higher seeding rates consistently control wild oat best with the highest grain yields, but they do indicate using medium to large sized seed at seeding rates ≥1 million seed/A can help increase barley yield.

Table 1. Effect of seed size on barley yield, plump and thin kernels pooled across seeding rate and pinoxaden rate, near Kimberly, ID.

Barley seed size	Grain yield	Plumps[1]	Thins[1]
	bu/A	%	%
Small (<6/64 and >5.5/64)	93	78	7
Medium (<7/64 and >6/64)	100	84	4
Large (>7/64)	102	81	6
LSD (0.05)	8	5	2

[1] LSD value calculated using P=0.10 probability level.

Table 2. Effect of barley seeding rate on grain yield, plum and thin kernels pooled across seed size and pinoxaden rate, near Kimberly, ID.

Barley seeding rate	Grain yield	Plumps	Thins[1]
	bu/A	%	%
750,000	99	84	5
1,000,000	92	77	7
1,250,000	99	79	7
1,500,000	104	83	5
LSD (0.05)	7	5	2

[1] LSD value calculated using P=0.10 probability level.

Table 3. Effect of herbicide rate on barley yield, plump and thin kernels pooled across seed size and seeding rate, near Kimberly, ID.

Herbicide treatment	Pinoxaden rate[1]	Grain yield	Plumps	Thins[2]
	lb ai/A	bu/A	%	%
Pinoxaden + Adigor	0 0 fl oz/a	91	79	7
Pinoxaden + Adigor	0.054 9.6 fl oz/a	106	83	5
		6	4	2

[1] Pinoxaden was applied with Adigor, a proprietary adjuvant, at 9.6 fl oz/A.

[2] LSD value calculated using P=0.10 probability level.

Table 4. Effect of barley seed size, seeding rate, and pinoxaden rate on wild oat control and barley head length, near Kimberly, ID.

Seed size	Seeding rate	Pinoxaden rate[1]	Wild oat control	Head length[2]
	seed/A	lb ai/A	%	mm
Small (<6/64 and >5.5/64)	750,000	0	0	82
Small (<6/64 and >5.5/64)	750,000	0.054	81	89
Medium (<7/64 and >6/64)	750,000	0	5	83
Medium (<7/64 and >6/64)	750,000	0.054	99	87
Large (>7/64)	750,000	0	22	84
Large (>7/64)	750,000	0.054	99	82
Small (<6/64 and >5.5/64)	1,000,000	0	1	83
Small (<6/64 and >5.5/64)	1,000,000	0.054	100	83
Medium (<7/64 and >6/64)	1,000,000	0	27	82
Medium (<7/64 and >6/64)	1,000,000	0.054	100	82
Large (>7/64)	1,000,000	0	3	78
Large (>7/64)	1,000,000	0.054	100	82
Small (<6/64 and >5.5/64)	1,250,000	0	36	80
Small (<6/64 and >5.5/64)	1,250,000	0.054	99	86
Medium (<7/64 and >6/64)	1,250,000	0	2	80
Medium (<7/64 and >6/64)	1,250,000	0.054	100	86
Large (>7/64)	1,250,000	0	3	77
Large (>7/64)	1,250,000	0.054	98	74
Small (<6/64 and >5.5/64)	1,500,000	0	16	82
Small (<6/64 and >5.5/64)	1,500,000	0.054	99	82
Medium (<7/64 and >6/64)	1,500,000	0	11	76
Medium (<7/64 and >6/64)	1,500,000	0.054	99	77
Large (>7/64)	1,500,000	0	39	76
Large (>7/64)	1,500,000	0.054	97	81
LSD			18	6

[1] Pinoxaden was applied with Adigor, a proprietary adjuvant, at 9.6 fl oz/A.

[2] LSD value calculated using P=0.10 probability level.

Broadleaf weed control in dry beans with preemergence herbicides followed by sequential postemergence herbicides. Richard N. Arnold, Michael K. O'Neill and Dan Smeal. (New Mexico State University Agricultural Science Center, Farmington, NM 87499) Research plots were established on May 29, 2007 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of dry beans (var. Bill Z) and annual broadleaf weeds to preemergence followed by sequential postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with four replications. Individual plots were 4, 34 in rows 30 ft long. Treatments were applied with a compressed air backpack sprayer calibrated to deliver 30 gal/A at 30 psi. Dry beans were planted with flexi-planters equipped with disk openers on May 29. Preemergence treatments were applied on May 31 and immediately incorporated with 0.75 in of sprinkler-applied water. Postemergence treatments were applied on June 27 when dry beans were in the 3rd to 4th trifoliate leaf stage and weeds were small. All postemergence treatments had a crop oil concentrate (Clean Crop) and urea ammonium nitrate added at 0.5 and 1.0 percent v/v. Black nightshade, prostrate and redroot pigweed infestations were heavy and common lambsquarters and Russian thistle infestations were moderate and light throughout the experimental area. Treatments were evaluated on August 1.

Common lambsquarters, black nightshade, redroot and prostrate pigweed control were good to excellent with all treatments except the check. Dimethenamid-p alone at 0.56 lb ai/A or in combination with pendimethalin at 0.56 plus 0.8 lb ai/A gave poor control of Russian thistle. Flumioxazin alone at 0.05 lb ai/A gave excellent control of all weeds. Yields were 2475 to 3843 lb/A higher in the herbicide treated plots as compared to the check.

Table. Broadleaf weed control in dry beans with preemergence followed by sequential postemergence herbicides.

Treatments[1]	Rate	Crop Injury[2]	Weed control[2]					Yield
			CHEAL	SOLNI	AMARE	AMABL	SASKR	
	lb ai/A	—%—			%			lb/A
Flumioxazin	0.05	0	99	97	96	97	97	4111
Dimethenamid-p	0.56	0	98	86	90	90	30	3074
Flumioxazin + pendimethalin	0.05+0.8	0	99	97	98	96	98	4342
Dimethenamid-p + pendimethalin	0.56+0.8	0	99	91	90	92	36	3381
Flumioxazin/imazamox + bentazon	0.05/0.032+0.25	0	100	98	98	98	97	4111
Dimethenamid-p/imazamox + bentazon	0.56/0.032+0.25	0	100	97	98	98	93	4111
Dimethenamid-p + pendimethalin/imazamox + bentazon	0.56+0.8/ 0.032+0.25	0	100	97	99	98	94	3919
Flumioxazin + pendimethalin/imazamox + bentazon	0.05+0.8/ 0.032 + 0.25	0	100	98	98	97	98	4111
Weedy check		0	0	0	0	0	0	499
LSD (0.05)			1	3	2	3	7	568

[1] First treatment applied preemergence then a slash, followed by a sequential postemergence treatment.

[2] Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.

Demonstration of what not to do with glyphosate in Roundup Ready sugar beet. Don W. Morishita, J. Daniel Henningsen, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A field study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to demonstrate to growers some of application and application condition errors that can be made for weed control in Roundup Ready sugar beet. Experimental design was a randomized complete block with four replications. Individual plots were four rows by 30 ft. Soil type was a Portneuf silt loam (17.9% sand, 61.8% silt, and 20.3% clay) with a pH of 8.0, 1.7% organic matter, and CEC of 21-meq/100 g soil. 'BTSCT 01RR07' sugar beet was planted April 14, 2007 in 22-inch rows at a rate of 57,024 seed/A. Kochia, common lambsquarters, redroot pigweed, green foxtail, and barnyardgrass were the major weed species present. Herbicides were applied broadcast with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa using 8001 flat fan nozzles. The conditions created to demonstrate potential problems with glyphosate applications included: applying glyphosate on dusty plants, applying with dust added to plants, applying with hard water, letting a mixture of glyphosate in water sit for up to 48 hours, tank mixing a non AMS or urea fertilizer with glyphosate, and applying glyphosate with dew present. Additional environmental and application information is given in Table 1. Crop injury and weed control were evaluated visually 14 days after the last herbicide application (DALA) on June 12. The two center rows of each plot were harvested mechanically October 3.

Table 1. Environmental conditions at application and weed species densities.

Application date	May 7	May 29
Application timing	4- leaf	6-leaf
Air temperature (F)	69	64
Soil temperature (F)	58	59
Relative humidity (%)	41	25
Wind velocity (mph)	1	3
Cloud cover (%)	15	1
Time of day	0910	0930
Weed species/ft^2		
pigweed, redroot	2	6
foxtail, green	62	60
kochia	<1	<1
lambsquarters, common	8	7
barnyardgrass	1	<1

None of the herbicide treatments injured the crop (Table 2). However, weed control was affected by the different application procedure or method. Kochia control with all herbicide treatments ranged from 30 to 95%. A similar response was observed with common lambsquarters control, which ranged from 27 to 94%. With both of these weeds, control was highest when glyphosate was applied with dew present. No difference in redroot pigweed control was observed 15 DALA among any of the treatments. Green foxtail responded the most positively to the addition of AMS to overcome dusty plants, dusted plants, and hard water conditions. Barnyardgrass control was only negatively affected by the use of the wrong foliar fertilizer containing calcium and zinc. Applying glyphosate with the wrong foliar fertilizer and applying glyphosate on dusty plants resulted in the greatest yield reductions, due to reduced weed control. The addition of AMS did not always positively impact weed control or sugar beet yield, but adding AMS did not ever reduce weed control or yield. Thus, adding AMS to glyphosate can be beneficial to improving weed control and yield without ever reducing weed control or yield potential.

Table 2. Roundup Ready sugar beet demonstration- what not to do[1]

Treatment[3]	Application rate	Application date	Crop injury 6/12	Weed control[2] KCHSC 6/12	CHEAL 6/12	AMARE 6/12	SETVI 6/12	ECHCG 6/12	Root yield	ERS
	lb ae/A		%	%	%	%	%	%	ton/A	lb/a
Glyphosate + AMS	0.75 + 2.5 lb /A	5/17 & 5/29	10 a	71 bc	77 bc	91 a	91 abc	100 a	40 a	10,223 a
Dusty plants glyphosate	0.75 +	5/17 & 5/29	10 a	47 de	27 e	89 a	82 e	100 a	26 cd	6,691 cd
Dusty plants glyphosate + AMS	0.75 + 2.5 lb /A	5/17 & 5/29	10 a	57 cd	39 e	93 a	93 a	100 a	33 b	8,491 b
Dusted plants glyphosate	0.75	5/17 & 5/29	10 a	68 bcd	69 cd	91 a	85 cde	100 a	34 ab	8,804 ab
Dusted plants glyphosate + AMS	0.75 + 2.5 lb /A	5/17 & 5/29	10 a	74 abc	58 d	93 a	90 a-d	100 a	36 ab	9,293 ab
240 ppm Ca H_20 glyphosate	0.75	5/17 & 5/29	10 a	74 abc	77 bc	91 a	84 de	100 a	35 ab	8,904 ab
240 ppm Ca H_20 glyphosate + AMS	0.75 + 2.5 lb /A	5/17 & 5/29	10 a	79 ab	87 ab	91 a	90 a-d	100 a	33 b	8,417 b
480 ppm Ca H_20 glyphosate	0.75	5/17 & 5/29	10 a	80 ab	80 abc	91 a	92 ab	100 a	33 b	8,469 b
480 ppm Ca H_20 glyphosate + AMS	0.75 + 2.5 lb/A	5/17 & 5/29	10 a	74 abc	80 abc	91 a	89 a-d	100 a	35 ab	8,958 ab
Mixed for 48 hours glyphosate + AMS	0.75 + 2.5 lb /A	5/17 & 5/29	10 a	75 abc	79 abc	92 a	86 b-e	100 a	33 b	8,426 b
Improper fertilizer glyphosate + foliar fertilizer-Ca-Zn	0.75 + 1 qt/A	5/17 & 5/29	10 a	30 e	29 e	87 a	18 f	20 b	24 d	6,172 d
Dew present glyphosate + AMS	0.75 + 2.5 lb /A	5/17 & 5/29	10 a	95 a	94 a	93 a	90 a-d	100 a	32 bc	8,274 bc

[1] Means followed by the same letter are not significantly different (P = 0.05)

[2] Weeds for control were kochia (KCHSC), redroot pigweed (AMARE), common lambsquarters (CHEAL), and green foxtail (SETVI), barnyardgrass (ECHCG).

[3] Dusty plants simulated plants with a very fine layer of soil on the leaves. Dusted plants were lightly dusted with soil to simulate soil stirred up by a spray implement tires. 240 and 480 ppm Ca in water simulated two levels of water hardness. The lower concentrated represented slightly hard water and 480 ppm represented very hard water. Mixed for 48 hours represented a glyphosate solution that had been mixed and allowed to stand 48 hours before using. Improper fertilizer represented using a wrong type of fertilizer with glyphosate. Dew present represented the presence of dew on the plants at application. This was done by applying a high volume of water with the plot sprayer before spraying with glyphosate.

Application timing and tank mixtures with glyphosate in Roundup Ready sugar beet. Donald L. Shouse, Don W. Morishita and J. Daniel Henningsen. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A field experiment was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to compare various application timings and glyphosate tank mixtures with soil active and foliar herbicides for weed control in sugar beet. Experimental design was a randomized complete block with four replications. Soil type was a Portneuf silt loam (17.9% sand, 61.8% silt, and 20.3% clay) with a pH of 8.0, 1.7% organic matter, and CEC of 21-meq/100 g soil. 'BTSCT 01RR07' sugar beet was planted April 14, 2007 in 22-inch rows at a rate of 57,024 seed/A. Kochia (KCHSC), common lambsquarters (CHEAL), redroot pigweed (AMARE), green foxtail (SETVI), and barnyardgrass (ECHCG) were the major weed species present. Herbicides were applied broadcast with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa using 8001 flat fan nozzles. Additional environmental and application information is given in Table 1. Crop injury and weed control were evaluated visually 11 and 40 days after the last herbicide application (DALA) on June 12 and July 11. The two center rows of each plot were harvested mechanically October 1.

Table 1. Environmental conditions at application and weed species densities.

Application date	April 25	May 8	May 15	May 23	June 4
Application timing	preemergence	cotyledon	2-leaf	6-8 leaf	10-leaf
Air temperature (F)	61	54	80	63	82
Soil temperature (F)	50	54	75	61	82
Relative humidity (%)	40	58	23	28	30
Wind velocity (mph)	3	4	5	4	4
Cloud cover (%)	30	0	0	40	80
Time of day	1100	0915	1600	1230	1440
Weed species/ft^2					
barnyardgrass	-	-	1	-	19
foxtail, green	-	-	61	-	19
pigweed, redroot	-	-	2	-	2
kochia	-	-	1	-	1
lambsquarters, common	-	-	8	-	7

Crop injury at the first evaluation date was 8% with the standard treatment consisting of ethofumesate applied preemergence followed by a 1:1:1 formulated mixture of ethofumesate, phenmedipham, and desmedipham (efs/dmp/pmp) + triflusulfuron and clopyralid (Table 2). No other treatment injured the crop more than 3%. Redroot pigweed , common lambsquarters, kochia and green foxtail control ranged from 65 to 72% with glyphosate + AMS applied three times. When nonionic surfactant (NIS) was added to this same combination, control of these same species ranged from 91 to 99% control. Control of redroot pigweed, common lambsquarters, kochia and green foxtail ranged from 5 to 64% at both evaluation dates with the standard treatment. Kochia control was marginal (79%) with glyphosate + clethodim. However, control of the other weed species was not adversely affected by this treatment. Sugar beet yield is greatly affected by poor weed control as evidenced by the 6 ton/A yield in the untreated control. Glyphosate alone or with tank mixtures worked well to control most of the weeds. The standard treatment consisting of ethofumesate applied preemergence followed by efs/dmp/pmp, triflusulfuron and clopyralid has worked well in the past but environmental conditions may have affected its efficacy this year.

Table 1. Application timing and tank mixtures with Roundup K-salt over-the-top of Roundup Ready sugarbeet near Kimberly, Idaho.[1]

	Application		Crop injury	Weed control[2]									
				AMARE		CHEAL		KCHSC		SETVI			
Treatment[3]	Rate[4]	Date	6/12	6/12	7/11	6/12	7/11	6/12	7/11	6/12	7/11	Root yield	ERS[5]
	lb ae/A		%									ton/A	lb/A
Check			-	-	-	-	-	-	-	-	-	6 c	3,521 e
Glyphosate + AMS	0.75 + 2.5 lb/A	5/15, 5/23 & 6/26	0 b	73 a	98 a	65 bc	95ab	74 bc	86 ab	72 b	98 ab	41 a	11,131 bc
Glyphosate + AMS + NIS	0.75 + 2.5 lb/A+ 0.25% v/v	5/15, 5/23 & 6/26	3 b	99 a	97 a	91 a	94 b	96 a	84 abc	96 a	95 b	41 a	10,741 c
MON 79790 + AMS MON 79790 + AMS	1.5 + 2.5 lb/A 2.25 + 2.5 lb/A	5/15, 6/1 & 6/26 5/23	0 b	99 a	97 a	99 a	99 a	100 a	89 a	99 a	99 a	40 a	11,624 abc
Glyphosate + AMS dimethenamid-p	0.75 + 2.5 lb/A 0.84 lb ai/A	5/15, 5/23 & 6/26 5/23	1 b	100 a	99 a	86 a	96 ab	99 a	84 abc	99 a	98 ab	44 a	12,290 a
Glyphosate + AMS dimethenamid-p	0.75 + 2.5 lb/A 0.84 lb ai/A	5/15, 5/23 & 6/26 5/15	0 b	99 a	99 a	94 a	99 a	99 a	89 a	99 a	99 a	42 a	11,677 abc
Glyphosate + AMS clopyralid	0.75 + 2.5 lb/A 0.094 lb ai/A	5/15, 5/23 & 6/26 5/15	3 b	99 a	98 a	86 a	95 ab	95 a	81 bc	98 a	96 ab	40 a	11,714 abc
Glyphosate + AMS clethodim	0.75 + 2.5 lb/A 0.13 lb ai/A	5/15, 5/23 & 6/26 5/15	0 b	99 a	98 a	83 ab	94 b	92 ab	79 c	97 a	96 ab	44 a	12,289 a
Ethofumesate + glyphosate + AMS	1.0 lb ai/A+ 0.75 + 2.5 lb/A	4/25 5/15, 5/23 & 6/26	0 b	99 a	97 a	93 a	97 ab	99 a	89 a	99 a	97 ab	41 a	11,417 abc
Glyphosate + AMS + ethofumesate	0.75 + 2.5 lb/A + 1.125 lb ai/a	5/15, 5/23 & 6/26 5/23	0 b	99 a	99 a	91 a	96 ab	99 a	84 abc	98 a	97 ab	41 a	11,687 abc
Ethofumesate + glyphosate + AMS ethofumesate	1.5 lb ai/A + 0.75 + 2.5 lb/A 1.0 lb ai/A	4/25 5/15, 5/23 & 6/26 5/23	3 b	99 a	97 a	90 a	95 ab	99 a	87 a	99 a	97 ab	41 a	11,712 abc

Table 1. Continued[1]

	Application		Crop injury	Weed control[2]								Root yield	ERS[5]
				AMARE		CHEAL		KCHSC		SETVI			
Treatment[3]	Rate[4]	Date	6/12	6/12	7/11	6/12	7/11	6/12	7/11	6/12	7/11		
	lb ae/A		%									ton/A	lb/A
Ethofumesate + efs/dmp/pmp + triflusulfuron + clopyralid + MSO	1.25 lb ai/A + 0.08 lb ai/A + 0.004 lb ai/A + 0.03 lb ai/A + 2% w/w	4/25 5/8, 5/23 & 6/4	8 a	84 a	35 b	64 c	56 c	59 c	5 d	60 b	45 c	23 b	7,722 d
Ethofumesate + Wet Sol glyphosate + AMS	1.0 lb ai/A + 1 gal/A 0.75 + 2.5	4/25 5/15, 5/23 & 6/26	1 b	99 a	98 a	90 a	96 ab	99 a	85 abc	98 a	97 ab	42 a	12,081 ab
Ethofumesate + Wet Sol Gro glyphosate AMS	1.0 lb ai/a 1 gal/A 0.75 2.5	4/25, 5/15, 5/23 & 6/26	3 b	99 a	97 a	89 a	95 ab	99 a	87 a	99 a	96 ab	41 a	11,446 abc

[1] Means followed by the same letter are not significantly different (P=0.05).

[2] Weeds evaluated for control were kochia (KCHSC), redroot pigweed (AMARE), common lambsquarters (CHEAL), and green foxtail (SETVI).

[3] MON 79790 is a new glyphosate formulation. AMS is ammonium sulfate. MSO is methylated seed oil. Efs/dmp/pmp is a 1:1:1 commercial formulation of ethofumesate, desmedipham, and phenmedipham sold as Progress.

[4] All herbicide rates other than glyphosate are listed in pounds active ingredient per acre.

[5] ERS is estimated recoverable sugar.

Crop injury, weed control and yield in Roundup Ready sugar beet with soil-active herbicides and generic glyphosate. J. Daniel Henningsen, Don W. Morishita, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A field experiment was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to compare generic and proprietary glyphosate applications alone and in combination with soil-active herbicides. Experimental design was a randomized complete block with four replications. Soil type was a Portneuf silt loam (17.9% sand, 61.8% silt, and 20.3% clay) with a pH of 8.0, 1.7% organic matter, and CEC of 21-meq/100 g soil. 'BTSCT 01RR07' sugar beet was planted April 14, 2007 in 22-inch rows at a rate of 57,024 seed/A. Kochia (KCHSC), common lambsquarters (CHEAL), redroot pigweed (AMARE) and green foxtail (SETVI) were the major weed species present. Herbicides were applied broadcast with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa using 8001 flat fan nozzles. Additional environmental and application information is given in Table 1. Crop injury and weed control were evaluated visually 13 days and 41 days after the last herbicide application (DALA) on June 12 and July 10. The two center rows of each plot were harvested mechanically October 2.

Table 1. Environmental conditions at application and weed species densities.

Application date	April 12	May 15	May 23	May 30
Application timing	preplant incorporated	2 leaf	6 leaf	8 leaf
Air temperature (F)	41	48	57	76
Soil temperature (F)	45	47	53	70
Relative humidity (%)	75	44	47	20
Wind velocity (mph)	3	4	2	5
Cloud cover (%)	-	0	5	0
Time of day	1000	0800	0940	1430
Weed species/ft^2				
barnyardgrass	-	2	-	3
foxtail, green	-	41	-	27
kochia	-	0	-	0
lambsquarters, common	-	6	-	6
pigweed, redroot	-	< 1	-	< 1

Crop injury at the first evaluation date (13 DALA) was highest (9%) with the glyphosate + EPTC + trifluralin and glyphosate + ethofumesate treatments. However by 41 DALA there were no differences among herbicide treatments and injury ranged from 0 to 3%. For common lambsquarters, redroot pigweed, and kochia, weed control at the first evaluation ranged from 91 to 100% with no significant differences among any herbicide treatment. Common lambsquarters control with glyphosate + EPTC + trifluralin and glyphosate + ethofumesate (0.75 lb ai/A) and glyphosate + dimethanamid were all <90% at the 41 DALA evaluation. Redroot pigweed control 41 DALA with glyphosate alone and glyphosate + cycloate was significantly lower than cycloate applied preplant incorporated followed by glyphosate and several other glyphosate combination treatments, although the differences were not biologically significant. Green foxtail control later in the season was the most variable among treatments. Glyphosate alone at the later evaluation had the poorest green foxtail control, mainly due to new grasses that had emerged where there was no soil-active herbicide. Sugar beet yield was affected greatly by no weed control as evidenced by the 9 tons/A yield where no herbicides were applied. Glyphosate alone (generic and proptrietary) and the glyphosate + ethofumesate treatments were among the lowest yielding herbicide treatments. Cycloate + glyphosate, glyphosate + EPTC + trifluralin, and glyphosate + dimethanamid were among the highest yielding treatments suggesting that certain soil-active herbicides tank-mixed with glyphosate are advantageous when growing Roundup Ready sugar beets.

Table 2. Crop injury, weed control and yield in Roundup Ready sugar beet with proprietary and generic glyphosate and soil-active herbicides, near Kimberly, Idaho.[1]

	Application		Crop injury		Weed control[2]								Beet	
					CHEAL		AMARE		KCHSC		SETVI			
Treatment[3]	rate	date	6/12	7/10	6/12	7/10	6/12	7/10	6/12	7/10	6/12	7/10	yield	ERS[4]
	lb ae/A		%										tons/A	lb/A
Check	-	-	-	-	-	-	-	-	-	-	-	-	9 e	2,498 e
Glyphosate + AMS	0.75 + 2.5 lb/A	5/15, 5/23 & 5/30	0 b	1 a	91 a	90 a-d	99 a	93 c	96 a	99 a	96 b	65 f	31 d	9,021 d
Cycloate + glyphosate-h + NIS	3 lb/A + 0.75 + 0.5% v/v	4/12 5/15 & 5/23	1 b	1 a	96 a	94 ab	100 a	95 ab	100 a	100 a	98 ab	93 bc	36 a-d	10,452 a-d
Cycloate + glyphosate-h + NIS	4.5 lb/A + 0.75 + 0.5% v/v	4/12 5/15 & 5/23	1 b	0 a	98 a	95 a	100 a	94 bc	99 a	98 a	99 ab	94 bc	41 a	11,676 a
Glyphosate-h + Cycloate + glyphosate-h + NIS	0.75 + 3 lb/A + 0.75 + 0.5% v/v	5/15 5/23	0 b	0 a	90 a	95 a	100 a	93 c	100 a	99 a	99 ab	95 b	39 ab	11,237 ab
Glyphosate-h + NIS + glyphosate-h + cycloate	0.75 + 0.5% v/v + 0.75 + 3 lb/A	5/15 5/23	6 ab	3 a	95 a	93 abc	100 a	95 ab	100 a	100 a	99 ab	95 b	38 abc	10,809 abc
Glyphosate-h + NIS +	0.75 + 0.5% v/v +	5/15, 5/23 &	1 b	0 a	97 a	95 a	100 a	93 c	100 a	100 a	99 ab	85 e	34 cd	9,614 cd
glyphosate + AMS + EPTC + trifluralin	0.75 + 2.5 lb/A + 2 lb/A + 0.5 lb/A	5/15, 5/23 5/23	9 a	3 a	89 a	89 bcd	100 a	97 a	95 a	95 a	100 a	99 a	38 abc	11,003 abc
Glyphosate + ethofumesate + AMS	0.75 + 1.0 lb/A + 2.5 lb/A	5/15	9 a	1 a	90 a	88 cd	100 a	95 ab	100 a	100 a	89 c	88 de	34 cd	9,663 cd
Glyphosate + ethofumesate + AMS	0.75 + 1.5 lb/A + 2.5 lb/A	5/15	6 ab	0 a	96 a	95 a	99 a	94 bc	100 a	96 a	90 c	90 cd	35 bcd	10,173 bcd

Table 2. Continued.[1]

					Weed control[2]									
	Application		Crop injury		CHEAL		AMARE		KCHSC		SETVI		Beet	
Treatment[3]	rate	date	6/12	7/10	6/12	7/10	6/12	7/10	6/12	7/10	6/12	7/10	yield	ERS[4]
	lb ae/A		------------	------------	------------	------------	------------	%-	------------	------------	------------	------------	tons/A	lb/A
Glyphosate + dimethenamid + AMS	0.75 + 0.656 lb/A + 2.5 lb/A	5/15	1 b	3 a	93 a	88 cd	100 a	96 ab	100 a	95 a	99 ab	93 bc	37 abc	10,701 abc
Glyphosate + dimethenamid + AMS	0.75 + 0.75 lb/A + 2.5 lb/A	5/15	0 b	0 a	90 a	86 d	99 a	96 a	99 a	98 a	98 ab	95 b	39 ab	11,119 ab

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[1] Means followed by the same letter are not significantly different (P=0.05).

[2] Weeds evaluated for percent control were common lambsquarters (CHEAL), redroot pigweed (AMARE), kochia (KCHSC), and green foxtail (SETVI).

[3] AMS is ammonium sulfate. Glyphosate-h is Helosate Plus. NIS is nonionic surfactant.

[4] ERS is estimated recoverable sugar.

Volunteer potato timing of removal in sugar beet (second year). Don W. Morishita, J. Daniel Henningsen and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). The second year of a two year field experiment was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to determine optimum timing of volunteer potato removal from sugar beet. Experimental design was a randomized complete block with four replications. Individual plots were four rows by 30 ft. Soil type was a Portneuf silt loam (17.9% sand, 61.8% silt, and 20.3% clay) with a pH of 8.0, 1.7% organic matter, and CEC of 21-meq/100 g soil. 'BTSCT 01RR07' sugar beet was planted April 13, 2007 in 22-inch rows at a rate of 57,024 seed/A. To determine potato interference, whole potato tubers averaging 2 oz each were planted at a density of 8,168 plants/A in addition to a treatment with no potato. All other weeds in the study area were controlled by applying a combination of ethofumesate & desmedipham & phenmedipham (efs&dmp&pmp) + triflusulfuron at 0.25 + 0.0156 lb ai/A at the sugar beet cotyledon growth stage. This was followed by an addition applications of efs&dmp&pmp + triflusulfuron at 0.33 + 0.0156 lb ai/A at the 2-leaf growth stage. Previous studies have shown this combination to have very little or no effect on potato growth. Herbicides were broadcast-applied with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa using 8001 flat fan nozzles. Hand weeding was used to control other weeds not controlled by the herbicides. Additional environmental and application information is given in Table 1. In other timing of weed removal interference studies, weed re-growth is not a factor if the weed is severed at ground level. Volunteer potato is different because a starch-filled tuber can provide energy for shoot re-growth should growth be interrupted, such as by hoeing or other shoot removal method. Consequently, in addition to the following treatments: remove at 4-inch rosette stage, remove at hooking (pre-tuber initiation), remove at tuber initiation, remove at early tuber bulking, remove at mid-tuber bulking, and potato not removed, additional treatments were needed to anticipate shoot re-growth. Those treatments included: remove as needed at 4-inch rosette, remove as needed at tuber hooking, and remove as needed at tuber initiation. Volunteer potato was removed just below the soil surface (0.4 inches) with a pair of hand pruners to simulate removal by hoeing. The 'remove as needed' treatments were evaluated weekly to determine when removal was needed. In those treatments shoots were cut each time potato plants had re-grown to 4-inch rosettes. The two center rows of sugar beet in each plot were harvested mechanically October 1.

Table 1. Environmental conditions at application.

Application date	May 4	May 16
Application timing	cotyledon	2 leaf
Air temperature (F)	38	50
Soil temperature (F)	44	58
Relative humidity (%)	70	50
Wind velocity (mph)	3	6
Cloud cover (%)	100	10
Time of day	0730	0730

In contrast to 2006 (see 2006 WSWS Res. Prog. Rept.), some tubers developed and were harvested in the 'remove as needed at 4 inch rosette' as well as the 'remove as needed at hooking and tuber initiation' treatments (Table 2). Tubers harvested in the 'potatoes not removed' treatment, had the highest total tuber weight at 3,987 lb/A, but this was about 25% of the volunteer potato yield in the same treatment in 2006. Potatoes 'removed once at 4 inch rosette' had a statistically equal yield at 3,212 lb/A to the 'potatoes not removed' treatment. Potatoes 'removed once at hooking' yielded 2,371 lb/A and had the second highest total tuber weight. Tuber weights of the 'remove as needed' treatments were significantly lower than each respective 'remove once' treatments. All of the 'remove once' treatments had tuber numbers ranging from 52,282 to 76,486 tubers/A. The 'potatoes not removed' treatment had the highest number of tubers at 81,393 tubers/A, but this was statistically not different from any of the 'remove once' treatments. Sugar beet root and sucrose yield in the 'no volunteer potato' treatment averaged 38 ton/A and 10,607 lb/A, respectively, compared to 33 ton/A and 9,503 lb/A in the 'not removed' treatment. This difference in yield is quite different from what has been observed in volunteer potato density experiments we have conducted. Volunteer potato in 2007 were not as competitive as in 2005 or 2006. However, the yield data still indicate that the optimum removal time for volunteer potato may be at tuber initiation. As was observed in 2006, sugar beet root and sucrose yield of the 'remove once at tuber initiation' and 'remove as needed at tuber initiation' treatments were equal. A trend is similar to 2006 indicating that removing above-ground plant material one time at earlier growth stages was apparently too soon because volunteer potato recovered and produced more tubers. Volunteer potato removal at early or mid-tuber bulking was apparently too late because sugar beet root and sucrose yield began to decline. The two center rows of each plot were harvested mechanically October 2, 2007.

Table 2. Tuber weight, tuber number, in volunteer potato timing of removal from sugar beets near Kimberly, Idaho.[1]

Treatment	Volunteer potato[2]										Root yield	Extractable sugar
	<1 oz	1-4 oz	4-6 oz	>6 oz	Total	<1 oz	1-4 oz	4-6 oz	>6 oz	Total		
	lb/A					tuber number/A					ton/A	lb/A
No volunteer potato	0 b	0 e	0 c	0 c	0 d	0 c	0 c	0 d	0 d	0 d	38 ab	10,607 a-d
Remove once at 4" rosette	31 b	957 a	1,047 a	1,178 b	3,212 a	4,159 bc	29,111 abc	16,041 a	11,288 b	60,599 ab	31 d	8,671 e
Remove as needed at 4" rosette	6 b	8 e	0 c	0 c	14 d	2,377 bc	2,377 bc	0 d	0 d	4,753 cd	37 abc	11,038 ab
Remove once at hooking	53 b	752 ab	673 b	892 b	2,371 b	5,557 b	24,952 abc	11,288 ab	8,317 bc	52,282 abc	35 bc	9,710 cde
Remove as needed at hooking	4 b	8 e	0 c	0 c	12 d	594 bc	594 c	0 d	0 d	1,188 d	41 a	11,760 a
Remove once at tuber initiation	211 a	545 bc	112 c	67 c	934 c	48,717 a	24,952 abc	1,782 cd	594 d	76,046 ab	37 abc	10,808 abc
Remove as needed at tuber initiation	45 b	29 de	0 c	0 c	74 d	26,141 ab	4,753 bc	0 d	0 d	30,894 bcd	39 ab	11,175 ab
Remove once at early tuber bulking	75 b	327 cd	0 c	0 c	402 cd	20,200 bc	32,082 ab	0 d	0 d	52,282 abc	35 bcd	10,402 bcd
Remove once at mid tuber bulking	32 b	313 cd	141 c	46 c	532 cd	19,012 bc	40,399 a	7,723 bc	2,377 cd	69,511 ab	35 bcd	9,704 cde
Not removed	62 b	707 ab	699 b	2,518 a	3,987 a	10,694 bc	38,023 a	11,288 ab	21,388 a	81,393 a	33 cd	9,503 de

[1] Means followed by the same letter are not significantly different (P=0.05).

[2] Volunteer potato was 'Russet Burbank'.

Downy brome control in established Kentucky bluegrass. Janice Reed and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were conducted near Colton and Mt. Hope, WA to determine the effect of several pre-emergence and post-emergence herbicides on crop response and downy brome control in established Kentucky bluegrass. The experiments were conducted in stands of 'South Dakota', 'Kenblue' and 'Kelly' bluegrass. 'South Dakota' and 'Kenblue' are tall, aggressive types of bluegrass and 'Kelly' is a shorter, less aggressive type. Plots were 8 by 30 ft, arranged in a randomized complete block design with four replications and an untreated check. Treatments in all studies were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Tables 1 and 2). Crop injury and downy brome control were evaluated visually. Downy brome density was estimated visually as a percentage of ground cover in the untreated plots. Crop response studies were swathed and harvested at maturity. Downy brome control studies were not harvested. This study is currently being repeated at four locations during the 2007 to 2008 growing season.

Table 1. Application and soil data for weed control study.

Study type	Downy brome control									
Bluegrass variety	'South Dakota'					'Kenblue'				
Application timing[1]	Pre	Fall	Esp	Sp	Lsp	Pre	Fall	Esp	Sp	Lsp
Application date	10/2/06	10/26/06	4/5/07	4/20/07	4/26/07	10/11/06	11/14/06	4/3/07	4/23/07	4/30/07
Growth stage										
Downy brome	--	2 lf	4 lf	1 tiller	2 tiller	--	1 lf	1-2 lf	2-4 lf	2 tiller
Bluegrass	2-6 in	3-8 in	5-9 in	6-10 in	6-10 in	1-3 in	1-3 in	3-6 in	4-9 in	6-10 in
Air temp (F)	67	53	62	50	53	56	44	53	63	61
Humidity (%)	49	58	60	63	65	50	72	52	65	62
Wind velocity	4 NW	5 ENE	3 NW	5 SE	2 NW	3 NW	6 NW	4 NW	4	3
Cloud cover (%)	5	95	30	40	30	0	40	50	70	30
Soil moisture	low	low	moist	moist	moist	very dry	low	low	moist	low
Soil temp at 2 in (F)	58	44	42	39	41	52	38	42	42	44
pH			4.5					5.1		
OM (%)			4.5					3.0		
CEC(meq/100 g)			22					22		
Texture			silt loam					sandy loam		

[1]Pre is preemergence to downy brome; Fall is post emergence to downy brome; Esp is early spring; Sp is spring; Lsp is late spring

Table 2. Application and soil data for crop response study.

Study type	Crop injury and seed yield									
Bluegrass variety	'South Dakota'					'Kelly'				
Application timing[1]	Pre	Fall	Esp	Sp	Lsp	Pre	Fall	Esp	Sp	Lsp
Application date	10/2/06	10/26/06	4/5/07	4/20/07	4/26/07	10/11/07	10/30/07	4/3/07	4/23/07	4/30/07
Growth stage										
Bluegrass	2-6 in	3-8 in	5-9 in	6-10 in	6-10 in	2-5 in	3-6 in	4-8 in	5-10 in	5-10 in
Air temp (F)	67	53	62	50	53	62	46	51	60	58
Humidity (%)	49	58	60	63	65	46	53	58	68	66
Wind velocity	4 NW	5 ENE	3 NW	5 SE	2	3 NW	4 NNW	3 NW	3	0
Cloud cover (%)	5	95	30	40	30	0	5	70	80	70
Soil moisture	low	low	moist	moist	moist	low	low	low	moist	moist
Soil temp at 2 in (F)	58	44	42	39	41	50	40	40	40	42
pH			4.5					4.6		
OM (%)			4.5					3.1		
CEC (meq/100g)			22					18		
Texture			silt loam					silt loam		

[1]Pre is preemergence to downy brome; Fall is post emergence to downy brome; Esp is early spring; Sp is spring; Lsp is late spring.

Weed Control – Table 3.

Downy brome control in 'Kenblue' was best (90-100%) with flufenacet/metribuzin treatments, sulfosulfuron treatments, ethofumesate, pimisulfuron (fall) + primisulfuron + flucarbazone (spring), and oxyfluorfen + diuron. Downy brome control was poor (18-39%) with proproxycarbazone, proproxycarbazone/mesosulfuron alone or with dicamba, and primisulfuron applied in the late spring. Mesosulfuron and dicamba alone did not control downy brome.

Downy brome control in 'South Dakota' was inconsistent across the study area due to variability in brome infestation, bluegrass stand, and broadleaf weeds. Downy brome control was similar to the 'Kenblue' study. Ethofumesate and oxyfluorfen + diuron controlled downy brome 95 and 100%, respectively. Mesosulfuron and dicamba alone did not control downy brome (0 and 5%).

Downy brome control with the pre-emergence herbicides tended to be lower in 'South Dakota' than 'Kenblue'. Brome emerged sooner at the 'South Dakota' site and pre-emergence treatments were applied 9 days earlier than the 'Kenblue' site. There was a longer period without precipitation following the pre-emergence application which may have lowered the efficacy of these treatments in the 'South Dakota' study.

Crop Response – Table 3.

Crop response (injury and yield) studies were conducted in fields that were not infested with downy brome. Bluegrass injury in 'South Dakota' was highest with mesosulfuron at 96%. Proproxycarbazone/mesosulfuron alone or with dicamba, and flufenacet/metribuzin alone or followed by a post-emergence fall application of metribuzin injured bluegrass 41 to 55%. All other treatments injured bluegrass 0 to 20%. 'South Dakota' seed yield ranged from 16 lb/A with mesosulfuron to 494 lb/A with primisulfuron applied early spring. Seed yield tended to be inversely related to injury. Treatments that injured bluegrass 41 to 96% yielded less than treatments that injured bluegrass 0 to 8%

Bluegrass injury in 'Kelly' was 45 to 59% with mesosulfuron and flufenacet/metribuzin alone or with metribuzin. Proproxycarbazone/mesosulfuron alone or with dicamba, and flufenacet/metribuzin with metolachlor injured bluegrass 25 to 28%. All other treatments did not substantially injure bluegrass (0-5%). 'Kelly' seed yield ranged from 53 lb/A with flufenacet/metribuzin to 258 lb/A with dicamba. Treatments that injured bluegrass 0 to 5% tended to have the highest yield while treatments with 45 to 59% injury tended to yield lowest. Yield in the untreated check did not differ from the higher yielding plots. Crop response was variable due to differences in stand vigor throughout the study and the presence of a taller off-type bluegrass variety.

Differences in crop response between 'South Dakota' and 'Kelly' can be attributed to differences in climate, soil type, and bluegrass variety. Proproxycarbazone/mesosulfuron treatments injured 'Kelly' 25 to 28% while injury to 'South Dakota' was 41 to 55%. Injury from mesosulfuron was 56% in 'Kelly' compared to 96% in 'South Dakota'. At the time of treatment applications, bluegrass was larger in 'South Dakota' than 'Kelly'. The taller off-type variety in the 'Kelly' study likely responded differently to herbicide treatments which confounded visual injury ratings and seed yield measurement.

Table 3. Downy brome control and Kentucky bluegrass injury and seed yield with pre- and post-emergence herbicides near Colton, WA and Mt. Hope, WA in 2006-2007.

Treatment[1]	Rate	Application[2] timing	Downy brome control[3,4] 'Kenblue'	Downy brome control[3,4] 'South Dakota'	'South Dakota'[3,4] Injury	'South Dakota'[3,4] Seed yield	'Kelly'[3,4] Injury	'Kelly'[3,4] Seed yield
	lb ai/A		%	%	%	lb/A	%	lb/A
Untreated check	---	---	---	---	---	292 def	---	231 a
Flufenacet/metribuzin	0.51	pre	96 a	66 cde	43 c	211 fg	59 a	53 g
Flufenacet/metribuzin + metribuzin	0.51 + 0.24	pre + fall	100 a	79 bc	46 bc	258 ef	45 a	69 fg
Metolachlor	1.27	pre	64 d	50 e-h	2 g	339 b-f	0 c	154 b-e
Metolachlor + flufenacet/metribuzin	0.635 + 0.25	pre + pre	90 abc	52 efg	18 de	273 ef	26 b	105 efg
Dicamba	2	pre	0 g	5 j	0 g	463 abc	0 c	258 a
Dicamba + sulfosufuron	2 + 0.031	pre + fall	94 a	75 c	5 g	452 abc	0 c	239 a
Dicamba + proproxycarbazone/mesosulfuron	1 + 0.025	pre + fall	30 e	40 ghi	41 c	273 ef	25 b	124 c-g
Ethofumesate	1	pre	98 a	95 a	0 g	430 a-d	0 c	128 c-f
Oxyfluorfen + diuron	0.375 + 0.75	fall + fall	98 a	100 a	20 d	332 c-f	5 c	188 abc
Sulfosulfuron	0.031	fall	94 a	81 bc	9 d-g	376 a-e	4 c	249 a
Proroxycarbazone	0.04	fall	29 ef	34 hi	15 def	390 d-f	5 c	185 a-d
Proproxycarbazone/mesosulfuron	0.025	fall	18 f	32 i	55 b	87 gh	28 b	112 d-g
Primisulfuron + flucarbazone	0.0178 + 0.0135	fall +fall	80 c	76 c	5 fg	367 a-e	0 c	255 a
Primisulfuron + primisulfuron + flucarbazone	0.0108 + 0.0178 + 0.0135	fall + spring + spring	93 ab	58 def	0 g	474 ab	0 c	188 abc
Primisulfuron	0.0356	early spring	81 bc	71 cd	8 efg	494 a	0 c	220 ab
Primisulfuron	0.0356	late spring	39 e	45 f-i	0 g	417 a-d	0 c	231 a
Mesosulfuron	0.0134	spring	0 g	0 j	96 a	16 gh	56 a	81 efg
Downy brome cover (% stand in untreated check)			30-60%	10-75%	---	---	---	---

[1] Non-ionic surfactant (R-11) was applied at 0.5% v/v with sulfosulfuron, proproxycarbazone, flucarbazone, and mesosulfuron, and at 0.25% v/v with diuron. Primisulfuron alone was applied with crop oil concentrate (Moract) at 2.5% v/v. Urea ammonium nitrate (UAN) was applied at 2 qt/A with proproxycarbazone, proproxycarbazone/mesosulfuron treatments and mesosulfuron.

[2] Pre= pre-emergence to downy brome. Fall treatments were applied to emerged (1-2 leaf) downy brome. Early spring is before April 10 and late spring is after April 20.

[3] Downy brome control and crop injury are expressed as a percent of the untreated check.

[4] Means followed by the same letter do not differ significantly at $P \leq 0.05$.

Glyphosate rate and application date effects on glyphosate-tolerant canola. Joan Campbell and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) An experiment was established near Moscow, Idaho to determine the effect of three glyphosate rates, three application dates, and sequential applications on glyphosate-tolerant canola. 'DKW 13-86' winter canola was planted 2 inch deep with a double disk drill on September 13, 2006. Herbicides were applied with a CO_2 pressurized backpack sprayer delivering 10 gpa at 3 mph and 32 psi (Table 1). Soil pH, organic matter, CEC, and texture were 6.2, 3.3%, 27 cmol/kg, and silt loam, respectively. The experimental design was a randomized complete block design with four replications. Experimental units were 8 ft by 30 ft. Crop injury was observed visually throughout the season and canola seed was harvested at maturity.

Table 1. Environmental and edaphic conditions at herbicide application.

Application date	October 13, 2006	November 17, 2006	April 11, 2007
Air temperature (F)	68	49	56
Soil temperature (F)	68	36	49
Soil moisture	dry	supersaturated	wet
Wind velocity (mph)	2 to 4 ENE	0 to 2 W	2 E
Clouds (%)	20	40	80
Canola growth stage	2 leaf	3 to 4 leaf	6 inch, bolt initiation
Relative humidity (%)	38	72	52

Dry soil conditions at seeding time and supersaturated soil in late fall caused a non-uniform canola stand. Plant vigor, height, flowering time (data not shown) and seed yield (Table 2) did not differ among treatments.

Table 2. Glyphosate rate and application date effects on glyphosate-tolerant canola seed yield.

Herbicide treatment	Glyphosate rate	Application date	Canola seed yield
	lb ai/acre		lb/acre
Glyphosate	0.56	October 13	1915
Glyphosate	0.77	October 13	1601
Glyphosate	1.55	October 13	1637
Glyphosate	0.56	November 17	1999
Glyphosate	0.77	November 17	2048
Glyphosate	1.55	November 17	2058
Glyphosate	0.56	April 11	1752
Glyphosate	0.77	April 11	1712
Glyphosate	1.55	April 11	1356
Glyphosate +	0.56	October 13	1910
glyphosate	0.56	April 11	
Glyphosate +	0.77	October 13	1910
glyphosate	0.77	April 11	
Glyphosate +	1.55	October 13	1345
glyphosate	1.55	April 11	
Glyphosate +	0.56	November 17	1789
glyphosate	0.56	April 11	
Glyphosate +	0.77	November 17	1768
glyphosate	0.77	April 11	
Glyphosate +	1.55	November 17	1769
glyphosate	1.55	April 11	
Untreated control	--	--	1560
LSD (0.05)			NS

Effect of growing oilseed crops along freeways on weed pressures. Dallas A. Hanks, Ralph E. Whitesides and, Grant Cardon (Department of Plants, Soils and Climate, Utah State University, Logan UT 84321). A study was initiated at Utah State University in April 2007 in cooperation with the Utah Department of Transportation to explore the effect on weed pressures by growing oil seed crops along freeway shoulders and medians for biofuel production. Freeway rights of ways represent over 100,000 acres in Utah and have been underutilized for biofuel crop production, generally providing safe harbor for several weed species and have maintenance costs of over 1.7 million dollars annually. This project assessed weed pressure effects in oilseed crops grown with and without glyphosate. Minimizing weed pressures can reduce the need for herbicides in contiguous areas and the biodiesel produced from these crops can be utilized as a clean burning sustainable fuel that decrease emissions, provide mechanisms for economical weed control, and save tax payers money. Experimental design was a complete randomized block with 6 treatments replicated 4 times near each of the following locations along the I-15 corridor: Tremonton, Kaysville, Mona, and Mile Marker 240. Treatments include an untreated control, glyphosate resistant spring canola without herbicide applied ('Hyola' at 7 lbs/acre), glyphosate resistant spring canola with glyphosate applied ('Hyola' at 7 lbs/acre), glyphosate resistant fall canola with glyphosate applied ('DKW' 1386 at 7 lbs/acre), glyphosate resistant fall canola without herbicide applied ('DKW' 1386 at 7 lbs/acre) and safflower ('S-208' at 15 lbs/acre). Plots were 8 feet by 20 inches with 25 feet space separations and were treated with 2 lbs WeatherMax Roundup®/acre 7 days prior to planting. All seeds were planted with a Tye Pasture Pleaser no-till drill equipped with 0.75 inch depth bands. Canola emergence was 0 to 30% compared with those under cultivated conditions. Safflower emergence was 0 to 7% compared with those under cultivated conditions. Field bindweed was present in each of the four research locations after existing vegetation, crested wheatgrass and tall wheatgrass were removed using glyphosate prior to planting. Field bindweed was the only weed of consequence common to all research sites and was not efficiently controlled.

Broadleaf weed control in field corn with tembotrione alone or in combination. Richard N. Arnold, Michael K. O'Neill and Dan Smeal. (New Mexico State University Agricultural Science Center, Farmington, NM 87499) Research plots were established on May 15, 2007 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of field corn (var. Pioneer 34N45RR) and annual broadleaf weeds to tembotrione alone or in combination. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with four replications. Individual plots were 4, 34 in rows 30 ft long. Field corn was planted with flexi-planters equipped with disk openers on May 16. Postemergence treatments were applied on June 12 when corn was in the 4th leaf stage and weeds were small. Black nightshade, prostrate and redroot pigweed, infestations were heavy and common lambsquarters and Russian thistle infestations were moderate and light throughout the experimental area. Treatments were evaluated on July 16.

No crop injury was noticed in any of the treatments. All treatments gave 95% or better control of common lambsquarters, black nightshade, prostrate pigweed and Russian thistle, except the check. Tembotrione applied alone or in combination with glyphosate gave <90% control of redroot pigweed.

Table. Broadleaf weed control in field corn with tembotrione alone or in combination.

		Crop[5]	Weed control[5]				
Treatments	Rate	injury	CHEAL	SOLNI	AMARE	AMABL	SASKR
	lb ai/A	—%—			%—		
Tembotrione[1]	0.08	0	97	95	87	96	99
Tembotrione+atrazine[1]	0.08+0.5	0	100	100	100	100	100
Tembotrione+atrazine[2]	0.08+0.5	0	100	100	100	100	100
Tembotrione+glyphosate OM[3,4]	0.08+1.0	0	98	96	88	100	96
Tembotrione+glyphosate OM +atrazine[3,4]	0.08+1.0+0.5	0	100	100	99	96	100
Weedy check		0	0	0	0	0	0
LSD (0.05)		ns	1	2	2	2	1

[1] Treatments applied with methylated seed oil and 32% urea ammonium nitrate at 1.0% v/v.

[2] Treatment applied with crop oil concentrate (Clean Crop) and 32% urea ammonium nitrate at 1.0% v/v.

[3] Treatments applied with ammonium sulfate at 2.5 lb/A.

[4] OM equal original max

[5] Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.

Broadleaf weed control in field corn with preemergence followed by sequential postemergence herbicides. Richard N. Arnold, Michael K. O'Neill and Dan Smeal. *(New Mexico State University Agricultural Science Center,* Farmington, NM 87499) Research plots were established on May 15, 2006 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of field corn (var. Pioneer 34N45RR) and annual broadleaf weeds to preemergence followed by sequential postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Field corn was planted with flexi-planters equipped with disk openers on May 15. Preemergence treatments were applied on May 16 and immediately incorporated with 0.75 in of sprinkler-applied water. Postemergence treatments were applied on June 12 when corn was in the 4th leaf stage and weeds were small. Black nightshade, prostrate and redroot pigweed, infestations were heavy, common lambsquarters were moderate and Russian thistle infestations were light throughout the experimental area. Treatments were evaluated on July 16.

Atrazine plus dimethenamid-p applied preemergence followed by a sequential postemergence treatment of diflufenzopyr plus dicamba had the highest crop injury of 5%. All treatments gave good to excellent control of common lambsquarters and black nightshade except the weedy check.. Glyphosate gave poor control of redroot and prostrate pigweed and Russian thistle. S-metolachlor plus glyphosate gave poor control of Russian thistle.

Table. Broadleaf weed control in field corn with preemergence followed by sequential postemergence herbicides.

Treatments[1]	Rate	Crop[4] injury	Weed control[4] CHEAL	SOLNI	AMARE	AMABL	SASKR
	lb ai/A	—%—			%		
Atrazine+s-metolachlor (pm)/s-metolachlor+glyphosate (pm)	0.75/1.65	0	100	100	100	100	100
Atrazine+s-metolachlor (pm)/s-metolachlor+glyphosate (pm)	1.5/1.65	0	100	100	100	100	100
s-metolachlor/glyphosate[2]	1.3/0.75	2	100	100	100	100	100
Atrazine+dimethenamid-p (pm)/diflufenzopyr+dicamba (pm)	1.25/0.25	2	100	100	100	100	100
Atrazine+dimethenamid-p (pm)/diflufenzopyr+dicamba (pm)	1.25/0.25	5	100	100	100	100	100
Atrazine+s-metolachlor (pm)/tembotrione[3]	1.5/0.08	3	100	100	100	100	100
Atrazine+dimethenamid-p (pm)/tembotrione[3]	1.25/0.08	2	100	100	100	100	100
S-metolachlor+glyphosate	1.65	0	90	98	90	94	79
Glyphosate[2]	0.75	0	93	95	82	84	57
Weedy check		0	0	0	0	0	0
LSD (0.05)		1	2	2	4	3	6

[1] pm equal packaged mix, first treatment applied preemergence then a slash, followed by a sequential postemergence treatment.

[2] A nonionic surfactant (Biosurf) was added to treatments at 0.25% v/v.

[3] A crop oil concentrate (Clean Crop) and 32% urea ammonium nitrate was added to treatments at 1% v/v.

[4] Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.

Crop sequencing can improve corn tolerance to weeds. Randy L. Anderson. (USDA-ARS, Brookings SD 57006). The corn-soybean rotation in eastern South Dakota has led to a weed community comprised of species with similar life cycles to the crops; subsequently, weed management is a major input cost for producers. We are exploring crop diversity in this rotation to determine if producers can reduce the need for herbicides for weed management. Crop diversity may affect the interaction between corn and weeds because of its beneficial impact on crop growth.

This study measured impact of crop sequence on corn tolerance to weed interference as well as corn response to preceding crops in weed-free conditions. This report summarizes two projects; the first study involved a native weed community whereas the second study involved an indicator species. All studies were established with no-till practices.

Methodology:

Impact of sequence on corn yield with a native weed community. Four crops, canola, dry pea, spring wheat, and soybean, were established in 2003 with no-till production practices. Plots were split into weed-free and weed-infested subplots, with weeds in the infested subplots allowed to produce seed. Green foxtail, yellow foxtail, and common lambsquarters comprised more than 90% of the weed community. Weeds in the weed-free subplots were controlled with herbicides appropriate for each crop and hand weeding.

Corn (DeKalb 42-95 RR/YGCB) was planted at 26,000 plants/ac in all plots in 2004. Weeds in the weed-free subplot were controlled by S-metolachlor at labeled rates plus post applications of glyphosate and hand weeding. Weeds in weed-infested subplots were not controlled. Weeds present at time of planting in both subplots were controlled with glyphosate.

Impact of sequence on corn yield with foxtail millet as an indicator species. The study, established in 2005, followed the same protocol as the native community study, but with two differences. First, corn replaced canola in the previous crops treatments. The second change was that weeds were controlled with labeled herbicides in the whole plots of all crops in the first year. In 2006, the same hybrid of corn used in the first study was planted again. Plots were split into two subplots. One subplot was maintained weed-free with weeds controlled by S-metolachlor, post applications of glyphosate, and hand weeding. With the 2nd subplot, foxtail millet [*Setaria italica* (L.) Beauv] was broadcast on the soil surface at 230 seeds/m^2 immediately before planting. Our purpose with the indicator species was to develop a uniform level of weed interference.

With both studies, treatments were arranged in a randomized split block design with four replications; whole plot size was 20 feet by 65 feet. Weed biomass was collected from two 0.5 m^2 quadrats, 7 weeks after corn emergence (WAE). Rainfall was normal in the 2004 growing season, whereas drought stress was prominent during tasseling in 2006.

Results:

Impact of sequence on corn yield with a native weed community. With weed-free conditions, yield varied only 7% among preceding crops, with corn yielding the highest following pea (Figure 1). In contrast, yield varied 20-fold among preceding crops with weed-infested conditions. Corn following pea yielded 60 bu/ac whereas corn following soybean yielded only 3 bu/ac. Yields in corn following canola and spring wheat were 47 and 33 bu/ac, respectively.

The drastically lower yield in soybean may be due to more weed interference. Weed biomass 7 WAE was similar between spring wheat, canola, and pea, averaging approximately 1000 gm fresh weight/m^2. Weed biomass in corn following soybean, however, was 1325 gm/m^2 or 30% more than with the other three preceding crops. Therefore, we altered the study to achieve uniform weed interference by planting foxtail millet.

Impact of sequence on corn yield with an indicator species, foxtail millet. With weed free conditions, corn again yielded the most following pea (Figure 2). In contrast, yield of corn following corn was 75% less compared with pea as a preceding crop. Corn seedling growth was visibly suppressed when planted into corn stubble. Corn tolerated weed interference more following pea than any other crop. Corn yielded 47 bu/ac following pea but only 21 and 26 bu/ac following spring wheat and soybean, respectively. Biomass (fresh weight) of foxtail millet was similar among all treatments, being 950 to 1000 gm/m^2.

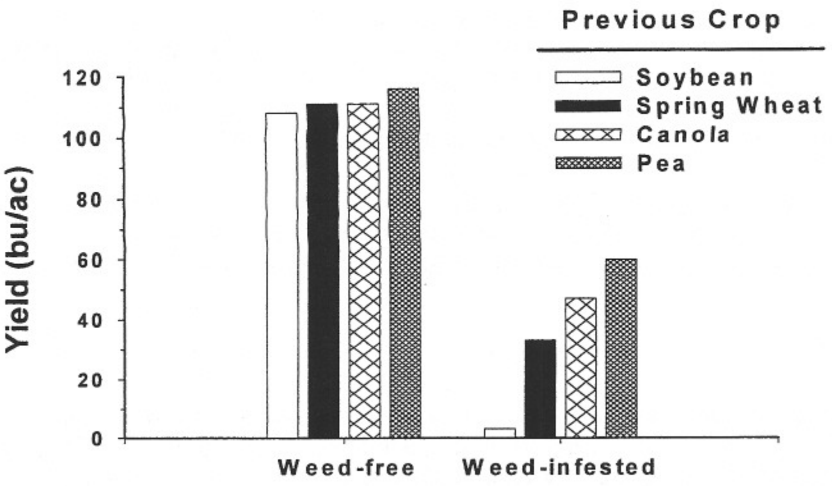

Figure 1. Impact of previous crop on corn yield in weed-free conditions and infested with a native weed community.

Corn following corn produced only 3 bu/ac, a decrease of 94% compared with pea as a preceding crop. Corn seedling growth was severely stunted following corn, which gave foxtail millet a competitive edge to reduce yield more.

Implications for Weed Management

In the semiarid Great Plains, a multi-tactic approach is effectively managing weeds with less cost compared to conventional management. A key to this approach is integrating several cultural tactics with crop management. Our study shows that crop sequencing may be one tactic that helps weed management; corn was more tolerant to weeds if corn followed pea. In contrast, tolerance to weeds was drastically reduced when corn followed corn. Even with weed-free conditions, preceding crop affected corn yield. Averaged across both studies, corn following pea yielded 10% more than following soybean. In the second study, yield of corn following corn was 75% less compared with pea as the preceding crop.

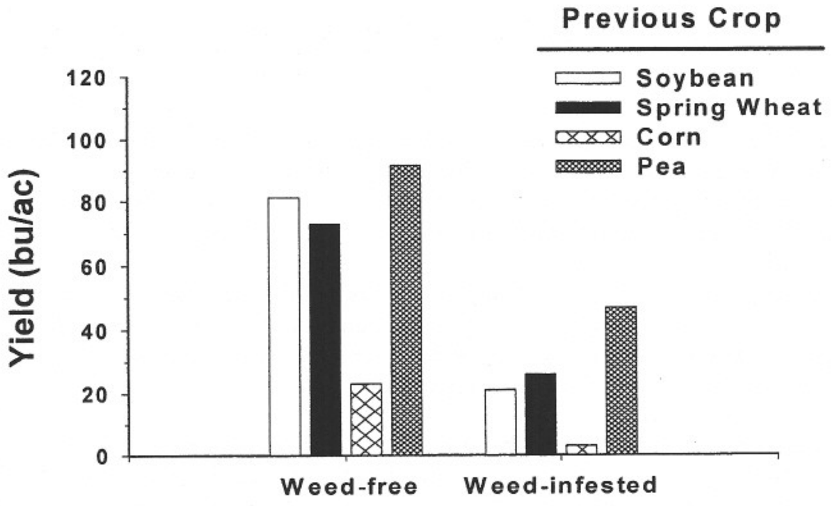

Figure 2. Impact of previous crop on corn yield in weed-free conditions and infested with an indicator species, foxtail millet [*Setaria italica* (L.) Beauv].

Weed control in chemical fallow with pyraflufen. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in chemical fallow to evaluate volunteer winter wheat and catchweed bedstraw control with pyraflufen combinations compared to glyphosate. The plots were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Winter wheat and catchweed bedstraw control were evaluated visually 25 and 54 days after treatment.

Table 1. Application and soil data.

Application date	April 19, 2007
Growth stage	
Winter wheat	2 tiller
Catchweed bedstraw	3 in tall
Air temperature (F)	58
Relative humidity (%)	46
Wind (mph, direction)	2, NW
Cloud cover (%)	60
Soil moisture	adequate
Soil temperature at 2 in (F)	50
pH	5.1
OM (%)	3.8
CEC (meq/100g)	24
Texture	silt loam

At 25 and 54 DAT, volunteer winter wheat was controlled 99% by glyphosate treatments (Table 2). Broadleaf herbicide treatments, pyraflufen combined with 2,4-D ester or dicamba, do not control volunteer winter wheat. At 25 DAT, catchweed bedstraw control was best with glyphosate at 0.75 lb ae/A plus COC treatments (96 to 98%) but did not differ from glyphosate plus 2,4-D ester or pyraflufen and pyraflufen plus dicamba (91 to 94%). By 54 DAT, only pyraflufen plus dicamba controlled catchweed bedstraw 92% but it did not differ from pyraflufen at 0.00325 lb ai/A plus glyphosate, glyphosate plus 2,4-D ester or glyphosate plus COC (64 to 86%).

Table 2. Winter wheat and catchweed bedstraw control with pyraflufen combinations in chemical fallow near Genesee, ID in 2007.

		Winter wheat control		Catchweed bedstraw control	
Treatment[1]	Rate	25 DAT	54 DAT	25 DAT	54 DAT
	lb ai/A	%			
Pyraflufen + glyphosate + COC	0.00081 0.75 1% v/v	99	99	96	55
Pyraflufen + glyphosate + COC	0.00163 0.5 1% v/v	99	99	91	48
Pyraflufen + glyphosate + COC	0.00163 0.75 1% v/v	99	99	96	60
Pyraflufen + glyphosate + COC	0.00325 0.75 1% v/v	99	99	97	64
Pyraflufen + 2,4-D ester + COC	0.00163 1 1% v/v	0	0	65	51
Pyraflufen + dicamba + COC	0.00163 0.25 1% v/v	0	0	94	92
Glyphosate + 2,4-D ester	0.75 0.5	99	99	94	74
Glyphosate + COC	0.75 1% v/v	99	99	98	86
Glyphosate	0.5	99	99	86	62
LSD (0.05)		1	1	9	29
Density (plants/ft^2)		6		4	

[1] COC is a crop oil concentrate (Moract). Glyphosate, 2,4-D ester, and dicamba rates are in lb ae/A.

Common lambsquarters control in spring pea with pre-emergence herbicides. Joan Campbell and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) An experiment was established near Genesee, Idaho in spring pea to determine common lambsquarters control with linuron and diuron. 'Joel' spring pea was direct-seeded at 140 lb/a into chemical fallow May 8, 2007. Herbicides were applied with a CO_2 pressurized backpack sprayer delivering 10 gpa at 3 mph and 32 psi on May 9. Air and soil temperature, relative humidity, and wind velocity were 64 and 61 F, 53%, and west at 1 mph, respectively. The sky was clear and the soil was dry on the surface and moist at 1.5 inch. Soil pH, organic matter, CEC, and texture were 5.2, 3.6%, 24 cmol/kg, and silt loam, respectively. The experimental design was a randomized complete block with four replications, and experimental units were 8 by 30 ft. Crop injury and weed control were observed visually throughout the season and pea seed was harvested at maturity.

Table. Pre-emergence herbicide effects on common lambsquarters control and pea seed yield.

Treatment	Rate	Common lambsquarters	Pea yield
	lb ai/acre	% of untreated control	lb/acre
Untreated control	-	-	2011
Linuron	0.5	70	2264
Linuron	0.75	55	2178
Linuron	1	70	2142
Diuron	1.2	80	2230
Diuron	1.6	70	2168
Diuron	2	55	2240
Metribuzin	0.25	0	2154
LSD (0.05)		NS	NS

Surface soil moisture was low after planting due to below average precipitation. This resulted in delayed weed seed germination until several weeks after the pea crop emerged and non-uniform weed density (0 to 5 plants/ft^2) across the experiment. Common lambsquarters was not controlled with metribuzin at 0.25 lb ai/acre (Table). Metribuzin applied pre-emergence works best with incorporation by tillage or rainfall. The pea crop was direct-seeded and the first rainfall was 2 weeks after application. Also, metribuzin has a soil half life of 14 to 28 days under optimum conditions. By the time the weeds were growing in late June, much of the herbicide likely had dissipated. Common lambsquarters control and pea seed yield did not differ among herbicide treatments due to non-uniform weed population (Table).

Italian ryegrass control with triallate in spring pea. Joan Campbell and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) An experiment was established near Moscow, Idaho to determine the effect of triallate and triallate in combination with other herbicides on Italian ryegrass control in spring pea. Herbicides were applied with a CO_2 pressurized backpack sprayer delivering 10 gpa at 3 mph and 32 psi on May 7, 2007. Two passes with a field cultivator/harrow were made immediately after herbicide application and 'Aragon' pea was planted 2 inch deep with a double disk drill set to 7 inch row spacing. Soil and air temperature, relative humidity, soil moisture, and wind velocity were 60 and 65 F, 66%, dry, and west at 6 mph, respectively. Soil pH, organic matter, CEC, and texture were 4.0, 5.1%, 45 cmol/kg, and clay, respectively. The experimental design was a randomized complete block design with four replications. Experimental units were 8 ft by 30 ft. Crop injury and Italian ryegrass control were observed visually throughout the season and pea seed was harvested at maturity.

Table. Preplant incorporated herbicide effects on Italian ryegrass control and pea seed yield.

Treatment	Rate	Italian ryegrass	Pea yield
	lb ai/acre	% of untreated control	lb/acre
Untreated control	-	-	618
Triallate	1.25	10	597
Triallate + trifluralin	1.25 + 0.25	65	600
Triallate + pendimethalin	1.25 + 0.475	28	824
Triallate + s-metolachlor	1.25 + 0.955	32	748
Triallate + ethafluralin	1.25 + 0.28	56	714
Trifluralin	0.25	71	667
Pendimethalin	0.475	48	606
s-metolachlor	0.955	41	804
Ethafluralin	0.28	66	697
LSD (0.05)		28	NS

Low soil moisture caused slow emergence of both Italian ryegrass and pea. The pea was seeded to moisture and germinated weeks before the Italian ryegrass emerged. Trifluralin and ethafluralin alone or combined with triallate controlled Italian ryegrass better than triallate alone or triallate combined with *s*-metolachlor or pendimethalin (Table). Pea seed yield was low and did not differ among treatments.

Field bindweed control with sequential herbicide treatments in peppermint. Barbara Hinds-Cook, Daniel Curtis, and Carol Mallory-Smith. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002). Three studies were conducted in established peppermint fields in the Willamette Valley of Oregon to evaluate the efficacy of sulfentrazone applied during the dormant season and followed by herbicide applications in the spring for suppression of field bindweed. The experimental design was a randomized complete block with three replications; individual plots were 8 by 20 feet or 8 by 25 feet. Herbicides were applied with a bicycle-wheel compressed air sprayer which delivered 20 gpa at 20 psi. Application information is presented in Table 1.

Table 1. Application conditions and growth stages

	Linn Co.		Benton Co.		Lane Co.	
Application date	2/21/06	5/16/06	2/16/07	6/1/07	2/16/07	6/1/07
Air temperature (F)	47	64	45	82	43	76
Relative humidity (%)	48	63	59	48	67	59
Wind speed (MPH)	4	3	4	0	2	4
Dew present	no	no	yes	no	yes	no
Soil temperature (F)	44	62	45	88	44	71
Soil moisture	dry surface	dry surface	muddy	moist	muddy	moist
Soil texture	silt loam	silt loam	silt loam	silt loam	silty clay loam	silty clay loam
Soil pH	5.9	5.9	6.0	6.0	5.3	5.3
Soil OM (%)	3.7	3.7	2.2	2.2	3.1	3.1
CEC (meq/100g)	30.2	30.2	18.4	18.4	25.8	25.8
Peppermint	dormant	6-18 inches	dormant	16 inches	dormant	18 inches
Field bindweed	dormant	6-24 inches	dormant		dormant	

Field bindweed suppression with sulfentrazone was excellent at all three sites as the bindweed began to emerge in April (data not shown), but by June the suppression was minimal (Table 2). The single application of MCPB in 2006 was less effective than when applied following sulfentrazone (Table 3). Carfentrazone following sulfentrazone in 2007 caused more visible injury than fluroxypyr or MCPB, but provided the best control of field bindweed. Field bindweed stand densities were much higher at the Linn and Lane County sites then at the Benton County site. This may account for the trend toward mint oil increases from the herbicide treatments at these sites.

Table 2. Field bindweed control, peppermint injury, and peppermint oil yield following herbicide applications, Benton County and Lane County, 2007

					Peppermint			
			Field bindweed control[1]		Injury[1]		Oil yield[2]	
Treatment	Application timing	Rate	Benton	Lane	Benton	Lane	Benton	Lane
		lb ai/A	%				lb/A	
Check	-	0	0	0	0	0	73	43
Sulfentrazone	2/16/07	0.375	13	7	0	0	61	61
Sulfentrazone/	2/16/07	0.375						
carfentrazone	6/1/07	0.015	83	92	13	17	50	51
Sulfentrazone/	2/16/07	0.375						
fluroxypyr	6/1/07	0.094	67	67	3	5	62	53
Sulfentrazone/	2/16/07	0.375						
MCPB	6/1/07	0.25	70	72	3	0	68	55
LSD (0.10)			20	21	4	4	ns	ns

[1] Evaluated June 11, 2007

[2] Harvested July 26, 2007

Table 3. Field bindweed control, peppermint injury, and peppermint oil yield following herbicide applications, Linn County, 2006

Treatment	Application date	Rate	Field bindweed control[1]	Peppermint Injury[1]	Peppermint Oil yield[2]
		lb ai/A	----------------------%----------------------		lb/A
Check	-	0	0	0	22
Sulfentrazone/ MCPB	2/21/06 5/16/07	0.375 0.25	88	30	36
MCPB	5/16/07	0.25	47	20	38
LSD (0.10)			11	0	15

[1] Evaluated June 5, 2006

[2] Harvested July 27, 2006

Mannagrass control in grasses grown for seed. Barbara Hinds-Cook, Daniel Curtis, Carol Mallory-Smith, and Bill Brewster. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002). Mannagrass (Glyceris spp.) infests wet fields in the Willamette Valley of Oregon. The development of resistance to ethofumesate has left no effective mannagrass control in Italian ryegrass, seedling perennial ryegrass or tall fescue grown for seed. A screening study at Corvallis and two subsequent studies in production fields were conducted to identify possible control measures. Experimental design was a randomized complete block, with 8 by 70 ft plots with four replications (Corvallis), and 8 by 25 ft plots with three replications (Tangent and Lebanon). The western mannagrass seed was obtained from a field in Lebanon. Treatments were applied with a bicycle-wheeled compressed-air sprayer which delivered a spray volume of 20 gpa at 20 psi. Italian ryegrass seed yield was obtained by hand-harvesting 27 sq ft in each plot and threshing out the seed with a small-plot combine. Herbicide application conditions and plant growth stages are listed in Table 1.

Table 1. Application conditions and growth stages

Location	Corvallis	Tangent	Lebanon
Application date	November 17, 2006	February 9, 2007	February 9, 2007
Air temperature (F)	40	60	64
Soil temperature (F)	40	61	62
Relative humidity (%)	80	75	71
Soil moisture	muddy	muddy	muddy
Soil texture	silt loam	silty clay loam	silty clay loam
Soil pH	5.4	5.7	4.9
Soil O.M. (%)	2.2	6.0	4.6
CEC (meq/100g)	14.1	31.4	17.7
Western mannagrass	1 tiller	4 leaf to 2 tillers	2 tillers
Italian ryegrass	2 tiller	2 leaf to 4 tillers	2 to 4 tillers
Perennial ryegrass	3 leaf to 1tiller		
Tall fescue	2 leaf		

Four of the 25 herbicide treatments and four of the plant species included in the screening study are included in Table 2. The standard ethofumesate treatment provided essentially no control of the mannagrass and caused minor stunting of Italian ryegrass and tall fescue. The three HPPD inhibitors provided excellent mannagrass control and crop tolerance.

Table 2. Mannagrass control and grass crop injury, Corvallis, 2007.

		Weed control[1]	Crop injury[1]		
Treatment	Rate	Western mannagrass	Italian ryegrass	Perennial ryegrass	Tall fescue
	lb ai/A	%			
Check	0	0	0	0	0
Ethofumesate	1	12	8	0	18
Mesotrione	0.094	100	0	0	0
Pyrasulfotole + bromoxynil	0.028 0.2	98	0	0	0
Topramazone	0.0165	100	0	0	0
LSD (0.10)		13	ns	ns	12

[1] Evaluated February 26, 2007

The control of western mannagrass in two Italian ryegrass production fields was less than in the screening trial (Table 3), probably due to the later stage of growth. Mannagrass stand density was much greater at the Lebanon site, which depressed ryegrass seed yield in the check plots.

Table 3. Western mannagrass control and Italian ryegrass injury and seed yield, Tangent and Lebanon, 2007.

		Western mannagrass		Italian ryegrass			
		control[1]		injury[1]		seed yield[2]	
Treatment	Rate	Tangent	Lebanon	Tangent	Lebanon	Tangent	Lebanon
	lb ai/A	----------------------	------%------	----------------------		-------lbs/A-------	
Check	0	0	0	0	0	1221	694
Pyrasulfotole + bromoxynil	0.028 0.2	78	82	0	0	1258	1285
LSD (0.10)		13	13	0	0	ns	575

[1] Evaluated April 26, 2007

[2] Harvested June 26, 2007

Annual bluegrass control in perennial ryegrass with carbon seeding. Daniel Curtis, Barbara Hinds-Cook, Carol Mallory-Smith, and Charles Cole. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR, 97331-3002.) Diuron has been used in carbon seeding and on established stands of perennial ryegrass and tall fescue for nearly 50 years in Western Oregon and is now largely ineffectual on annual bluegrass throughout much of the area. EPTC and related herbicides have not been extensively used in many Willamette Valley fields that are infested with diuron-resistant annual bluegrass. Two studies were conducted on preplant incorporated EPTC applications at the Hyslop Research Farm near Corvallis, OR. Both studies were conducted as randomized complete block experiments with four replicates and 10 ft by 30 ft plots. Treatments were applied with a CO_2-pressurized backpack sprayer that delivered a spray volume of 20 gpa at 20 psi. Application conditions are presented in Table 1.

Table 1. Application conditions.

Application date	September 20, 2006	October 3, 2006
Application timing	PPI	PES
Air temperature (F)	66	60
Relative humidity (%)	70	45
Soil temperature (F)	65	60
Soil moisture	moist	dry
Soil texture	silt loam	
Soil OM (%)	2.4	
Soil pH	5	
CEC (meq/100g)	13.9	

The annual bluegrass in these studies was not highly resistant to diuron. In Study 1, four rates of EPTC were compared to preemergent applications of diuron and pronamide. The EPTC treatments were incorporated to a depth of 4 inches with a tractor mounted rototiller. One month after the EPTC application, perennial ryegrass was seeded and activated charcoal was applied in 1-inch wide band over the seeded row at a rate of 300 lbs per treated acre. Diuron and pronamide were applied three days after seeding. The perennial ryegrass was placed at a depth of 0.25 inch as previous research has shown that deeper seeding results in too much injury from EPTC. The placement of carbon over the row prevented EPTC from accumulating at the soil surface to penetrate the emerging ryegrass shoots.

In Study 2, rototilling was compared to hand-raking to incorporate EPTC. Rototilling is impractical on large grass seed fields so hand-raking was used to simulate light harrowing.

EPTC was more effective than diuron but not pronamide (Table 2) for annual bluegrass control in Study 1. Annual bluegrass at this site was likely diuron resistant. Stunting of the perennial ryegrass was fairly high at the higher rates of EPTC, but there were no differences among perennial ryegrass seed yield means. In Study 2, hand-raking was as effective as rototilling for bluegrass control.

Table 2. Study 1, annual bluegrass control and perennial ryegrass injury and seed yield following EPTC application and carbon seeding, Corvallis, 2007.

Treatment	Rate	Application timing[1]	Annual bluegrass control[2]	Perennial ryegrass[3] injury[2]	Perennial ryegrass[3] seed yield[4]
	lb ai/A		%	%	lb/A
Check	0	-	0	0	1169
EPTC	1.3	PPI	74	10	1180
EPTC	1.75	PPI	82	25	1195
EPTC	2.6	PPI	89	42	1141
EPTC	3.5	PPI	91	45	1106
Diuron	2.4	PES	60	15	1098
Pronamide	0.25	PES	92	18	1137
LSD (0.05)			20	11	195

[1] PPI applied September 20, 2006; PES applied October 23, 2006.

[2] Evaluated April 10, 2006.

[3] Seeded October 20, 2006.

[4] Harvested August 6, 2007.

Table 3. Study 2, effect of rototilling and harrowing incorporation of EPTC on annual bluegrass control and perennial ryegrass injury and seed yield with carbon seeding, Corvallis, 2007.

Treatment	Rate	Application timing[1]	Incorporation technique[2]	Annual bluegrass control[3]	Perennial ryegrass[4] injury	Perennial ryegrass[4] seed yield[5]
	lb ai/A			%	%	lb/A
Check	0	-	-	0	0	1548
EPTC	2.6	PPI	rototiller	94	19	1443
EPTC	2.6	PPI	rake	94	15	1374
Diuron	2.4	PES	-	91	5	1418
Pronamide	0.25	PES	-	92	18	1359
LSD (0.05)				3	11	166

[1] PPI applied September 20, 2006; PES applied October 23, 2006.

[2] Tractor mounted rototiller operated to a depth of 4 inches; garden rake to a depth of 1 inch.

[3] Evaluated April 10, 2007.

[4] Seeded October 20, 2006.

[5] Harvested August 6, 2007.

Wild carrot control with DPX-KJM44 in perennial ryegrass grown for seed. Daniel Curtis, Barbara Hinds-Cook, Carol Mallory-Smith and Charles Cole. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002) Wild carrot is a difficult to control weed in grasses grown for seed in the Willamette Valley of Oregon. Studies were conducted at three sites over the past two years to evaluate the efficacy of DPX-KJM44 on wild carrot and its effect on perennial ryegrass seed production. Sites 1 and 3 were established perennial ryegrass plantings being grown for seed and Site 2 was in a non-crop mixed-grass roadside border. Experimental design at each site was a randomized complete block. Site 1 had three replications and 6.5 ft by 30 ft plots. Sites 2 and 3 had four replications each. Plot dimensions were 8 ft by 50 ft at Site 2 and 8 ft by 35 ft at Site 3. Treatments were applied with a CO_2 pressurized back-pack sprayer at Site 1 and with a compressed-air pressurized unicycle plot sprayer at Sites 2 and 3. Treatments were applied in 20 gpa at 20 psi. Conditions at application are listed in Table 1. Grass seed yields were obtained by swathing the grass in individual plots and threshing out the seed with a small plot combine at sites 1 and 3.

Table 1 . Application conditions and growth stage information.

Location	Site 1	Site 2	Site 3
Application date	September 23, 2005	March 6, 2007	March 23, 2007
Air temperature (F)	65	52	47
Realtive humidity	55	78	89
Soil temperature (F)	56	50	48
Soil moisture	dry	moist	moist
Soil texture	silt loam	silt loam	silt loam
Soil pH	5.4	-	5.3
Soil OM (%)	3.2	-	2.8
CEC	12.9	-	15.2
Perennial ryegrass	5 inch tall	-	4 to 8 inch tall
Wild carrot	flowering	2 to 6 inch dia	-

Fall treatments of DPX-KJM44 were only effective at the highest rate of application (Table 2). No injury symptoms developed, and yield was not affected. Late winter applications in 2007 (Table 3) were highly effective at the two highest rates. Complete control was obtained in October. Site 3 was nearly weed free except for wild garlic. No injury symptoms developed on the perennial ryegrass at this site, but seed yield and percent germination of seed produced in plots treated at the 0.25 lb ai/A and 0.5 lb ai/A rates were reduced compared to the untreated check.

Table 2. Wild carrot control, perennial ryegrass injury, and perennial ryegrass seed yield following applications of DPX-KJM44, Site 1, Corvallis, 2006.

		Wild carrot		Perennial ryegrass		
		control		injury		seed yield[2]
Treatment[1]	Rate	Oct-07	Jun-07	17-Oct	13-Jun	
	lb ai/A	%				lb/A
Check	0	0	0	0	0	1142
DPX-KJM44	0.011	23	0	0	0	1166
DPX-KJM44	0.022	33	25	0	0	1166
DPX-KJM44	0.067	37	33	0	0	1149
DPX-KJM44	0.134	50	50	0	0	1170
DPX-KJM44	0.268	80	95	0	0	1207
LSD (0.10)		23	19	0	0	141

[1] Applied Sept 23, 2005.

[2] Harvested July 7, 2006.

Table 3. Wild carrot control in non-cropland with DPX-KJM44, Site 2, Corvallis, 2007.

		Wild carrot control	
Treatment[1]	Rate	April-07	October-07
	lb ai /A	--------------%--------------	
Check	0	0	0
DPX-KJM44	0.031	60	68
DPX-KJM44	0.063	72	75
DPX-KJM44	0.125	98	100
DPX-KJM44	0.25	100	100
LSD (0.10)		12	16

[1] Applied March 6, 2007, NIS added at 0.25 % v/v.

Table 4. Perennial ryegrass injury, seed yield and germination following applications of DPX-KJM44, Site 3, Corvallis, 2007.

		Perennial ryegrass			
		injury		seed	
Treatment[1]	Rate	April-07	May-07	yield	germination
	lb ai/A	-------------%-------------		lb/A	------%------
Check	0	0	0	1529	92
DPX-KJM44	0.063	0	0	1546	96
DPX-KJM44	0.125	0	0	1456	96
DPX-KJM44	0.25	0	0	1372	84
DPX-KJM44	0.5	0	0	1187	31
LSD (0.10)		0	0	203	13

[1] Applied March 23, 2007, NIS added at 0.25 % v/v.

Broadleaf weed control in tribenuron tolerant sunflower with preemergence followed by sequential postemergence herbicides. Richard N. Arnold, Michael K. O'Neill and Dan Smeal. (New Mexico State University Agricultural Science Center, Farmington, NM 87499) Research plots were established on June 4, 2007 at the Agricultural Science Center, Farmington, New Mexico, to evaluate the response of tribenuron tolerant sunflower (var. Pioneer 63N81) and annual broadleaf weeds to preemergence followed by sequential postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with four replications. Individual plots were 4, 34 in rows 30 ft long. Sunflower was planted with flexi-planters equipped with disk openers on June 4. Preemergence treatments were applied on June 5 and immediately incorporated with 0.75 in of sprinkler-applied water. Postemergence treatments were applied on June 27 when sunflowers were in the V3 to V4 leaf stage and weeds were <3 in tall. All postemergence treatments had crop oil concentrate (Clean Crop) applied at 1.0% v/v. Black nightshade, prostrate and redroot pigweed, were heavy, common lambsquarters were moderate and Russian thistle infestations were light throughout the experimental area. Treatments were evaluated on July 26.

Sulfentrazone applied preemergence at 0.14 lb ai/A had the highest sunflower injury ratings of 4 and 5. All preemergence treatments followed by a postemergence treatment of tribenuron at either 0.008 or 0.015 lb ai/A gave good to excellent control of broadleaf weeds. Tribenuron applied postemergence at 0.008 and 0.015 lb ai/a gave poor control of redroot and prostrate pigweed. Yields were 1716 to 2196 lb/A higher in the herbicide treated plots as compared to the weedy check.

Table. Broadleaf weed control in field corn with preemergence followed by sequential postemergence herbicides.

		Crop			Weed control[2]			
Treatments[1]	Rate	Injury[2]	CHEAL	SOLNI	AMARE	AMABL	SASKR	Yield
	lb ai/A	%	%					lb/A
Pendimethalin/tribenuron	0.8/0.008	0	100	96	92	91	95	3500
Pendimethalin/tribenuron	0.8/0.015	0	100	98	93	94	97	3533
Sulfentrazone/tribenuron	0.14/0.008	4	100	100	100	100	100	3475
Sulfentrazone/tribenuron	0.14/0.015	5	100	100	100	100	100	3552
S-metolachlor/tribenuron	1.0/0.008	0	99	97	99	100	96	3513
S-metolachlor/tribenuron	1.0/0.015	0	100	98	97	99	98	3500
Dimethenamid-p/tribenuron	0.56/0.008	7	100	99	100	100	95	3500
Dimethenamid-p/tribenuron	0.56/0.015	5	100	100	100	100	97	3526
Tribenuron[2]	0.008	0	92	83	55	67	81	3072
Tribenuron[2]	0.015	0	99	90	72	75	88	3225
Tribenuron[2]	0.024	0	100	93	76	77	96	3244
Weedy check		0	0	0	0	0	0	1356
LSD (0.05)		2	1	3	3	2	3	292

[1] First treatment applied preemergence then a slash, followed by a sequential postemergence treatment.

[2] Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.

Wild oat control in irrigated spring wheat with pyroxsulam formulations and other herbicide combinations. Don W. Morishita, J. Daniel Henningsen, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to compare pyroxsulam formulations and tank mix combinations for wild oat and broadleaf weed control in irrigated spring wheat. 'Centennial' was planted March 31, 2007 at 100 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (20.4% sand, 71% silt, and 8.6% clay) with a pH of 8.1, 1.5% organic matter, and CEC of 17-meq/100 g soil. Herbicides were applied on May 11 with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 22 psi. Environmental conditions at application were as follows: air temperature 53 F, soil temperature 61 F, relative humidity 44%, wind speed 4 mph, and 20% cloud cover. Wild oat, kochia, and common lambsquarters densities averaged 7, 3, and 13 plants/ft^2, respectively. Application began at 0800. Crop injury and weed control were evaluated visually 31 and 63 days after application (DAA) on June 11 and July 13, respectively. Grain was harvested July 31 with a small-plot combine.

No crop injury was observed at either evaluation date (Table). Wild oat control was somewhat variable among the herbicide treatments. However, wild oat control was poorest with GF-1847 (pyroxsulam) + mineral oil applied at 0.01006 lb ai/A and pyroxsulam applied at 0.0134 lb ai/A without any adjuvant. The best wild oat control at 63 DAA was generally with the addition of methylated seed oil (MSO) to GF-1847 (pyroxsulam alone) or GF-1848 (florasulam + fluroxypyr + pyroxsulam). Wild oat control with GF-1848 was equal to or better than clodinafop, fenoxaprop, flucarbazone, and pinoxaden, propoxycarbazone / mesosulfuron. Kochia control at 31 and 63 DAA ranged from 95 to 100% with GF-1848. Kochia control with GF-1847 was generally good at 31 DAA with all combinations of adjuvants with the exception of GF-1847 applied with nonionic surfactant (NIS) or at the 0.01006 lb ai/A rate. By 63 DAA, GF-1848 applied alone or with MSO did not satisfactorily control kochia. Common lambsquarters control was >80% with all GF-1847 and GF-1848 treatments with the exception of GF-1847 applied with mineral oil or without an adjuvant. These same two treatments had grain yields statistically equal to the untreated check, which yielded 74 bu/A. All other GF-1847 and GF-1848 treatments had grains yields ≥90 bu/A, as did the registered herbicide treatments. GF-1848 + MSO and flucarbazone + 2,4-D LVE were among the highest yielding treatments.

Table. Crop injury, weed control and grain yield with pyroxsulam alone and in combination with other herbicides, near Kimberly, ID[1].

				Weed control[2]						
	Application	Crop injury		AVEFA		KCHSC		CHEAL		Grain
Treatment[3]	rate	6/11	7/13	6/11	7/13	6/11	7/13	6/11	7/13	yield
		-----------------------------------%---								bu/A
Check			-	-	-	-	-	-	-	74 d
GF-1848 + NIS + AMS	0.079 lb ae/A + 0.5% v/v + 1.52 lb/A	0 a	0 a	83 a-c	84 cde	95 a	99 a	95 a	96 a	94 ab
GF-1848	0.105 lb ae/A	0 a	0 a	85 a-c	81 def	97 a	98 a	90 a	88 ab	97 ab
GF-1848 + NIS	0.105 lb ae/A + 0.5% v/v	0 a	0 a	75 bc	90 a-e	97 a	100 a	95 a	98 a	98 a
GF-1848 + NIS + AMS	0.105 lb ae/A + 0.5% v/v + 1.52 lb/A	0 a	0 a	87 ab	98 ab	97 a	99 a	92 a	100 a	99 a
GF-1848 + mineral oil	0.105 lb ae/A + 0.8% v/v	0 a	0 a	78 a-c	87 a-e	96 a	99 a	88 a	95 a	99 a
GF-1848 + MSO	0.105 lb ae/a + 0.8% v/v	0 a	0 a	83 a-c	94 abc	95 a	99 a	87 a	99 a	104 a
GF-1847 + mineral oil	0.01006 lb ai/A + 0.8% v/v	0 a	0 a	53 d	52 g	80 b	95 a	72 cd	73 bc	79 cd
GF-1847	0.0134 lb ai/A	2 a	0 a	70 c	68 f	93 a	37 c	57 e	40 d	82 bcd
GF-1847 + NIS	0.0134 lb ai/A + 0.5% v/v	0 a	0 a	78 a-c	94 a-d	77 c	80 ab	82 ac	93 a	95 ab
GF-1847 + NIS + AMS	0.0134 lb ai/A + 0.5% v/v + 1.52 lb/A	0 a	0 a	92 a	99 a	88 abc	90 ab	88 a	100 a	95 ab
GF-1847 + mineral oil	0.0134 lb ai/A + 0.8% v/v	2 a	0 a	77 a-c	83 cde	92 ab	83 ab	87 a	98 a	90 abc
GF-1847 + MSO	0.0134 lb ai/A + 0.8% v/v	2 a	0 a	83 a-c	87 a-e	92 ab	50 bc	88 a	93 a	99 a
GF-1847 + 2,4-D LVE	0.0134 lb ai/A + 0.375 lb ae/A	0 a	0 a	78 a-c	85 b-e	90 ab	93 a	93 a	100 a	94 abc
GF-1847 + mineral oil	0.0161 lb ai/A + 0.8% v/v	0 a	0 a	77 a-c	84 cde	90 ab	90 ab	93 a	99 a	93 abc
GF-1674 + mineral oil	0.0134 lb ai/A + 0.8% v/v	0 a	0 a	75 bc	92 a-e	90 ab	71 abc	87 a	98 a	97 ab
Pinoxaden + Adigor + clopyralid / fluroxypyr + MCPA LVE	0.0535 lb ai/A + 9.6 fl oz/A + 0.187 lb ae/A + 0.375 lb ai/A	0 a	0 a	92 a	92 a-e	95 a	100 a	95 a	100 a	100 a
Fenoxaprop + bromoxynil / MCPA	0.082 lb ae/A + 0.5 lb ae/A	0 a	0 a	72 bc	79 ef	90 ab	100 a	93 a	100 a	95 ab
Codinafop + thifensulfuron/ tribenuron	0.05 lb ai/A + 0.0188 lb ai/A	0 a	0 a	87 ab	95 abc	90 ab	100 a	95 a	100 a	97 ab
Flucarbazone + 2,4-D LVE	0.0178 lb ai/A + 0.375 lb ae/A	0 a	0 a	87 ab	82 cde	92 ab	83 ab	93 a	100 a	103 a
Propoxycarbazone/ mesosulfuron + NIS + AMS	0.0111 lb ai/A + 0.25% v/v + 1.52 lb/A	0 a	0 a	88 ab	90 a-d	85 ab	36 c	58 de	65 cd	98 a

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[1] Means followed by the same letter are not significantly different at $P = 0.05$.

[2] Weeds evaluated for controlled were wild oat (AVEFA), kochia (KCHSC), and common lambsquarters (CHEAL).

[3] GF-1848 is a 1:39.6:5.9 formulated mixture of florasulam, fluroxypyr, and pyroxsulam. GF-1847 is a pyroxsulam formulation with 0.375 lb ai/gal plus cloquinocet safener. GF-1647 is a pyroxsulam formulation with 0.25 lb ai/gal plus cloquinocet safener. Clopyralid / fluroxypyr is a 1:1.1 formulated mixture sold as Widematch. Bromoxynil / MCPA is a 1:1 formulated mixture and is sold as Bronate Advanced. Thifensulfuron / tribenuron a 4:1 formulated sold as Affinity TM. Propoxycarbazone / mesosulfuron is a 4:1 formulated mixture sold as Rimfire. NIS is nonionic surfactant and AMS is ammonium sulfate.

Pyraflufen ethyl applied in combination with other broadleaf herbicides for weed control in spring wheat. Don W. Morishita, J. Daniel Henningsen, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to evaluate the efficacy and safety of applying pyraflufen ethyl with other broadleaf herbicides for weed control in irrigated spring wheat. 'Centennial' was planted March 31, 2007 at 100 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (18.9% sand, 60.1% silt, and 21% clay) with a pH of 8.1, 1.83% organic matter, and CEC of 20-meq/100 g soil. Herbicides were applied with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 22 psi. Additional application and environmental information is given in Table 1. Crop injury and weed control was/were evaluated visually 10 and 37 days after the last application (DALA) on May 25 and June 21, respectively. Grain was harvested August 7 with a small-plot combine.

Table 1. Environmental conditions at application and weed species densities.

Application date	May 10	May 15
Application timing	2-4 leaf	tillering
Air temperature (F)	72	48
Relative humidity (%)	42	44
Wind velocity (mph)	1.5	4
Soil temperature (F)	61	47
Cloud cover (%)	10	0
Time of day	0930	0815
Weed species (plants/ft^2)		
kochia	75	75
lambsquarters, common	22	22
pigweed, redroot	3	3

Pyraflufen ethyl + 2,4-D LVE at 0.00163 lb ai + 0.5 lb ae/A injured the wheat 14%, which was the highest among herbicide treatments 10 DALA. No differences in crop injury were observed 37 DALA and injury ranged from 0 to 3%. Kochia control 10 DALA ranged from 63 to 90% and from 51 to 97% by 37 DALA. Pyraflufen ethyl + bromoxynil or fluroxypyr were among the best treatments for kochia control. Common lambsquarters control was much better overall and ranged from 91 to 100% over both evaluation dates for all herbicide treatments. Grain yield ranged from 82 to 111 bu/A, with the untreated check averaging 93 bu/A. Only three treatments, pyraflufen ethyl at 0.00163 lb ai/A + MCPA and pyraflufen ethyl at 0.00122 lb ai/A + bromoxynil or thifensulfuron / tribenuron BS, had grain yields greater than the untreated check. However, weed control did not closely follow the yield response of these three treatments. Pyraflufen ethyl appears to be a good tank mix partner with several broadleaf herbicides, unless ALS inhibitor resistant kochia is present.

Table 2. Crop injury, weed control, and grain yield with broadleaf herbicides in irrigated spring wheat with pyraflufen ethyl near Kimberly, Idaho.[1]

				Weed control[2]				
	Application	Crop injury		KCHSC		CHEAL		Grain
Treatment[3]	rate	5/25	6/21	5/25	6/21	5/25	6/21	yield
	lb ai/A	%						bu/A
Check	-	-	-	-	-	-	-	93 bc
Pyraflufen ethyl + MCPA LVE + nonionic surfactant	0.00081 + 0.5lb ae/A + 0.25 % v/v	1 cd	0 a	67 bc	72 bc	99 a	99 b	82 c
Pyraflufen ethyl + MCPA LVE + nonionic surfactant	0.00122 + 0.5 lb ae/A + 0.25 % v/v	6 b	3 a	66 c	74 b	96 abc	100 a	104 ab
Pyraflufen ethyl + MCPA LVE + nonionic surfactant	0.00163 + 0.5 lb ae/A + 0.25 % v/v	6 b	0 a	74 bc	89 a	96 abc	100 a	111 a
Pyraflufen ethyl + 2,4-D LVE + nonionic surfactant	0.00122 + 0.5 lb ae/A + 0.25 % v/v	8 b	1 a	63 c	51 d	99 ab	100 a	98 ab
Pyraflufen ethyl + 2,4-D LVE + nonionic surfactant	0.00163 + 0.5 lb ae/A + 0.25 % v/v	14 a	3 a	65 c	60 cd	91 c	100 a	100 ab
Pyraflufen ethyl + Bromoxynil + nonionic surfactant	0.00122 + 0.5 + 0.25 % v/v	5 bc	0 a	90 a	96 a	100 a	100 a	109 a
Pyraflufen ethyl + Fluroxypyr + nonionic surfactant	0.00122 + 0.094 lb ae/A + 0.25 % v/v	1 d	0 a	90 a	93 a	98 ab	100 ab	108 ab
Pyraflufen ethyl + Fluroxypyr + nonionic surfactant	0.00163 + 0.094 lb ae/A + 0.25 % v/v	3 cd	0 a	91 a	96 a	94 bc	100 ab	104 ab
Pyraflufen ethyl + thifensulfuron/tribenuron BS + nonionic surfactant	0.00122 + 0.0125 + 0.25 % v/v	0 d	3 a	71 bc	61 bcd	96 abc	100 a	110 a
Pyraflufen ethyl + thifensulfuron/tribenuron TM + nonionic surfactant	0.00122 0.0125 0.25 % v/v	6 b	1 a	81 ab	93 a	99 ab	100 a	101 ab
Bromoxynil/MCPA + Fluroxypyr + nonionic surfactant	0.5 + 0.094 lb ae/A + 0.25 % v/v	0 d	1 a	95 a	97 a	98 ab	100 a	101 ab
Bromoxynil/MCPA + thifensulfuron/tribenuron BS + nonionic surfactant	0.5 + 0.0125 + 0.25 % v/v	0 d	0 a	90 a	91 a	100 a	100 a	108 ab

[1] Means followed by the same letter are not significantly different (P=0.05).

[2] Weeds evaluated for percent control were kochia (KCHSC) and common lambsquarters (CHEAL)

[3] Pyrafluefen ethyl + 2,4-D LVE was applied 5 days after all other treatments were applied. Thifensulfuron/tribenuron BS is a 2:1 mixture of thifensulfuron and tribenuron. Thifensulfuron/tribenuron TM is a 4:1 mixture of thifensulfuron and tribenuron. Bromoxynil/MCPA is a 1:1 commercial formulated pre-mixture sold as Bronate Advanced.

Broadleaf weed control with pyroxsulam alone and in combination with broadleaf herbicides. Don W. Morishita, J. Daniel Henningsen, and Donald L. Shouse. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). A study was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to evaluate the effectiveness of pyroxsulam tank mixed with broadleaf herbicides for weed control in spring wheat. 'Centennial' was planted March 31, 2007 at 100 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Portneuf silt loam (18.9% sand, 60.1% silt, and 21% clay) with a pH of 8.1, 1.83% organic matter, and CEC of 20-meq/100 g soil. Herbicides were applied on May 10 with a CO_2-pressurized bicycle-wheel sprayer using 11001 flat fan nozzles calibrated to deliver 10 gpa at 24 psi. Environmental conditions at application were as follows: air temperature 61 F, soil temperature 54 F, relative humidity 47%, wind speed 2 mph, and 15% cloud cover. Kochia and common lambsquarters densities averaged 96 and 25 plants/ft^2, respectively. Application began at 0730 and a heavy dew was present due to a sprinkler irrigation the previous day. Crop injury and weed control were evaluated visually 12, 36, and 45 days after treatment (DAT) on May 22, June 15, and July 12, respectively. Grain was harvested August 6 with a small-plot combine.

Very little or no crop injury was observed in any of the herbicide treatments at any of the three evaluation dates (Table). Kochia control with pyroxsulam alone was unacceptable (<70%) at all three evaluation dates. However, when pyroxsulam was applied with florasulam and fluroxypyr in a formulated three-way mixture, kochia control was ≥92% control at 36 and 45 DAT, regardless of adjuvant type used with this treatment. The combination of fluroxypyr and clopyralid applied with pinoxaden controlled kochia >90% at all three evaluation dates. Common lambsquarters control ranged from 95 to 100% at 36 and 45 DAT with pyroxsulam alone or in combination with florasulam and fluroxypyr. Kochia appeared to have a greater effect reducing grain yield compared to common lambsquarters, presumably due to higher density of this weed species. Wheat yields ranged from 66 to 105 bu/A, with the untreated check yielding 78 bu/A. The highest yielding treatments were primarily seen in the three way pyroxsulam, florasulam, and fluroxypyr combination.

Table. Crop injury, weed control, and grain yield with pyroxsulam in spring wheat, near Kimberly, Idaho[1].

		Crop injury[4]	Weed control						Grain yield
			kochia			common lambsquarters			
Treatment[2]	Application rate[3]	5/22	5/22	6/15	7/12	5/22	6/15	7/12	
	lb ae/A		%						bu/A
Check	-	-	-	-	-	-	-	-	78 f-h
Flslm & flxpr & pxslm + NIS + AMS	0.079 + 0.5% v/v + 1.52 lb/A	1 a	90 a	94 ab	92 a	95 abc	98 a	99 a	104 a-c
Flslm & flxpr & pxslm	0.105	0 a	90 a	95 a	95 a	96 abc	98 a	98 a	101 a-d
Flslm & flxpr & pxslm + NIS	0.105 + 0.5% v/v	0 a	89 a	96 a	95 a	83 def	100 a	100 a	105 ab
Flslm & flxpr & pxslm + NIS + AMS	0.105 + 0.5% v/v + 1.52 lb/A	0 a	88 a	96 a	94 a	90 cde	99 a	100 a	101 a-d
Flslm & flxpr & pxslm + Mineral oil	0.105 + 0.8% v/v	1 a	89 a	94 ab	94 a	94 a-d	98 a	99 a	102 a-c
Flslm & flxpr & pxslm + MSO	0.105 + 0.8% v/v	0 a	91 a	96 a	96 a	99 ab	100 a	100 a	95 a-e
Flslm & flxpr & pxslm + 2,4-D LVE	0.105 + 0.25	1 a	90 a	95 a	95 a	99 ab	99 a	100 a	100 a-d
Pyroxsulam + Mineral oil	0.16 oz ai/A + 0.8% v/v	0 a	23 fg	20 de	3 fg	66 f	95 a	99 a	88 d-f
Pyroxsulam	0.21 oz ai/A	0 a	38 e	31 d	5 fg	96 abc	96 a	100 a	93 a-e
Pyroxsulam + NIS	0.21 oz ai/A + 0.5% v/v	0 a	29 ef	29 d	5 fg	95 a-d	99 a	100 a	71 gh
Pyroxsulam + NIS + AMS	0.21 oz ai/A + 0.5% v/v + 1.52 lb/a	1 a	55 cd	34 d	18 de	91 b-e	100 a	100 a	84 e-g
Pyroxsulam + Mineral oil	0.21 oz ai/A + 0.8% v/v	0 a	43 de	21 d	3 fg	93 bcd	100 a	100 a	83 e-g
Pyroxsulam + Mineral oil	0.21 oz ai/A + 0.8% v/v	0 a	16 fg	5 e	0 g	94 a-d	96 a	100 a	66 h
Pyroxsulam + MSO	0.21 oz ai/A + 0.8% v/v	0 a	39 e	26 d	8 fg	78 ef	99 a	100 a	90 c-f
Pyroxsulam + Mineral oil	0.25 oz ai/A + 0.8% v/v	0 a	43 de	26 d	10 ef	92 b-e	99 a	100 a	99 a-d
Pinoxaden + Adigor + clprld & flxypr + MCPA LVE	0.86 oz ai/A + 9.6 fl oz/A + 0.187 + 0.375	1 a	91 a	90 ab	91 a	97 abc	99 a	100 a	99 a-d
Fenoxaprop + bromoxynil & MCPA	1.3 oz ai/A + 0.5	0 a	73 b	79 b	76 b	100 a	97 a	100 a	107 a
Clodinafop + thifen & triben TM	0.8 oz ai/A + 0.3 oz ai/A	0 a	38 e	24 d	20 d	94 a-d	100 a	100 a	91 b-f
Flucarbazone + 2,4-D LVE	0.28 oz ai/A + 0.375	1 a	66 bc	60 c	38 c	100 a	100 a	100 a	90 c-f
Prpxcbzn & mslfrn + NIS + AMS	0.18 oz ai/A + 0.25% v/v + 1.52 lb/A	0 a	13 g	24 d	4 fg	97 abc	100 a	100 a	96 a-e

[1] Means followed by the same letter are not significantly different (P=0.05).

[2] Flslm & flxpr & pxslm is a 1:39.6:5.9 formulated mixture of florasulam, fluroxypyr, and pyroxsulam; clprld & flxypr is a 1:1.1 formulated mixture of clopyralid and fluroxypyr; thfen & triben TM is a 4:1 formulated mixture of thifensulfuron and tribenuron; prpxcbzn & mslfrn is a 4:1 formulated mixture of propoxycarbazone and mesosulfuron; NIS is nonionic surfactant; and AMS is ammonium sulfate.

[3] All rates expressed in pounds acid equivalent per acre unless duly noted.

[4] Additional visual injury evaluations were taken June 15 and July 12 with no injury observed in any herbicide treatment.

Triallate pre-plant and pre-emergence incorporated application effects on spring wheat varieties. Joan Campbell and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) An experiment was established near Moscow, Idaho to determine the effect of triallate applied pre-plant (PPI) and pre-emergence (PRE) incorporated on six spring wheat varieties. Wheat was planted 1.5 inch deep with a seven-opener cone seeder set to 7 inch row spacing. Triallate was applied at 1.25 lb ai/acre with a tractor mounted sprayer delivering 20 gpa at 3 mph and 37 psi (Table 1). Treated and untreated plots were worked immediately after triallate application. The PPI treatment was worked twice with a field cultivator and the PRE treatments were worked once with a harrow. Soil pH, organic matter, CEC, and texture were 4.0, 5.1%, 45 cmol/kg, and clay, respectively. The experimental design was a split block design with four replications. Main plots were a factorial of herbicide and application method and subplots were variety. Experimental units were 4 ft by 25 ft. Crop injury was observed throughout the season and spring wheat grain was harvested at maturity.

Table 1. Environmental conditions at herbicide application.

Date	April 30, 2007	May 1, 2007
Application	Pre-plant incorporated	Pre-emergence incorporated
Air temperature (F)	63	66
Soil temperature (F)	60	61
Relative humidity (%)	39	32
Soil moisture	dry	dry

Soil conditions were dry and spring wheat growth was poor across all varieties and treatments. There were no treatment by variety interactions. 'Buck Pronto' and 'Jefferson' grain yield was lower than the other varieties, and 'Hank', 'Nick', and 'Tara' grain yield was higher than the other varieties (Table 2). Test weight followed a similar pattern with the exception of 'Jefferson' which was equal to 'Nick' and 'Tara'.

Averaged over varieties, grain yield was best from the untreated PPI treatment (Table 3). However, incorporation timing affected grain yield more than triallate (Table 4). Grain yield was higher with PPI incorporated treatments (70 lb/a) compared to PRE treatments (54 lb/a), and grain yield was higher with the untreated (66 lb/a) compared to triallate treatments (58 lb/a) averaged over incorporation timing. Test weight did not differ among treatments averaged over varieties (Table 3).

Table 2. Spring wheat grain yield averaged over triallate treatment.

Variety	Wheat type	Grain yield	Grain test weight
		lb/acre	lb/bu
Nick	white	96 a[1]	59.6 a
Tara	hard red	91 a	59.4 a
Hank	hard red	84 a	59.0 b
Westbred 926	hard red	45 b	58.3 c
Buck Pronto	hard red	30 c	57.9 d
Jefferson	hard red	27 c	59.6 a

[1] Means followed by the same letter are not statistically different according to LS means (0.05).

Table 3. Effect of triallate treatment and application time on spring wheat grain averaged over variety.

Treatment	Incorporation	Wheat grain yield	Wheat test weight
		lb/acre	lb/bushel
Untreated control	PPI	76 a[1]	59.0 a
Untreated control	PRE	56 bc	59.0 a
Triallate	PPI	64 b	58.8 a
Triallate	PRE	52 c	58.9 a

[1] Means followed by the same letter are not statistically different according to LS Means (0.05).

Table 4. Orthogonal contrasts for spring wheat grain yield averaged over variety.

Treatment contrast	Wheat grain yield	Probability > F
	lb/acre	
PPI vs PRE	70 vs 54	0.0001
Untreated vs triallate	66 vs 58	0.02

Grass weed control in wheat with pinoxaden/adjuvant formulation. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in winter wheat near Potlatch, ID and in spring wheat near Troy, ID to evaluate grass weed control and wheat response with a combined pinoxaden/adjuvant formulation. Studies were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). The spring wheat site was sprayed with thifensulfuron/tribenuron at 0.0234 lb ai/A and clopyralid at 0.112 lb ae/A on June 19, 2007 to control broadleaf weeds. Wheat response and grass weed control were evaluated visually. Wheat seed was harvested at the Potlatch and Troy sites with a small plot combine on August 8 and 13, 2007, respectively.

Table 1. Application and soil data.

Location	Potlatch, Idaho	Troy, Idaho
Crop	'Madsen' winter wheat	'Alpowa' spring wheat
Application date	May 7, 2007	June 15, 2007
Growth stage		
Wheat	4 tiller	jointing
Quackgrass (AGRRE)	3 tiller	--
Interrupted windgrass (APEIN)	3 tiller	--
Italian ryegrass (LOLMU)	--	8 tiller
Air temperature (F)	71	70
Relative humidity (%)	59	55
Wind (mph, direction)	3, N	0
Cloud cover (%)	60	30
Soil moisture	adequate	adequate
Soil temperature at 2 in (F)	56	66
pH	4.9	4.7
OM (%)	3.6	3.6
CEC (meq/100g)	22	22
Texture	silt loam	silt loam

At Potlatch, no treatment visually injured winter wheat (data not shown). Only mesosulfuron treatments controlled quackgrass (AGRRE) 90% or better (Table 2). All treatments controlled interrupted windgrass (APEIN) 99%. Wheat seed yield did not differ among treatments or the untreated check.

At Troy, flucarbazone and mesosulfuron treatments injured spring wheat 27 to 30% and 10 to 21%, respectively (Table 3). Mesosulfuron, trade name Osprey, is not registered for use on spring wheat. Flucarbazone applied at jointing can injure wheat. All treatments controlled Italian ryegrass 75 to 94%. Wheat seed yield was best with mesosulfuron alone and pinoxaden/adjuvant plus pyrasulfotole/MCPA but did not differ from pinoxaden/adjuvant combined with florasulam/MCPA or bromoxynil plus thifensulfuron/tribenuron and mesosulfuron plus bromoxynil/MCPA. Wheat seed yield was less with flucarbazone alone or combined with bromoxynil/MCPA than the untreated check.

Table 2. Quackgrass and interrupted windgrass control and winter wheat response with pinoxaden/adjuvant formulation near Potlatch, ID in 2007.

Treatment[1]	Rate	Weed control[2]		Wheat yield
		AGRRE	APEIN	
	lb ai/A	%		lb/A
Pinoxaden/adjuvant	0.0534	0	99	6684
Pinoxaden/adjuvant + bromoxynil/MCPA	0.0534 0.5	0	99	6731
Pinoxaden/adjuvant + bromoxynil + thifensulfuron/tribenuron	0.0534 0.5 0.028	0	99	6605
Pinoxaden/adjuvant + pyrasulfotole/bromoxynil	0.0534 0.22	0	99	6553
Pinoxaden/adjuvant + florasulam/MCPA	0.0534 0.315	0	99	7026
Fenoxaprop	0.083	0	99	6981
Fenoxaprop + bromoxynil/MCPA	0.083 0.5	0	99	6598
Fenoxaprop + bromoxynil + thifensulfuron/tribenuron	0.083 0.5 0.028	0	99	6936
Mesosulfuron	0.0134	90	99	6952
Mesosulfuron + bromoxynil/MCPA	0.0134 0.5	98	99	6718
Mesosulfuron + bromoxynil + thifensulfuron/tribenuron	0.0134 0.5 0.028	93	99	6829
Untreated check	--	--	--	6774
LSD (0.05)		4	NS	NS
Density (plants/ft^2)		3	1	

[1] A non-ionic surfactant (R-11) at 0.25 and 0.5% v/v was applied with thifensulfuron/tribenuron and mesosulfuron treatments, respectively. Urea ammonium nitrate (URAN) at 5% v/v was applied with all mesosulfuron treatments.
[2] June 28, 2007 evaluation.

Table 3. Italian ryegrass control and spring wheat response with pinoxaden/adjuvant formulation near Troy, ID in 2007.

Treatment[1]	Rate	Wheat injury[2]	LOLMU control[2]	Wheat yield[3]
	lb ai/A	%		lb/A
Pinoxaden/adjuvant	0.0534	0	92	2652
Pinoxaden/adjuvant +	0.0534			
bromoxynil/MCPA	0.5	2	90	2731
Pinoxaden/adjuvant +	0.0534			
bromoxynil +	0.5			
thifensulfuron/tribenuron	0.028	0	94	2945
Pinoxaden/adjuvant +	0.0534			
pyrasulfotole/bromoxynil	0.22	3	84	3331
Pinoxaden/adjuvant +	0.0534			
florasulam/MCPA	0.315	5	94	3006
Flucarbazone	0.026	30	75	1525
Flucarbazone +	0.026			
bromoxynil/MCPA	0.5	30	80	2014
Flucarbazone +	0.026			
bromoxynil +	0.5			
thifensulfuron/tribenuron	0.028	27	80	2084
Mesosulfuron	0.0134	10	92	3319
Mesosulfuron +	0.0134			
bromoxynil/MCPA	0.5	18	79	3160
Mesosulfuron +	0.0134			
bromoxynil +	0.5			
thifensulfuron/tribenuron	0.028	21	85	2745
Untreated check	--	--	--	2568
LSD (0.05)		10	NS	545
Density (plants/ft^2)			2	

[1] A non-ionic surfactant (R-11) was applied at 0.25% v/v with thifensulfuron/tribenuron and flucarbazone treatments and at 0.5% v/v with mesosulfuron treatments. Urea ammonium nitrate (URAN) at 5% v/v was applied with all mesosulfuron treatments.

[2] July 18, 2007 evaluation.

[3] Only 3 replications were included due to a fertility problem in one replication.

Broadleaf weed control in winter wheat with pyrasulfotole/bromoxynil. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in winter wheat near Genesee and Moscow, Idaho to evaluate broadleaf weed control and wheat response with pyrasulfotole/bromoxynil, a herbicide with a new mode of action for cereals. Studies were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). The entire Moscow site was sprayed with pinoxaden at 0.0534 lb ai/A on May 15, 2007 to control grass weeds. Wheat response and broadleaf weed control were evaluated visually. Wheat seed was harvested at the Genesee and Moscow sites with a small plot combine on August 2 and 7, 2007, respectively.

Table 1. Application and soil data.

Location	Genesee, Idaho	Moscow, Idaho
Winter wheat variety	'Eddie' hard red	'Madsen' soft white
Application date	April 26, 2007	April 26, 2007
Growth stage		
Winter wheat	5 tiller	3 tiller
Prickly lettuce (LACSE)	4 inch diameter	--
Common lambsquarters (CHEAL)	4 leaf	--
Catchweed bedstraw (GALAP)	5 inches tall	--
Mayweed chamomile (ANTCO)	2 inches tall	--
Scentless chamomile (MATIN)	--	3 to 10 inches tall
Air temperature (F)	64	56
Relative humidity (%)	48	56
Wind (mph, direction)	1, W	1, W
Cloud cover (%)	80	40
Soil moisture	adequate	excessive
Soil temperature at 2 in (F)	60	50
pH	5.2	5.5
OM (%)	4.6	3.6
CEC (meq/100g)	31	23
Texture	silt loam	silt loam

At Genesee, no treatment visually injured winter wheat (data not shown). All treatments controlled prickly lettuce (LACSE) 93% or better except metribuzin and pyrasulfotole/bromoxynil at the lowest rate (Table 2). Common lambsquarters (CHEAL) control was 92% or greater with all treatments. Catchweed bedstraw (GALAP) control was poorest with metribuzin (55%) compared to all other treatments (81 to 99%). Mayweed chamomile (ANTCO) control was better with pyrasulfotole/bromoxynil combined with bromoxynil/MCPA, fluroxypyr/bromoxynil, and fluroxypyr/clopyralid (99%) than pyrasulfotole/bromoxynil at 0.145 lb ai/A and metribuzin, clopyralid/2,4-D, fluroxypyr/bromoxynil at 0.477 lb ai/A (75 to 85%). Wheat seed yield did not differ among treatments or the untreated check.

At Moscow, no treatment visually injured winter wheat (data not shown). All treatments controlled scentless chamomile 83 to 99%, except metribuzin and bromoxynil/MCPA alone and the three lowest rates of pyrasulfotole/bromoxynil alone (Table 3). Wheat seed yield was higher for fluroxypyr/clopyralid than metribuzin and cloypralid/2,4-D alone; pyrasulfotole/bromoxynil combined with bromoxynil/MCPA or fluroxypyr/bromoxynil; and pyrasulfotole/bromoxynil at 0.145 and 0.22 lb ai/A. Wheat seed yield was higher for all treated plots compared to the untreated check.

Table 2. Broadleaf weed control and winter wheat response with pyrasulfotole/bromoxynil near Genesee, ID in 2007.

		Weed control[2]				Wheat
Treatment	Rate[1]	LACSE	CHEAL	GALAP	ANTCO	yield
	lb ai/A	%				lb/A
Pyrasulfotole/bromoxynil	0.145	84	92	84	85	7461
Pyrasulfotole/bromoxynil	0.18	99	93	99	90	7144
Pyrasulfotole/bromoxynil	0.22	99	98	99	89	7272
Pyrasulfotole/bromoxynil	0.24	99	98	99	94	7044
Pyrasulfotole/bromoxynil +	0.18					
metribuzin	0.1875	99	99	99	92	6936
Pyrasulfotole/bromoxynil +	0.18					
bromoxynil/MCPA	0.5	99	99	81	96	7072
Pyrasulfotole/bromoxynil +	0.18					
clopyralid/2,4-D	0.6	99	99	99	99	6904
Pyrasulfotole/bromoxynil +	0.18					
fluroxypyr/clopyralid	0.25	99	99	99	99	6742
Pyrasulfotole/bromoxynil +	0.18					
fluroxypyr/bromoxynil	0.477	99	99	99	99	6778
Metribuzin	0.1875	80	94	55	75	6794
Bromoxynil/MCPA	0.5	96	99	84	79	6732
Clopyralid/2,4-D	0.5	93	97	97	94	6672
Fluroxypyr/clopyralid	0.25	98	93	97	94	7157
Fluroxypyr/bromoxynil	0.477	94	94	99	85	6810
Fluroxypyr/bromoxynil	0.62	99	95	99	91	6886
Fluroxypyr/bromoxynil +	0.477					
metribuzin	0.14	99	99	99	92	6526
Untreated check	--	--	--	--	--	7249
LSD (0.10)		10	5	18	12	NS
Density (plants/ft^2)		1	2	0.5	1	

[1] Rate is in lb ae/A for bromoxynil/MCPA and all treatments containing fluroxypyr or clopyralid.

[2] May 23, 2007 evaluation.

Table 3. Scentless chamomile control and winter wheat response with pyrasulfotole/bromoxynil near Moscow, ID in 2007.

Treatment	Rate[1]	Scentless chamomile control[2]	Wheat yield
	lb ai/A	%	lb/A
Pyrasulfotole/bromoxynil	0.145	55	9002
Pyrasulfotole/bromoxynil	0.18	69	9534
Pyrasulfotole/bromoxynil	0.22	71	8779
Pyrasulfotole/bromoxynil	0.24	83	9503
Pyrasulfotole/bromoxynil +	0.18		
metribuzin	0.1875	96	9254
Pyrasulfotole/bromoxynil +	0.18		
bromoxynil/MCPA	0.5	98	9191
Pyrasulfotole/bromoxynil +	0.18		
clopyralid/2,4-D	0.6	99	9882
Pyrasulfotole/bromoxynil +	0.18		
fluroxypyr/clopyralid	0.25	99	9640
Pyrasulfotole/bromoxynil +	0.18		
fluroxypyr/bromoxynil	0.477	95	9179
Metribuzin	0.1875	67	9121
Bromoxynil/MCPA	0.5	78	9297
Clopyralid/2,4-D	0.5	99	8516
Fluroxypyr/clopyralid	0.25	99	10705
Fluroxypyr/bromoxynil	0.477	92	10490
Fluroxypyr/bromoxynil	0.62	83	9353
Fluroxypyr/bromoxynil +	0.477		
metribuzin	0.14	99	9814
Untreated check	--	--	5417
LSD (0.05)		18	1466
Density (plants/ft^2)		9	

[1] Rate is in lb ae/A for bromoxynil/MCPA and all treatments containing fluroxypyr or clopyralid.

[2] July 10, 2007 evaluation.

<u>Broadleaf weed control with florasulam/MCPA in winter wheat</u>. Traci A. Rauch and Donald C. Thill (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established in 'Eddie' hard red winter wheat to evaluate broadleaf weed control with florasulam/MCPA ester alone or in combination with other broadleaf herbicides near Genesee, Idaho. The experimental design was a randomized complete block with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Winter wheat injury and weed control were evaluated visually. Winter wheat seed was harvested with a small plot combine on August 2, 2007.

Table 1. Application and soil data.

Application date	April 27, 2007
Growth stage	
Wheat	5 tiller
Catchweed bedstraw (GALAP)	5 inches tall
Mayweed chamomile (ANTCO)	2 inches tall
Common lambsquarters (CHEAL)	4 leaf
Prickly lettuce (LACSE)	4 inches in diameter
Air temperature (F)	67
Relative humidity (%)	51
Wind (mph, direction)	1, E
Cloud cover (%)	10
Soil moisture	adequate
Soil temperature at 2 in (F)	50
pH	5.2
OM (%)	4.6
CEC (meq/100g)	31
Texture	silt loam

No treatment visually injured winter wheat (data not shown). Catchweed bedstraw (GALAP), mayweed chamomile (ANTCO), and common lambsquarters (CHEAL) control ranged from 64 to 98, 80 to 99, and 96 to 99%, respectively, and did not differ among treatments (Table 2). Pyrasulfotole/bromoxynil treatments and florasulam/MCPA plus bromoxynil controlled prickly lettuce (LASCE) the best (99%) but did not differ from fluroxypyr/clopyralid plus MCPA ester (96%). Wheat seed yield did not differ among treatments and ranged from 5258 to 6629 lb/A.

Table 2. Broadleaf weed control and wheat response with florasulam/MCPA combinations near Genesee, Idaho in 2007.

		Weed control				Wheat
Treatment[1]	Rate	GALAP	ANTCO	CHEAL	LASCE	yield
	lb ai/A	%				lb/A
Florasulam/MCPA	0.315	81	92	98	86	6461
Pyrasulfotole/bromoxynil	0.18	98	92	99	99	6131
Pyrasulfotole/bromoxynil	0.22	82	98	96	99	6629
Florasulam/MCPA +	0.315					
pyrasulfotole/bromoxynil	0.18	94	99	99	99	5828
Florasulam/MCPA +	0.315					
pyrasulfotole/bromoxynil	0.22	99	99	99	99	6294
Florasulam/MCPA +	0.315					
fluroxypyr	0.126	91	85	96	87	5694
Florasulam/MCPA +	0.315					
bromoxynil	0.25	97	99	99	99	5258
Florasulam/MCPA +	0.315					
clopyralid	0.124	81	96	98	86	5794
Bromoxynil/MCPA	0.625	85	83	99	87	5397
Clopyralid/MCPA	0.606	64	80	99	84	5924
Fluroxypyr/clopyralid +	0.187					
MCPA ester	0.347	93	85	99	96	5978
Thifensulfuron/tribenuron +	0.0188					
MCPA ester	0.347	90	82	97	85	5520
Untreated check	--	--	--	--	--	5589
LSD (0.05)		NS	NS	NS	11	NS
Density (plants/ft^2)		0.5	0.5	1	2	

[1] A nonionic surfactant (R-11) at 0.25% v/v rate was included with thifensulfuron/tribenuron.

[2] Evaluation date June 5, 2007.

Downy brome and jointed goatgrass control in winter wheat. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established near Lewiston, ID to evaluate downy brome and jointed goatgrass control with 1) propoxycarbazone or propoxycarbazone/mesosulfuron combinations and 2) pendimethalin and imazamox plus adjuvants; and near Uniontown, WA to evaluate downy brome control with 3) flucarbazone and imazamox plus thifensulfuron/tribenuron combinations. All plots were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). In all experiments, wheat injury and downy brome control were evaluated visually during the growing season, and wheat seed was harvested on July 25 and August 2, 2007 at Lewiston and Uniontown, respectively.

Table 1. Application and soil data.

	Propoxycarbazone study			Imazamox and pendimethalin study	Imazamox and flucarbazone study	
Location	Lewiston, Idaho			Lewiston, Idaho	Uniontown, Washington	
Wheat variety	'ORCF101'			'ORCF101'	'ORCF101'	
Application date	10/25/06	3/19/07	4/6/07	4/13/07	4/20/07	4/24/07
Growth stage						
Winter wheat	pre	3 leaf	1 tiller	2 tiller	4 tiller	4 tiller
Downy brome (BROTE)	pre	1 leaf	3 leaf	1 tiller	2 tiller	2 tiller
Jointed goatgrass (AEGCY)	pre	1 tiller	3 tiller	4 tiller	--	--
Air temperature (F)	55	60	68	60	62	58
Relative humidity (%)	55	58	53	50	48	64
Wind (mph, direction)	1, NNW	3, W	2, N	4, S	4, NW	3, S
Cloud cover (%)	30	60	70	60	80	100
Soil moisture	dry	moist	moist	moist	moist	moist
Soil temperature at 2 in (F)	49	48	52	54	54	50
pH	5.0				5.3	
OM (%)	6.5				4.1	
CEC (meq/100g)	30				25	
Texture	silt loam				silt loam	

In the propoxycarbazone study, all spring-applied metribuzin treatments injured winter wheat 2 to 4% (Table 2). Jointed goatgrass (AEGCY) control was better with propoxycarbazone plus propoxycarbazone/mesosulfuron treatments (86 and 82%) than propoxycarbazone alone, flufenacet/metribuzin alone, and flufenacet/metribuzin + propoxycarbazone + metribuzin (0 to 59%). All treatments controlled downy brome (BROTE) 99% except flufenacet/metribuzin alone (5%). Wheat seed yield samples were contaminated with jointed goatgrass seed and therefore did not correlate well with weed control. Wheat seed yield in the untreated check tended to be lower than all other treatments.

In the imazamox and pendimethalin study, propoxycarbazone/mesosulfuron plus pyrasulfotole/bromoxynil injured winter wheat 8% (Table 3). All treatments containing imazamox controlled jointed goatgrass 96% or better, while propoxycarbazone/mesosulfuron plus pyrasulfotole/bromoxynil suppressed jointed goatgrass 66%. Pendimethalin alone did not control jointed goatgrass (0%). Downy brome control was 95% or better with all treatments except pendimethalin alone (0%). Wheat seed yield was lowest in the untreated check and pendimethalin alone, but did not differ from propoxycarbazone/mesosulfuron plus pyrasulfotole/bromoxynil.

In the imazamox and flucarbazone study, imazamox combined with UAN at 30% v/v injured wheat 13 and 10% (Table 4). Downy brome control was 92% or greater with all treatments except thifensulfuron/tribenuron alone (62%). Wheat seed yield did not differ among treatments and the untreated check.

Table 2. Downy brome and jointed goatgrass control and wheat response with propoxycarbazone and propoxycarbazone/mesosulfuron near Lewiston, Idaho in 2007.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	Weed control[4]		Wheat yield[5]
				AEGCY	BROTE	
	lb ai/A		------------------------	--------%--------	------------------------	lb/A
Flufenacet/metribuzin	0.425	preemergence	0	0	5	1475
Propoxycarbazone + NIS	0.04 + 0.5% v/v	1 leaf	0	38	99	1663
Propoxycarbazone + metribuzin	0.04 + 0.188	3 leaf	2	65	99	1882
Flufenacet/metribuzin	0.425	preemergence				
propoxycarbazone +metribuzin	0.026 + 0.188	3 leaf	4	59	99	1815
Propoxycarbazone+	0.026	1 leaf				
propoxycarbazone +metribuzin	0.026 +0.188	3 leaf	4	72	99	1770
Propoxycarbazone/mesosulfuron	0.044	3 leaf	0	70	99	1584
Flufenacet/metribuzin +	0.425	preemergence				
propoxycarbazone/mesosulfuron	0.044	3 leaf	0	72	99	1727
Propoxycarbazone +	0.026	1 leaf				
Propoxycarbazone/mesosulfuron	0.044	3 leaf	0	82	99	1578
Propoxycarbazone +	0.04	1 leaf				
Propoxycarbazone/mesosulfuron	0.044	3 leaf	0	86	99	1519
Untreated check	--	--		--	--	1351
LSD (0.05)			1	21	5	313
Density (plants/ft^2)				10	1	

[1] 90% nonionic surfactant (R-11) was applied with propoxycarbazone (except propoxycarbazone alone) treatments at 0.25% v/v and propoxycarbazone/mesosulfuron at 0.5% v/v. Urea ammonium nitrate (URAN) at 5% v/v was applied with propoxycarbazone/mesosulfuron.

[2] Application timing based on downy brome growth stage.

[3] April 23, 2007 evaluation.

[4] June 4, 2007 evaluation.

[5] Yield based on unclean samples contaminated with jointed goatgrass.

Table 3. Downy brome and jointed goatgrass control and wheat response with pendimethalin and imazamox plus adjuvants combinations near Lewiston, Idaho in 2007.

Treatment[1]	Rate	Wheat injury[2]	Weed control[3] AEGCY	Weed control[3] BROTE	Wheat yield[4]
	lb ai/A	%	%	%	lb/A
Imazamox	0.031	0	98	99	2036
Imazamox + pyrasulfotole/bromoxynil	0.031 0.22	0	99	99	2119
Imazamox + UAN	0.031 30% v/v	0	99	99	1957
Imazamox + pyrasulfotole/bromoxynil + UAN	0.031 0.22 30% v/v	0	98	99	2024
Imazamox + AMS	0.031 15 lb ai/100 gal	0	96	98	2096
Imazamox + pyrasulfotole/bromoxynil + AMS	0.031 0.22 15 lb ai/100 gal	0	98	99	2048
Imazamox + AMS	0.031 25 lb ai/100 gal	0	97	95	2098
Imazamox + pyrasulfotole/bromoxynil + AMS	0.031 0.22 25 lb ai/100 gal	0	98	99	2129
Pendimethalin	0.95	0	0	0	1333
Imazamox + pendimethalin	0.031 0.71	0	98	99	1912
Imazamox + pendimethalin	0.031 0.95	0	96	97	2131
Propoxycarbazone/mesosulfuron + pyrasulfotole/bromoxynil	0.04 0.22	8	66	99	1651
Untreated check	--	--	--	--	1462
LSD (0.05)		1	9	2	311
Density (plants/ft^2)			10	1	

[1] Non ionic surfactant (R-11) was applied at 0.25% v/v with all treatments except pendimethalin alone and at 0.5% v/v with propoxycarbazone. UAN is urea ammonium nitrate (URAN) and was applied at 2.5% v/v with imazamox treatments, except with UAN at 30% v/v or AMS and at 5% v/v with propoxycarbazone.

[2] April 23, 2007 evaluation.

[3] June 4, 2007 evaluation.

[4] Yield based upon unclean samples contaminated with jointed goatgrass.

Table 4. Downy brome control and wheat response with flucarbazone and imazamox plus thifensulfuron/tribenuron combinations near Uniontown, WA in 2007.

Treatment[1]	Rate	Wheat injury[2]	Downy brome control[2]	Wheat yield
	lb ai/A	-------------------	----%------------------	lb/A
Imazamox	0.039	0	99	5013
Thifensulfuron/tribenuron	0.001875	6	62	5493
Imazamox +	0.039			
thifensulfuron/tribenuron	0.01875	9	99	4542
Imazamox +	0.039			
MCPA ester	0.23	2	99	5112
Imazamox +	0.039			
MCPA ester +	0.23			
thifensulfuron/tribenuron	0.01875	1	99	5263
Imazamox +	0.039			
MCPA ester +	0.23			
UAN	30% v/v	10	99	5077
Imazamox +	0.039			
MCPA ester+	0.23			
thifensulfuron/tribenuron +	0.01875			
UAN	30% v/v	13	99	4494
Flucarbazone +	0.0263			
NIS +	0.25% v/v			
UAN	5% v/v	0	99	4890
Flucarbazone +	0.0263			
Basic blend	01% v/v	0	99	4726
Flucarbazone +	0.0263			
MSO/NIS/NH_4/buffer	1.75 pt/A	7	99	4792
Untreated check	--	--	--	5447
LSD (0.05)		9	22	NS
Density (plants/ft^2)			0.5	

[1] NIS is a nonionic surfactant (R-11) and was applied at 0.25% v/v with all imazamox and thifensulfuron/tribenuron treatments. UAN is urea ammonium nitrate (URAN) and was applied at 2.5% v/v with imazamox treatments, except UAN at 30% v/v. Basic blend (Quad 7) contains a buffering agent and ammonia. Modified seed oil/NIS/NH_4/buffer is Renegade.

[2] May 25, 2007 evaluation.

Scentless chamomile control with sulfonylurea herbicides in winter wheat. Traci A. Rauch and Donald C. Thill (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established in 'Madsen' winter wheat to evaluate scentless chamomile control with sulfonylurea herbicides near Moscow, Idaho. The experimental design was a randomized complete block with four replications and included an untreated check. Plots were 8 by 25 ft. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). The entire study was sprayed with pinoxaden at 0.0534 lb ai/A on May 15, 2007 to control grass weeds. Winter wheat injury and weed control were evaluated visually. Winter wheat seed was harvested with a small plot combine on August 7, 2007.

Table 1. Application and soil data.

Application date	April 25, 2007
Wheat growth stage	3 tiller
Scentless chamomile (MATIN) growth stage	3 to 10 in
Air temperature (F)	57
Relative humidity (%)	65
Wind (mph, direction)	3, W
Cloud cover (%)	100
Soil moisture	excessive
Soil temperature at 2 in (F)	50
pH	5.5
OM (%)	3.6
CEC (meq/100g)	23
Texture	silt loam

On May 14, INC-104 and INC-103 visually injured winter wheat 11 and 12%, respectively (Table 2). By June 10, wheat injury ranged from 0 to 10% and did not differ among treatments. All treatments controlled scentless chamomile 99%, except pyrasulfotole/bromoxynil plus bromoxynil/MCPA (82%). Wheat seed yield for all treatments was greater than the untreated check and did not differ among herbicide treatments.

Table 2. Scentless chamomile control and winter wheat response with sulfonylurea herbicides near Moscow, Idaho in 2007.

Treatment[1]	Rate	Wheat injury 5/14/07	Wheat injury 6/10/07	MATIN control[2]	Wheat yield
	lb ai/A			%	lb/A
Metsulfuron	0.00375	0	0	99	9252
Metsulfuron +	0.00375				
2,4-D amine	0.25	0	0	99	9656
Tribenuron	0.0155	0	0	99	9079
INC-101	0.028	0	1	99	9414
INC-102	0.0155	2	6	99	9484
INC-103	0.0188	12	5	99	9191
INC-104	0.018	11	10	99	8888
Thifensulfuron/tribenuron (Nimble)	0.028	2	4	99	9457
Thifensulfuron/tribenuron (Harmony Extra XP)	0.028	2	6	99	9259
Prosulfuron	0.0135	0	0	99	9255
Pyrasulfotole/bromoxynil +	0.22				
bromoxynil/MCPA	0.5	0	2	82	8835
Untreated check	--	--	--	--	7014
LSD (0.05)		4	NS	10	1141
Density (plants/ft^2)				9	

[1] A nonionic surfactant (R-11) at 0.25% v/v rate was included with all treatments except pyrasulfotole/bromoxynil + bromoxynil/MCPA. Nimble and Harmony Extra XP are trade names for thifensulfuron/tribenuron.

[2] Evaluation date July 10, 2007.

Broadleaf weed control with pyroxsulam in winter wheat. Traci A. Rauch and Donald C. Thill (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established in 'ORCF 101' winter wheat near Uniontown, WA to evaluate prickly lettuce and tumble mustard control with pyroxsulam. The experimental design was a randomized complete block with four replications and plots were 8 by 25 ft. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Winter wheat injury and broadleaf weed control were evaluated visually. Wheat seed was harvested with a small plot combine on August 2, 2007.

Table 1. Application and soil data.

Application date	April 23, 2007
Growth stage	
Wheat	2 tiller
Prickly lettuce (LACSE)	2 inch diameter
Tumble mustard (SSYAL)	3 inch diameter
Air temperature (F)	62
Relative humidity (%)	59
Wind (mph, direction)	3, NW
Cloud cover (%)	60
Soil moisture	adequate
Soil temperature at 2 in (F)	55
pH	5.3
OM (%)	4.1
CEC (meq/100g)	25
Texture	silt loam

Mesosulfuron plus COC and pyroxsulam plus 2,4-D ester injured 6 and 9%, respectively (Table 2). Prickly lettuce and tumble mustard control was 82 to 99 and 96 to 99%, respectively, with all treatments. Wheat seed yield did not differ among treatments or from the untreated check.

Table 2. Broadleaf weed control and wheat response with pyroxsulam near Uniontown, WA in 2007.

Treatment[1]	Rate	Weed control LACSE[2]	Weed control SSYAL[3]	Spring wheat Injury	Spring wheat Yield
	lb ai/A	%	%	%	lb/A
Pyroxsulam +	0.0134				
NIS	0.5% v/v	99	96	0	5059
Pyroxsulam +	0.0167				
NIS	0.5% v/v	99	99	0	4933
Pyroxsulam +	0.0167				
MSO	1% v/v	99	99	0	4546
Pyroxsulam +	0.0167				
2,4-D ester +	0.25				
NIS	0.5% v/v	99	99	9	5320
Pyroxsulam +	0.0167				
metsulfuron +	0.0019				
NIS	0.5% v/v	99	99	2	4586
Sulfosulfuron +	0.031				
NIS	0.5% v/v	82	96	1	4830
Propoxycarbazone +	0.04				
NIS	0.5% v/v	99	96	0	4458
Mesosulfuron +	0.0134				
NIS	0.5% v/v	99	97	0	4708
Mesosulfuron +	0.0134				
MSO	1% v/v	99	99	6	4363
Chlorsulfuron/metsulfuron +	0.0116				
NIS	0.25% v/v	99	99	0	5317
Untreated check	--	--	--	--	4573
Density (plants/ft^2)		0.5	1	--	--
LSD (0.05)		NS	NS	3	NS

[1] NIS is a 90% nonionic surfactant (Agral 90) and MSO is a methylated seed oil (Scoil).

[2] April 30, 2007 evaluation date.

[3] May 25, 2007 evaluation date.

Wild oat control in winter wheat with pinoxaden and a deposition aid. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in winter wheat to evaluate wild oat control with pinoxaden at reduced rates with and without a deposition aid (In-Place). The plots were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). The study was oversprayed with clopyralid at 0.124 lb ae/A on May 15, 2007 to control Canada thistle. Wild oat control was evaluated visually during the growing season. Wheat seed was harvested with a small plot combine on August 8, 2007.

Table 1. Application and soil data.

Application date	May 7, 2007
Growth stage	
Winter wheat 'Madsen'	4 tiller
Wild oat	2 leaf
Air temperature (F)	63
Relative humidity (%)	69
Wind (mph, direction)	2, W
Cloud cover (%)	20
Soil moisture	adequate
Soil temperature at 2 in (F)	52
pH	4.9
OM (%)	3.6
CEC (meq/100g)	22
Texture	silt loam

No treatment visually injured winter wheat (data not shown). Wild oat control tended to be slightly lower with pinoxaden alone (97%) compared to pinoxaden plus In-Place (99%) at 0.032 lb ai/A (60% of the use rate) but control was not different among all pinoxaden treatments (Table 2). Wheat seed yield did not differ among treatments but tended to be the lowest in the untreated check.

Table 2. Wild oat control and winter wheat response with pinoxaden and a deposition aid near Potlatch, Idaho in 2007.

Treatment[1]	Rate	Wild oat control[2]	Winter wheat yield
	lb ai/A	%	lb/A
Pinoxaden (use rate) +	0.053		
Adigor	0.6 pt/A	99	6403
Pinoxaden (80% of use rate) +	0.0425		
Adigor	0.48 pt/A	99	6391
Pinoxaden (80% of use rate) +	0.0425		
Adigor +	0.48 pt/A		
In-Place	1.65 oz/A	99	6688
Pinoxaden (60% of use rate) +	0.032		
Adigor	0.36 pt/A	97	6374
Pinoxaden (60% of use rate) +	0.032		
Adigor +	0.36 pt/A		
In-Place	1.25 oz/A	99	6529
Untreated check	--	--	6228
LSD (0.05)		NS	NS
Density (plants/ft^2)		2	

[1] Adigor, an adjuvant, was applied with all pinoxaden treatments. In-Place is a deposition aid.

[2] July 20, 2007 evaluation.

Wild oat control in winter wheat with pyrasulfotole/bromoxynil combined with grass herbicides. Traci A. Rauch and Donald C. Thill (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established in 'Coda' winter wheat to evaluate wild oat control with pyrasulfotole/bromoxynil combined with grass herbicides near Melrose, Idaho. The experimental design was randomized complete block with four replications and included an untreated check. Plots were 8 by 25 ft. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). The entire study was sprayed with thifensulfuron/tribenuron at 0.0156 lb ai/A plus fluroxypyr/MCPA ester at 0.66 lb ae/A on May 24, 2007. Winter wheat injury and weed control were evaluated visually. Winter wheat seed was harvested with a small plot combine on August 9, 2007.

Table 1. Application and soil data.

Application date	May 9, 2007
Wheat growth stage	3 tiller
Wild oat growth stage	2 leaf
Air temperature (F)	67
Relative humidity (%)	53
Wind (mph, direction)	4, NW
Cloud cover (%)	20
Soil moisture	adequate
Soil temperature at 2 in (F)	60
pH	4.8
OM (%)	4.3
CEC (meq/100g)	27
Texture	silt loam

No treatment visually injured winter wheat (data not shown). Wild oat control was 90 to 99% with all treatments, except pyrasulfotole/bromoxynil alone (0%) (Table 1). Pyrasulfotole/bromoxynil is a broadleaf herbicide and does not control wild oat. Wild oat control was not decreased by the addition of pyrasulfotole/bromoxynil compared to any grass herbicide alone. Wheat seed yield did not differ among treatments and ranged from 4414 to 5188 lb/A.

Table 2. Wild oat control and winter wheat response with pyrasulfotole/bromoxynil combined with grass herbicides near Melrose, ID in 2007.

Treatment[1]	Rate	Wild oat control[2]	Wheat yield
	lb ai/A	%	lb/A
Pyrasulfotole/bromoxynil	0.24	0	4683
Clodinafop	0.05	99	4578
Clodinafop +	0.05		
pyrasulfotole/bromoxynil	0.24	99	4701
Tralkoxydim + NIS/COC + AMS	0.25 + 0.5% v/v + 15 lb ai/100 gal	90	4414
Tralkoxydim + NIS/COC + AMS +	0.25 + 0.5% v/v + 15 lb ai/100 gal		
pyrasulfotole/bromoxynil	0.24	99	4867
Mesosulfuron + UAN + NIS	0.0134 + 5% v/v + 0.5% v/v	99	5188
Mesosulfuron + UAN + NIS +	0.0134 + 5% v/v + 0.5% v/v		
pyrasulfotole/bromoxynil	0.24	99	4696
Pinoxaden/adjuvant	0.0534	99	4481
Pinoxaden/adjuvant +	0.0534		
pyrasulfotole/bromoxynil	0.24	99	4586
Flucarbazone + UAN + NIS	0.027 + 5% v/v + 0.25% v/v	98	4637
Flucarbazone + UAN + NIS +	0.027 + 5% v/v + 0.25% v/v		
pyrasulfotole/bromoxynil	0.24	99	4424
Mesosulfuron/propoxycarbazone + UAN + NIS	0.044 + 5% v/v + 0.5% v/v	99	4648
Mesosulfuron/propoxycarbazone + UAN + NIS +	0.044 + 5% v/v + 0.5% v/v		
pyrasulfotole/bromoxynil	0.24	99	4558
Untreated check		--	4975
LSD (0.05)		5	NS
Density (plants/ft^2)		2	

[1] NIS/COC = nonionic surfactant/crop oil concentrate (Supercharge); AMS = ammonium sulfate (Bronc); UAN = urea ammonium nitrate (URAN); and NIS = nonionic surfactant (R-11).

[2] Evaluation date June 27, 2007.

Herbicide combinations for wild oat control in winter wheat. Corey Ransom and Ralph Whitesides. (Plants, Soils, and Climate Department, Utah State University, Logan, UT 84322-4820) Herbicides for controlling wild oat were evaluated alone and in tank mixtures with herbicides having broadleaf activity. Herbicide treatments were applied on May 15, 2007 when the winter wheat was 40 cm tall and wild oats were 36 cm tall. Herbicide treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 112 l/ha at 207 kPa. Research plots were 3 by 9 meters and were arranged in a randomized complete block design with four replications. None of the herbicide treatments caused significant wheat injury. Wild oat control was similar among the graminicide alone treatments and combinations of the graminicides with tribenuron plus thifensulfuron plus fluroxypyr. However, combinations of clodinafop or fenoxyprop with bromoxynil plus MCPA significantly reduced wild oat control. Control of wild oat was not reduced when pinoxaden was applied in combination with bromoxynil plus MCPA. Only the treatments exhibiting antagonism for wild oat control produced wild oat plants with seed heads. All treatments except those tank mixture combinations exhibiting wild oat antagonism increased winter wheat yields compared to the untreated control.

Table. Wild oat control, wild oat seed head numbers, and wheat yield in response to herbicide combinations[1].

		Wild oat		
Herbicide	Rate	Control[3]	Seed heads	Wheat yield
	g ai/ha	--%--	--no/m^2--	--kg/ha--
Untreated	--	--	119	2890
Pinoxaden	60	93 ab	0	4821
Pinoxaden[2] + bromoxynil + MCPA	60 + 420 + 420	91 ab	0	4885
Pinoxaden + tribenuron + thifensulfuron + fluroxypyr	60 + 14 + 14 + 105	88 b	0	5138
Clodinafop	56	97 a	0	4972
Clodinafop + bromoxynil + MCPA	56 + 420 + 420	75 c	0	3577
Clodinafop + tribenuron + thifensulfuron + fluroxypyr	56 + 14 + 14 + 105	96 ab	0	5536
Fenoxaprop	94	95 ab	0	5181
Fenoxyprop + bromoxynil + MCPA	94 + 420 + 420	74 c	24	4093
Fenoxyprop + tribenuron + thifensulfuron + fluroxypyr	94 + 14 + 14 + 105	99 a	24	4416
LSD (0.05)		--	5	1430

[1] Herbicide treatments were applied on May 15, 2007. Wild oat control was evaluated June 28, 2007. Wild oat seed head counts and wheat yield were taken August 1, 2007.

[2] In this treatment pinoxaden was premixed with a proprietary adjuvant. In the other pinoxaden treatments a proprietary adjuvant was added at 9.6 fl oz/A.

[3] Separations for wild oat control ratings were performed on arcsine square root transformed data. Untransformed means are presented.

Italian ryegrass control using flufenacet/metribuzin plus a deposition aid. Seth A. Gersdorf and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) This study was established near Moscow, ID in 'Madsen' winter wheat to evaluate Italian ryegrass control using flufenacet/metribuzin with and without a deposition aid. Plots were 8 by 30 ft, arranged in a randomized complete block design with four replications, and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Italian ryegrass control and wheat injury were evaluated visually. Wheat seed was not harvested due to high infestation of Italian ryegrass.

Table 1. Application and soil data.

Application date	October 4, 2006	May 6, 2007
Wheat growth stage	preemergence	2-3 tiller
Italian ryegrass growth stage	preemergence	3 tiller
Air temperature (F)	70	58
Relative humidity (%)	50	56
Wind (mph, direction)	2, NW	0-3, NW
Cloud cover (%)	0	40
Soil moisture	adequate	dry, 1 inch to moisture
Soil temperature at 2 in (F)	60	50
Soil		
pH	5.1	
OM (%)	3.2	
CEC (cmol(+)/kg)	20	
Texture	silt loam	

On May 14, all flufenacet/metribuzin treatments controlled Italian ryegrass 91 to 98% (Table 2). By June 11, Italian ryegrass control had decreased to 73 to 88% with all flufenacet/metribuzin treatments. However, the addition of the deposition aid increased control 17% at the high rate of flufenacet/metribuzin. At both dates, Italian ryegrass control with mesosulfuron was the poorest (60 and 62%) and most likely due to large Italian ryegrass (3 tiller) at time of application.

On May 14, all flufenacet/metribuzin treatments injured wheat 17 to 40% and was greatest at the high rate of flufenacet/metribuzin with the deposition aid (40%). By June 11, the high rate of flufenacet/metribuzin plus deposition aid still injured wheat the most at 14% and flufenacet/metribuzin at 0.6375 lb ai/A injured wheat 6%.

Table 2. Italian ryegrass and winter wheat response with flufenacet/metribuzin and a deposition aid near Moscow, Idaho in 2007.

Treatment[1]	Rate	Italian ryegrass control		Wheat injury	
		May 14	June 11	May 14	June 11
	lb ai/A	---------------%---------------		---------------%---------------	
Flufenacet/metribuzin	0.425	91	78	19	1
Flufenacet/metribuzin + deposition aid	0.425 1.25 oz/A	91	80	18	1
Flufenacet/metribuzin	0.6375	96	83	26	6
Flufenacet/metribuzin + deposition aid	0.6375 1.875 oz/A	95	83	23	3
Flufenacet/metribuzin	0.85	91	73	17	0
Flufenacet/metribuzin + deposition aid	0.85 2.5 oz/A	98	88	40	14
Mesosulfuron	0.0134	60	62	1	0
LSD (0.05)		23	6	12	4

[1] A nonionic surfactant (R-11) at 0.5% v/v and urea ammonium nitrate (URAN) at 5% v/v were applied with the mesosulfuron treatment.

Italian ryegrass control in winter wheat. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Two studies were established in 'Madsen' winter wheat planted on September 27. 2006 near Moscow, Idaho to evaluate ACCase-resistant Italian ryegrass control and wheat response with flufenacet/metribuzin and triasulfuron combinations, and pinoxaden/adjuvant formulation. Studies were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Wheat response and Italian ryegrass control was evaluated visually. Wheat seed was not harvested due to poor Italian ryegrass control.

Table 1. Application and soil data.

	Flufenacet/metribuzin and triasulfuron study		Pinoxaden/adjuvant study	
Application date	10/6/06	4/30/07	10/4/06	4/30/07
Growth stage				
Wheat	preemergence	3 tiller	preemergence	3 tiller
Italian ryegrass	preemergence	3 tiller	preemergence	3 tiller
Air temperature (F)	68	63	70	63
Relative humidity (%)	49	50	50	50
Wind (mph, direction)	3, NW	0	2, NW	0
Cloud cover (%)	60	10	0	10
Soil moisture	adequate	adequate	adequate	adequate
Soil temperature at 2 in (F)	59	50	60	50
pH	5.1			
OM (%)	3.2			
CEC (meq/100g)	20			
Texture	silt loam			

In the flufenacet/metribuzin and triasulfuron study, all flufenacet/metribuzin treatments injured wheat 13 to 26% on June 10 (Table 2). By June 28, the three way herbicide combinations and flufenacet/metribuzin at 0.425 lb ai/A plus mesosulfuron injured wheat 15 to 21%. All treatments controlled Italian ryegrass 88 to 96% except flufenacet/metribuzin, mesosulfuron and pinoxaden/adjuvant alone.

In the pinoxaden/adjuvant study, all flufenacet/metribuzin treatments injured wheat 19 to 28% on June 10 (Table 3). By June 28, flufenacet/metribuzin combined with pinoxaden/adjuvant or mesosulfuron injured wheat 16 and 20% but did not differ from any flufenacet/metribuzin treatment (11 and 12%). Treatments containing more than one grass herbicide controlled Italian ryegrass 80% or better.

Table 2. Italian ryegrass control and winter wheat response with flufenacet/metribuzin and triasulfuron combinations near Moscow, ID in 2007.

Treatment[1]	Rate	Application timing[2]	Wheat injury 6/10	Wheat injury 6/28	Italian ryegrass control[3]
	lb ai/A		%	%	%
Flufenacet/metribuzin	0.425	preemergence	15	9	76
Triasulfuron	0.026	preemergence	11	2	88
Flufenacet/metribuzin +	0.34	preemergence			
triasulfuron	0.026		13	10	93
Flufenacet/metribuzin +	0.425	preemergence			
triasulfuron	0.026		18	12	92
Mesosulfuron	0.0134	3 tiller	0	0	80
Flufenacet/metribuzin +	0.34	preemergence			
mesosulfuron	0.0134	3 tiller	16	7	94
Flufenacet/metribuzin +	0.425	preemergence			
mesosulfuron	0.0134	3 tiller	25	15	96
Pinoxaden/adjuvant	0.0534	3 tiller	0	0	45
Triasulfuron +	0.026	preemergence			
pinoxaden/adjuvant	0.0534	3 tiller	8	0	92
Flufenacet/metribuzin +	0.34	preemergence			
triasulfuron +	0.026	3 tiller			
pinoxaden/adjuvant	0.0534		26	21	96
Flufenacet/metribuzin +	0.34	preemergence			
triasulfuron +	0.026	3 tiller			
mesosulfuron	0.0134		20	15	92
LSD (0.05)			12	8	10
Density (plants/ft^2)					20

[1] A non-ionic surfactant (R-11) at 0.5% v/v and urea ammonium nitrate (URAN) at 5% v/v was applied with all mesosulfuron treatments.

[2] Application timing based on Italian ryegrass growth stage.

[3] June 28, 2007 evaluation.

Table 3. Italian ryegrass control and winter wheat response with pinoxaden/adjuvant combinations near Moscow, ID in 2007.

Treatment[1]	Rate	Application timing[2]	Wheat injury		Italian ryegrass control[3]
			6/10	6/28	
	lb ai/A		----------	----------%----------	----------
Flufenacet/metribuzin	0.425	preemergence	21	12	74
Triasulfuron	0.026	preemergence	0	0	77
Flufenacet/metribuzin +	0.425	preemergence			
triasulfuron	0.026		19	11	89
Pinoxaden/adjuvant	0.0534	3 tiller	0	0	39
Triasulfuron +	0.026	preemergence			
pinoxaden/adjuvant	0.0534	3 tiller	5	1	86
Flufenacet/metribuzin +	0.425	preemergence			
pinoxaden/adjuvant	0.0534	3 tiller	26	20	86
Triasulfuron +	0.026	preemergence			
pinoxaden/adjuvant +	0.0534	3 tiller			
pyrasulfotole/bromoxynil	0.22		5	0	88
Flufenacet/metribuzin +	0.425	preemergence			
pinoxaden/adjuvant +	0.0534	3 tiller			
pyrasulfotole/bromoxynil	0.22		21	16	80
Mesosulfuron	0.0134	3 tiller	0	0	70
Flufenacet/metribuzin +	0.425	preemergence			
mesosulfuron	0.0134	3 tiller	28	16	93
Mesosulfuron +	0.0134	3 tiller			
pinoxaden/adjuvant	0.0534		0	0	95
Mesosulfuron +	0.0134	3 tiller			
pyrasulfotole/bromoxynil	0.22		0	0	68
Flucarbazone	0.027	3 tiller	0	0	28
Clodinafop	0.0625	3 tiller	0	0	0
LSD (0.05)			7	9	17
Density (plants/ft^2)					20

[1] A non-ionic surfactant (R-11) was applied at 0.25 and 0.5%v/v for flucarbazone and mesosulfuron treatments, respectively; except mesosulfuron plus pinoxaden/adjuvant. Urea ammonium nitrate (URAN) at 5% v/v was applied with all mesosulfuron and flucarbazone treatments.

[2] Application timing based on Italian ryegrass growth stage.

[3] June 28, 2007 evaluation.

Tolerance of imidazolinone-resistant winter wheat varieties to imazamox. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established near Grangeville, Idaho to evaluate injury and yield of six imidazolinone-resistant winter wheat varieties treated with two rates of imazamox applied at two growth stages. The experimental design was a randomized complete block, incomplete factorial with four replications. Main plots were six winter wheat varieties (ID 587, IDO653, IDO655, 99-435, 00-475-2DH, and 02-859), subplots were two application times (early and late) and sub-subplots were two imazamox rates (0.047 and 0.094 lb ai/A) and an untreated check. Imazamox treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). To control broadleaf weeds, the entire study was sprayed with metsulfuron at 0.00375 lb ai/A, metribuzin at 0.234 lb ai/A and MCPA ester at 0.65 lb ae/A on April 4, 2007. Wheat injury was evaluated visually. Wheat seed was harvested with a small plot combine on August 1, 2007.

Table 1. Application and soil data.

Planting date	October 17, 2006	
Application date	April 19	May 1
Wheat growth stage	1 to 2 tiller	3 to 5 tiller
Air temperature (F)	56	68
Relative humidity (%)	50	61
Wind (mph, direction)	3, SE	2, N
Cloud cover (%)	70	60
Soil moisture	excessive	adequate
Soil temperature at 2 in (F)	50	56
pH	6.6	
OM (%)	4.4	
CEC (meq/100g)	34	
Texture	silt loam	

Wheat injury was greater with imazamox at 0.094 lb ai/A (19%) than at 0.047 lb ai/A (5%) [LSD (0.05) = 4] and greater at the 1 to 2 tiller (18%) than the 3 to 5 tiller application time (6%) [LSD (0.05) = 4]. At both application times, wheat injury increased with increasing imazamox rate (Table 2). Wheat seed yield was lower for the high rate of imazamox (2536 lb ai/A) compared to the low rate of imazamox and the untreated check (3298 and 3362 lb/A) [LSD (0.05) = 177]. Also, seed yield was greater for the untreated check and the 3 to 5 tiller application time (3362 and 3320 lb/A) compared to the 1 to 2 tiller timing (2501 lb/A) [LSD (0.05) = 125]. For varieties, seed yield was greatest for IDO653 and 99-435 (3279 and 3248 lb/A) followed by ID 587, IDO655 and 02-859 (3037, 2972, and 2839 lb/A) [LSD (0.05) = 208]. Seed yield was the lowest for 00-475-2 (2612 lb/A).

Table 2. Wheat injury and yield averaged over variety in 2007.

Application time	Imazamox rate[1]	Wheat injury[2]
	lb ai/A	%
1 to 2 tiller	0.047	9
	0.094	29
3 to 5 tiller	0.047	2
	0.094	8
LSD (0.05)		5

[1] Imazamox treatments were applied with 90% non-ionic surfactant (R-11) at 0.25% v/v and 32% urea ammonium nitrate (URAN) at 1 qt/A.

[2] June 20, 2007 evaluation.

Winter wheat tolerance to flufenacet/metribuzin plus a deposition aid at different timings and planting depths. Seth A. Gersdorf and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) This study was established at the Parker Research Farm in Moscow, ID in winter wheat variety 'Brundage 96' planted October 10, 2006 to evaluate the effect of planting depth (0.5 and 1.5 inch), herbicide rate (one and two times the label rate), application time (0 days after seeding, 7 days after seeding, spike stage of the wheat), and a deposition aid on winter wheat tolerance to flufenacet/metribuzin. Plots were 8 by 30 ft, arranged in a full factorial design with four replications, and included untreated checks at each planting depth and herbicide timing. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Plant counts were taken and wheat injury was evaluated visually. Wheat seed was harvested with a small plot combine on August 13, 2007.

Table 1. Application and soil data.

	Timing 1	Timing 2	Timing 3
Application date	October 10, 2006	October 17, 2006	October 31, 2006
Wheat growth stage	seed	radical emerged	spike
Air temperature (F)	66	60	44
Relative humidity (%)	48	70	56
Wind (mph, direction)	0-2, NW	0-1, SW	0-4, NW
Cloud cover (%)	75	100	0
Soil moisture	dry, 3 inch to moisture	wet	dry, 1 inch to moisture
Soil temperature at 2 in (F)	56	50	40
Soil			
pH	5.67		
OM (%)	2.8		
CEC (meq/100 g)	18.2		
Texture	silt loam		

On March 18, fewer plants emerged in the 0.5 inch planted depth compared to the 1.5 inch depth (Table 2). Fewer plants emerged in the 0 days after planting (DAP) time treatments compared to the 7 DAP and the spike stage time treatments (Table 3). However, the 7 DAP and spike stage times were not different from each other. The higher rate of flufenacet/metribuzin had fewer plants emerge than the lower rate and the lower rate had fewer plants than the untreated check (Table 4). In general, there was no difference in plant emergence between treatments with the deposition aid versus treatments without the deposition aid. The least number of plants emerged in the three way interaction of 0.5 inch planted, 0 days after planting timing, high rate of flufenacet/metribuzin with and without the deposition aid, with 16 and 15 plants/m, respectively (data not shown).

By May 14, at the 1.5 inch depth, no treatment visibly injured wheat (Table 2). Wheat was injured 4% at the shallow seeding depth. The most injury occurred at the 0 DAP at 5% with both 7 DAP and the spike stage of the wheat injured 1%. The high rate of flufenacet/metribuzin caused 7% injury, however the addition of the deposition agent reduced injury to 4%. In this case, at the shallow depth, shortest application interval, and highest herbicide rate, the addition of the deposition aid reduced visible injury from 28 to 16% (data not shown).

Seed yield showed similar patterns as visible injury. Shallow seeded wheat yielded less than deeper seeded wheat (Table 2). Plots sprayed the same day as planting yielded less than plots sprayed 7 DAP or at the spike stage of the wheat (Table 3). Plots treated with the high rate of flufenacet/metribuzin yielded the lowest out of all the herbicide treatments, however the addition of the deposition aid increased yield by 42 lb/A. The only significant difference between test weights was at the depth factor (Table 2). Again, the shallow seeded wheat had a lower test weight than the deeper seeded wheat.

Tables 5 to 7 show the two way interactions of application time versus planting depth, herbicide treatment versus planting depth, and herbicide treatment versus application time, respectively, which show similar trends as the main effects in tables 2 to 4.

It is important to note that the most significant effects on wheat occurred at the shallow seeded depth, spraying the same day as planting, and at the double the label rate of flufenacet/metribuzin. These are all against current recommendations when using flufenacet/metribuzin. When using flufenacet/metribuzin it is important to plant at least deeper than 0.5 inch, wait at least 7 days after planting to spray, and to use the label rate of flufenacet/metribuzin. In this case, the effect of the deposition aid was only seen at the higher use rate of flufenacet/metribuzin.

Table 2. Winter wheat response to planting depth averaged over application time and treatment in Moscow, ID in 2007.

	Wheat			
Planting Depth	Density[1]	Injury[2]	Yield	Test weight
inches	# plants/m	%	lb/A	grams
0.5 inch seeding depth	26	4	4156	438
1.5 inch seeding depth	30	0	4396	441
LSD (0.05)	1	1	77	1

[1] Wheat density determined March 18, 2007.

[2] Wheat injury evaluated May 14, 2007.

Table 3. Winter wheat response to application time averaged over planting depth and herbicide treatment in Moscow, ID in 2007.

	Wheat			
Application time	Density[1]	Injury[2]	Yield	Test weight
	# plants/m	%	lb/A	grams
0 days after planting	26	5	4170	440
7 days after planting	29	1	4316	439
Spike stage of wheat	29	1	4342	438
LSD (0.05)	2	2	95	NS

[1] Wheat density determined March 18, 2007.

[2] Wheat injury evaluated May 14, 2007.

Table 4. Winter wheat response to herbicide treatment averaged over planting depth and application time in Moscow, ID in 2007.

		Wheat			
Treatment	Rate	Density[1]	Injury[2]	Yield	Test weight
	lb ai/A	# plants/m	%	lb/A	grams
Deposition aid	1.875 oz/A	31	0	4414	439
Flufenacet/metribuzin	0.425	29	1	4347	440
Flufenacet/metribuzin + deposition aid	0.425 1.25 oz/A	26	2	4188	440
Flufenacet/metribuzin	0.85	24	7	4088	439
Flufenacet/metribuzin + deposition aid	0.85 2.5 oz/A	25	4	4131	438
Untreated check	--	32	--	4489	439
LSD (0.05)		2	2	134	NS

[1] Wheat density determined March 18, 2007.

[2] Wheat injury evaluated May 14, 2007.

Table 5. Winter wheat response to planting depth by application time averaged over herbicide treatment in Moscow, ID in 2007.

		Wheat			
Application time	Planting depth	Density[1]	Injury[2]	Yield	Test weight
	inches	# plants/m	%	lb/A	grams
0 days after planting	0.5	23	10	4000	438
0 days after planting	1.5	29	0	43401	442
7 days after planting	0.5	27	2	4169	438
7 days after planting	1.5	31	0	4462	441
Spike stage of wheat	0.5	27	2	4299	436
Spike stage of wheat	1.5	31	0	4385	440
LSD (0.05)		NS	2	134	NS

[1] Wheat density determined March 18, 2007.

[2] Wheat injury evaluated May 14, 2007.

Table 6. Winter wheat response to planting depth by herbicide treatment averaged over application time in Moscow, ID in 2007.

			Wheat			
Treatment	Rate	Planting depth	Density[1]	Injury[2]	Yield	Test weight
	lb ai/A	inches	# plants/m	%	lb/A	grams
Deposition aid	1.875 oz/A	0.5	31	0	4394	437
Deposition aid	1.875 oz/A	1.5	31	0	4435	442
Flufenacet/metribuzin	0.425	0.5	26	2	4217	438
Flufenacet/metribuzin	0.425	1.5	32	0	4477	442
Flufenacet/metribuzin + deposition aid	0.425 1.25 oz/A	0.5	24	5	4073	439
Flufenacet/metribuzin + deposition aid	0.425 1.25 oz/A	1.5	29	0	4303	441
Flufenacet/metribuzin	0.85	0.5	20	12	3831	436
Flufenacet/metribuzin	0.85	1.5	28	1	4345	442
Flufenacet/metribuzin + deposition aid	0.85 2.5 oz/A	0.5	21	7	3973	437
Flufenacet/metribuzin + deposition aid	0.85 2.5 oz/A	1.5	29	1	4288	440
Untreated check	--	0.5	33	--	4448	439
Untreated check	--	1.5	32	--	4530	440
LSD (0.05)			3	3	190	NS

[1] Wheat density determined March 18, 2007.

[2] Wheat injury evaluated May 14, 2007.

Table 7. Winter wheat response to application time by herbicide treatment averaged over planting depth in Moscow, ID in 2007.

			Wheat			
Treatment	Rate	Application time	Density[1]	Injury[2]	Yield	Test weight
	lb ai/A		# plants/m	%	lb/A	grams
Deposition aid	1.875 oz/A	0 days after planting	31	0	4411	441
Deposition aid	1.875 oz/A	7 days after planting	30	0	4481	438
Deposition aid	1.875 oz/A	spike stage of wheat	33	0	4352	439
Flufenacet/metribuzin	0.425	0 days after planting	30	1	4256	441
Flufenacet/metribuzin	0.425	7 days after planting	27	1	4370	439
Flufenacet/metribuzin	0.425	spike stage of wheat	30	0	4415	440
Flufenacet/metribuzin + deposition aid	0.425 1.25 oz/A	0 days after planting	23	6	4052	440
Flufenacet/metribuzin + deposition aid	0.425 1.25 oz/A	7 days after planting	28	1	4129	440
Flufenacet/metribuzin + deposition aid	0.425 1.25 oz/A	spike stage of wheat	28	0	4383	440
Flufenacet/metribuzin	0.85	0 days after planting	21	14	3909	439
Flufenacet/metribuzin	0.85	7 days after planting	26	2	4195	440
Flufenacet/metribuzin	0.85	spike stage of wheat	25	4	4161	438
Flufenacet/metribuzin + deposition aid	0.85 2.5 oz/A	0 days after planting	22	8	4020	440
Flufenacet/metribuzin + deposition aid	0.85 2.5 oz/A	7 days after planting	29	2	4186	439
Flufenacet/metribuzin + deposition aid	0.85 2.5 oz/A	spike stage of wheat	25	3	4186	436
Untreated check	--	0 days after planting	32	--	4374	439
Untreated check	--	7 days after planting	34	--	4535	440
Untreated check	--	spike stage of wheat	31	--	4558	439
LSD (0.05)			4	4	NS	NS

[1] Wheat density determined March 18, 2007.

[2] Wheat injury evaluated May 14, 2007.

Tillage affects imazamox persistence in soil (Year 2). Jonquil R. Rood, Traci A. Rauch, Donald C. Thill, and Bahman Shafii, (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339), Rodney J. Rood and Joseph P. Yenish (Crop and Soil Sciences, Washington State University, Pullman, WA 99163), and Daniel A. Ball and Larry Bennett (Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR 97801). Studies were established near Genesee, ID, Davenport, WA and Pendleton, OR in 'ORCF-101' winter wheat to determine how tillage affects imazamox persistence in soil. Studies were arranged in a split block, split plot with four replications and included an untreated check. Treatments are three tillage systems (conventional, minimum, and direct seed) and seven herbicide treatments (1, 2, and 3x rates of imazamox applied in fall and spring, plus an untreated control). Herbicide treatments were applied at Davenport using a small plot tractor sprayer delivering 10 gpa at 35 psi, at Kambitsch using a CO_2-pressurized backpack sprayer calibrated to deliver 10 gpa at 35 psi, and Pendleton using a small plot tractor sprayer delivering 10 gpa at 20 psi (Table 1). The Genesee site was oversprayed with fluroxypyr at 0.12 lb ai/A and bromoxynil/MCPA at 0.5 lb ai/A for broadleaf control on April 29, 2007. Wheat injury and weed control were evaluated visually. Wheat seed was harvested with a small plot combine at Genesee on August 13, Davenport on August 1, and Pendleton on July 24, 2007. Moldboard and chisel plow tillage strips were applied on October 18 at Pendleton and October 23, 2007 at both the Davenport and Genesee sites and will be field cultivated prior to spring planting at all three sites. In spring 2008, 'IdaGold' yellow mustard will be seeded with a Fabro no-till drill at all three sites. Yellow mustard plant counts, visual injury, crop biomass, and seed yield will be determined.

Table 1. Application and soil data.

Location	Genesee, ID		Davenport, WA		Pendleton, OR	
Application date	12/14/06	5/11/07	10/27/06	4/26/07	11/20/06	3/22/07
Wheat growth stage	3-4 leaves	2-3 tillers	3-4 leaves	2-3 tillers	3-4 leaves	2-3 tillers
Air temperature (F)	48	80	39	52	54	64
Relative humidity (%)	90	58	89	48	64	52
Wind (mph, direction)	2, N	5.5, N	6.5, N	7, N	1, N	3, N
Cloud cover (%)	100	0	100	20	50	80
Soil moisture	wet	moist	dry	moist	wet	dry
Soil temperature at 2 in (F)	40	42	40	42	52	62
pH	6.0		4.9		5.0	
OM (%)	4.0		3.1		2.4	
CEC (meq/100g)	28		19		20	
Texture	silt loam		silt loam		silt loam	

At all locations, the highest rate in the fall and the spring injured wheat 20 to 68% (Tables 2-4). At Pendleton, imazamox at 0.094 lb ai/A at both timings injured wheat 13 and 29%, while the lowest rate applied in the spring at Genesee injured wheat 10%. No grass weeds were present at Genesee or Davenport. At Pendleton, downy brome was controlled 90 to 100% by all imazamox treatments. At Genesee, injury from the high rate of imazamox in the spring reduced head number and biomass compared to the untreated control. At Pendleton, downy brome competition reduced the number of wheat heads and biomass in the untreated control compared to herbicide treated plots. No treatments adversely affected grain yield or test weight compared to the untreated control at all locations.

Table 2. Wheat injury, head number, biomass, grain yield and test weight in imazamox soil persistence studies near Genesee, ID in 2007.

Treatment	Rate	Application timing	Wheat injury[1]	Wheat			
				Head[2]	Biomass	Yield	Test weight
	lb ai/A		%	#/m	grams/m row	bu/A	lb/bu
Imazamox	0.047	Fall	0	105	232	93	61.3
Imazamox	0.094	Fall	0	122	276	103	61.5
Imazamox	0.140	Fall	25	113	255	102	61.7
Imazamox	0.047	Spring	10	106	252	99	61.4
Imazamox	0.094	Spring	18	109	250	97	61.8
Imazamox	0.140	Spring	36	103	233	103	61.7
Untreated check			---	129	292	86	61.7
LSD (0.05)			10	21	49	NS	NS

[1] Wheat injury was evaluated seven days after spring herbicide application on May 18, 2007. Means are pooled over tillage because tillage is not yet a factor.

[2] Average number of heads/m on June 27, 2007.

Table 3. Wheat injury, head number, biomass, grain yield and test weight in imazamox soil persistence near Davenport, WA in 2007.

Treatment	Rate	Application Timing	Wheat injury[1]	Wheat			
				Heads[2]	Biomass	Yield	Test weight
	lb ai/A		%	#/m	grams/m row	bu/A	lb/bu
Imazamox	0.047	Fall	0	105	232	64	61.4
Imazamox	0.094	Fall	0	97	212	67	61.4
Imazamox	0.140	Fall	20	98	206	69	61.4
Imazamox	0.047	Spring	0	102	227	69	61.6
Imazamox	0.094	Spring	0	108	245	69	61.5
Imazamox	0.140	Spring	28	108	227	70	61.6
Untreated check			---	96	216	67	61.6
LSD (0.05)			10	NS	NS	6	NS

[1] Wheat injury was evaluated 14 days after spring application on May 10, 2007. Means are pooled over tillage because tillage is not yet a factor.

[2] Average number of heads/m on June 18, 2007.

Table 4. Wheat injury, downy brome control, head number, biomass, grain yield and test weight in imazamox soil persistence near Pendleton, OR in 2007.

Treatment	Rate	Application timing	Wheat injury[1]	Downy brome control[2]	Wheat			
					Heads[3]	Biomass	Yield	Test weight
	lb ai/A		%	%	#/m	grams/m row	bu/A	lb/bu
Imazamox	0.047	Fall	1	90	93	290	61	55.4
Imazamox	0.094	Fall	13	95	95	294	62	55.2
Imazamox	0.140	Fall	30	95	86	284	64	54.9
Imazamox	0.047	Spring	6	99	102	307	60	56.0
Imazamox	0.094	Spring	29	100	118	278	62	55.6
Imazamox	0.140	Spring	68	100	100	216	59	55.8
Untreated check			---	---	56	150	59	55.6
LSD (0.05)			10	4	27	71	NS	0.9

[1] Wheat injury was evaluated 28 days after spring application on April 26, 2007. Means are pooled over tillage because tillage is not yet a factor.

[2] Downy brome control was evaluated on June 11, 2007.

[3] Average number of heads/m on June 18, 2007.

Tillage affects imazamox carryover in yellow mustard. Jonquil R. Rood, Traci A. Rauch, Donald C. Thill and Bahman Shafii (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339), Rodney J. Rood and Joseph P. Yenish (Crop and Soil Sciences, Washington State University, Pullman, WA 99163), and Daniel A. Ball and Larry Bennett (Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR 97801). Studies were established in fall 2005 near Genesee, ID, Davenport, WA, and Pendleton, OR in 'ORCF-101' winter wheat to determine how tillage affects imazamox persistence in soil. Studies were arranged in a split block, split plot with four replications and included an untreated check. Treatments are three tillage systems (conventional, minimum, and direct seed) and seven herbicide treatments (1, 2, and 3x rates of imazamox applied in fall 2005 and spring 2006, plus an untreated control). Wheat seed was harvested with a small plot combine at Genesee on August 15, Davenport on August 9, and Pendleton on July 16, 2006 (data not shown). Moldboard and chisel plow tillage strips were applied fall 2006 and were field cultivated prior to spring planting at all three sites. In spring 2007, 'IdaGold' yellow mustard was seeded with a Fabro no-till drill at all three sites. Yellow mustard seed was harvested with a small plot combine at Genesee on August 28, Davenport on August 6, and Pendleton on July 31. Tillage strips were implemented again on October 18 at Pendleton and on October 23, 2007 at both the Davenport and Genesee sites. 'IdaGold' yellow mustard will be seeded spring 2008 using a Fabro no-till drill and yellow mustard seed yield will be determined.

Table 1. Application and soil data.

Location	Genesee, ID		Davenport, WA		Pendleton, OR	
Application date	11/2/05	4/25/06	10/18/05	4/27/06	11/2/05	2/3/06
Wheat growth stage	3-4 leaves	2-3 tillers	3-4 leaves	2-3 tillers	3-4 leaves	2-3 tillers
Air temperature (F)	49	54	51	64	48	43
Relative humidity (%)	58	39	44	29	86	76
Wind (mph, direction)	4, SW	2, SW	4, N	8, N	2, N	2, N
Cloud cover (%)	100	90	0	20	70	10
Soil moisture	wet	moist	dry	moist	moist	moist
Soil temperature at 2 in (F)	44	50	50	48	---	38
pH	5.1		4.9		5.2	
OM (%)	3.5		4.1		2.6	
CEC (meq/100g)	20		16		17	
Texture	silt loam		silt loam		silt loam	

Yellow mustard data are expressed as a percentage of the untreated control (Tables 2-5). Data are presented by location and separated by treatment and tillage because there were no significant treatment by tillage interactions. Imazamox applied at both application timings and at the two highest rates to winter wheat injured mustard 21 to 91% at all locations. At Genesee and Davenport, imazamox at the label rate at both timings injured mustard 41 to 57% (Table 2).

Mustard seed yield was significantly higher when the 1X rate was applied in both the fall and spring at Pendleton compared to all other treatments (Table 2). Due to an infestation of prickly lettuce (*Lactuca serriola* L.) at Genesee, the data are unbalanced and therefore LSD values are not reported for yield. Yellow mustard seed yield was reduced least by the 1X fall and spring applications of imazamox compared to other treatments at Genesee. At Davenport, imazamox at 1X and 2X rates fall-applied had significantly greater mustard yield than all other treatments. However, data from Davenport were affected by drift from an aerial application of propoxycarbazone at 0.039 lb ai/A that occurred between April 17 and 24, 2007.

At Pendleton, mustard injury was greatest in conventional tillage and least in the direct-seeded plots (Table 3). Wheat residue was removed from the direct-seeded plots in fall 2006, which likely allowed for more microbial degradation of the herbicide compared to other tillage treatments. At Genesee, mustard was injured the least in conventional tillage compared to minimum and direct-seed tillage. At Davenport, visual injury did not differ among tillage treatments, likely due to the aerial drift of propoxycarbazone.

At Pendleton, biomass was significantly lower in the conventional tillage compared to the other two tillages (Table 3). At Genesee, conventional tillage had significantly more plants then the direst-seed plots and significantly more biomass than the minimum plots. At Davenport, conventional tillage had significantly less plants than the direct-seed plots.

At Pendleton, yield was different among all tillage treatments, with the highest seed yield in the direct seeded treatment (Table 3). At Genesee, yield tended to be the highest in conventional tillage followed by direct-seed and minimum tillage. At Davenport, minimum tillage had significantly less yield than conventional and direct-seed tillage.

At Davenport, spring affects were always greater than fall for injury, plant counts, biomass and yield (Table 4 and 5). Injury was always greater for the 2X versus the 1X application rates at all locations. The effect of the 1X application rate compared to the 2X and 3X rates was always significantly less for injury, plant counts, biomass and yield at both the Pendleton and Davenport, but only for injury and biomass at Genesee. Seed yield was not different between fall and spring imazamox applications at Pendleton and Genesee.

[redacted]

Yield
%
93
94
63
70
43
31
19

Yield
%
74
54
68
11

Yield
%
<.0001
0.0618
0.0002

Table 2. Mustard injury, plant counts, biomass, and yield by application timing and rate as a percentage of the control.

			Pendleton				Genesee				Davenport			
Treatment	Rate	Application timing	Injury	Plants	Biomass	Yield	Injury	Plants	Biomass	Yield[1]	Injury	Plants	Biomass	Yield
	lb ai/A		%	%	%	%	%	%	%	%	%	%	%	%
Imazamox	0.047	Fall	1	94	82	109	42	107	84	83	41	98	108	93
Imazamox	0.094	Fall	21	112	53	82	64	130	44	50	50	100	90	94
Imazamox	0.140	Fall	40	128	45	69	86	124	25	49	60	109	71	63
Imazamox	0.047	Spring	5	123	88	112	50	110	108	77	57	96	85	70
Imazamox	0.094	Spring	27	128	48	76	71	100	45	35	81	62	76	43
Imazamox	0.140	Spring	49	127	27	60	86	94	28	35	91	30	24	31
LSD (0.05)			7	24	14	19	11	33	38	---	12	31	39	19

[1] LSD could not be calculated because of unbalanced data.

Table 3. Mustard injury, plant counts, biomass, and yield by tillage as a percentage of the control.

	Pendleton				Genesee				Davenport			
Tillage	Injury	Plants	Biomass	Yield	Injury	Plants	Biomass	Yield[1]	Injury	Plants	Biomass	Yield
	%	%	%	%	%	%	%	%	%	%	%	%
Conventional	32	130	45	62	58	151	73	70	56	73	81	74
Minimum	23	114	64	78	73	112	35	29	67	85	85	54
Direct-seed	16	112	62	114	69	69	60	66	67	90	61	68
LSD (0.05)	10	NS	3	14	10	49	32	---	13	15	NS	11

[1] LSD could not be calculated because of unbalanced data.

Table 4. Mustard injury, plant counts, biomass and yield contrasts.

	Pendleton				Genesee				Davenport			
Contrasts	Injury	Plants	Biomass	Yield	Injury	Plants	Biomass	Yield	Injury	Plants	Biomass	Yield
	%	%	%	%	%	%	%	&	%	%	%	%
	--P-Values--											
Fall vs Spring	0.0044	0.0353	0.1403	0.4833	0.1137	0.0481	0.3854	0.6408	<.0001	<.0001	0.0157	<.0001
1X vs 2X	<.0001	0.1715	<.0001	<.0001	<.0001	0.5681	0.0003	0.1318	0.0004	0.1665	0.3152	0.0618
1X vs 2&3X	<.0001	0.0415	<.0001	<.0001	<.0001	0.7076	<.0001	0.0827	<.0001	0.0278	0.0108	0.0002

DF=1

Table 5. Mustard injury, plant counts, biomass and yield contrast means.

	Fall vs. Spring[1]				1X vs. 2X[2]				1X vs. 2&3X[3]			
	Injury	Plants	Biomass	Yield	Injury	Plants	Biomass	Yield	Injury	Plants	Biomass	Yield
	%	%	%	%	%	%	%	%	%	%	%	%
Pendleton	21/27	111/126	60/54	87/83	3/16	109/120	85/51	111/79	3/34	109/124	85/43	111/72
Genesee	64/69	120/101	51/60	61/49	46/68	109/115	96/45	80/43	46/77	109/112	96/36	80/42
Davenport	50/76	102/63	90/62	83/48	49/66	97/81	97/83	82/69	49/71	97/75	97/65	82/58

[1] Numbers to the left of the slash represent means for fall while numbers to the right of the slash represent means for spring.

[2] Numbers to the left of the slash represent means for 1X while numbers to the right of the slash represent means for 2X.

[3] Numbers to the left of the slash represent means for 1X while numbers to the right of the slash represent means for 2&3X.

Newly reported exotic species in Idaho. Sandra S. Robins and Timothy S. Prather. (Idaho Agricultural Experiment Station, University of Idaho, Moscow, Idaho, 83844-2339). The Lambert C. Erickson Weed Diagnostic Laboratory received 586 specimens for identification in 2007. The utilization of the lab was up 6% from the 553 submissions from 2006 (Figure 1). Two hundred and ninety-four exotic species were identified. Seventy-six digital images were submitted for identification in 2007, up 62% from the 29 submissions in 2006. Four species reported were new to the state, princess-feather (*Persicaria orientalis*), Chinese thorn-apple (*Datura quercifolia*), elongated mustard (*Brassica elongata*), and Brazilian elodea (*Egeria densa*) (Table 1). The lab identified 40 exotic species that were new county records (see Tables 1, 2 and Figure 2). A total of 31 counties submitted samples (Figure 3). Pinnate mosquitofern (*Azolla pinnata*) was reported for the first time to the Pacific Northwest, it was discovered in a lawn and garden store. Species in Table 2 have not previously been reported from the county to the Erickson Weed Diagnostic Laboratory or the Invaders Database System, although previously reported in one or more counties in Idaho.

Table 1. Identified exotic species new to the state based on the Invaders Database System in 2007.

County	Family	Scientific Name	Common Name
Ada	Azollaceae	*Azolla pinnata*	Pinnate mosquitofern**
Ada	Polygonaceae	*Persicaria orientalis*	princess-feather
Bonneville	Solanaceae	*Datura quercifolia*	Chinese thorn-apple*
Franklin	Brassicaceae	*Brassica elongata*	elongated mustard
Latah	Hydrocharitaceae	*Egeria densa*	Brazilian elodea

*native species
**species reported new to the Pacific Northwest.

Table 2 . Identified exotic species new to a county based on the Invaders Database System in 2007.

County	Family	Scientific Name	Common Name
Ada	Azollaceae	*Azolla pinnata*	pinnate mosquitofern
Ada	Polygonaceae	*Persicaria orientalis*	Princess-feather
Benewah	Euphorbiaceae	*Euphorbia lathyris*	moleplant
Boise	Asteraceae	*Hypochaeris radicata*	spotted catsear
Bonneville	Brassicaceae	*Brassica nigra*	black mustard
Bonneville	Brassicaceae	*Cardaria chalapensis*	lenspodded whitetop
Bonneville	Brassicaceae	*Chorispora tenella*	blue mustard
Bonneville	Solanaceae	*Datura quercifolia*	Chinese thorn-apple
Bonneville	Balsaminaceae	*Impatiens glandulifera*	policeman's helmet
Bonneville	Asteraceae	*Iva xanthifolia*	marshelder
Bonneville	Asteraceae	*Iva axillaris*	povertyweed
Bonneville	Brassicaceae	*Malcolmia africana*	African mustard
Bonneville	Chenopodiaceae	*Salsola tragus*	Russian thistle
Bonneville	Brassicaceae	*Sisymbrium altissimum*	tumble mustard
Bonneville	Boraginaceae	*Symphytum officinale*	common comfrey
Bonneville	Tamaricaceae	*Tamarix chinensis*	Chinese saltcedar
Boundary	Caryophyllaceae	*Spergularia rubra*	red sandspurry
Canyon	Apiaceae	*Anthriscus caucalis*	bur chervil
Canyon	Boraginaceae	*Asperugo procumbens*	catchweed
Canyon	Euphorbiaceae	*Euphorbia peplus*	petty spurge
Canyon	Poaceae	*Phalaris arundinaceae*	reed canarygrass

Table 2. Continued.

County	Family	Scientific Name	Common Name
Custer	Brassicaceae	*Alyssum desertorum*	desert madwort
Custer	Brassicaceae	*Draba verna*	spring whitlowgrass
Custer	Polygonaceae	*Rumex crispus*	curlydock
Elmore	Solanaceae	*Datura stramonium*	jimson weed
Franklin	Brassicaceae	*Brassica elongata*	elongated mustard
Idaho	Brassicaceae	*Alliaria petiolata*	garlic mustard
Idaho	Fabaceae	*Coronilla varia*	crown vetch
Idaho	Balsaminaceae	*Impatiens glandulifera*	policeman's helmet
Kootenai	Apiaceae	*Aegopodium podagraria*	bishop's goutweed
Kootenai	Asteraceae	*Mycelis muralis*	wall lettuce
Latah	Hydrocharitaceae	*Egeria densa*	Brazilian elodea
Latah	Caryophyllaceae	*Silene noctiflora*	nightflowering catchfly
Lemhi	Brassicaceae	*Alyssum desertorum*	desert madwort
Lemhi	Brassicaceae	*Alyssum alyssoides*	yellow alyssum
Lemhi	Chenopodiaceae	*Salsola tragus*	Russian thistle
Nez Perce	Boraginaceae	*Myosotis arvensis*	tarweed fiddleneck
Nez Perce	Tamaricaceae	*Tamarix parviflora*	smallflower tamarisk
Nez Perce	Scrophulariaceae	*Veronica hederaefolia*	ivy speedwell
Washington	Asteraceae	*Tripleurospermum perforata*	scentless chamomile

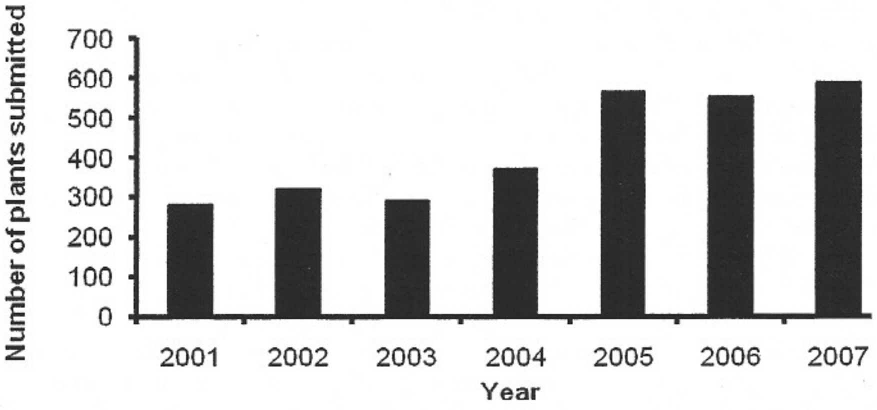


Figure 1. Erickson Weed Diagnostic Laboratory received 586 plant specimens for identification in 2007. The utilization of the lab was up 6% from the 564 submissions in 2005.

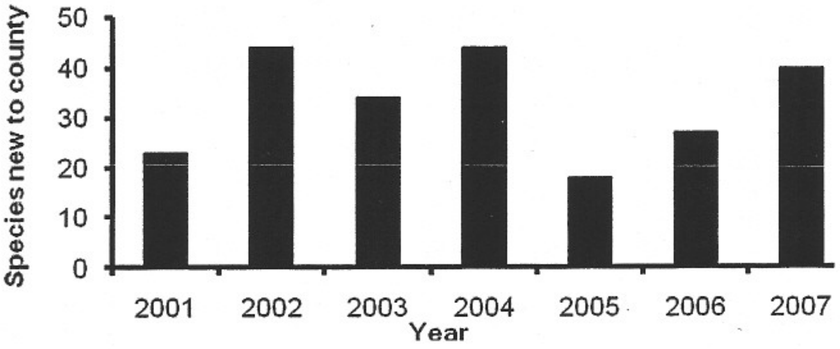


Figure 2. The lab identified 40 exotic species that were new Idaho records.

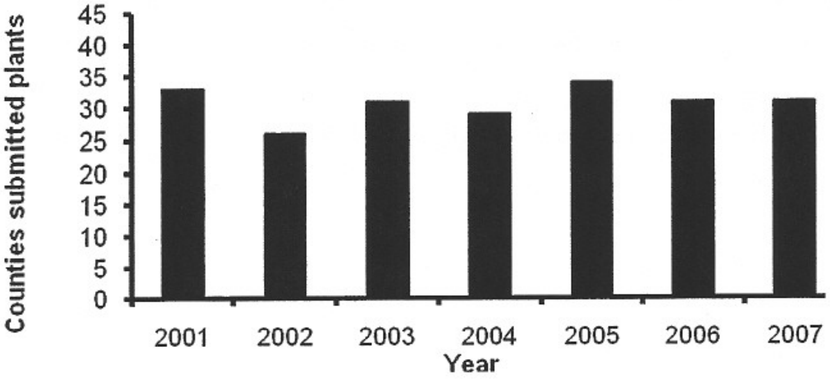


Figure 3. Thirty-one Idaho counties submitted plants.

Evaluating herbicides applied at low rates for annual weed control in wildlands. Carl E. Bell (Cooperative Extension, University of California, 5555 Overland Ave, suite 4101, San Diego, CA). In wildland situations it is often useful to know just how little herbicide is required to kill annual weeds because of concerns for native vegetation that might be damaged by these herbicides. This field experiment was conducted on a naturally occurring population of invasive Mediterranean annual weeds on a California Department of Fish and Game Preserve in San Diego County, CA. Several weed species were present at the time of herbicide application; including wild radish, ripgut brome, and prickly lettuce. These weeds were all mature, from 12 to 24 inches tall, with flowers and seed, but not yet senescing. The experiment utilized a completely randomized design with four replications. Plot size was 5 by 30 feet. Eight herbicides were applied on May 5, 2006 with a CO_2 backpack sprayer using 3 - 8002vs flat fan nozzles on a boom covering 5 feet at 40 psi for a spray volume of 48 gpa. Weather at time of application was 65 F, cloudy, and winds were 3-5 mph. Plots were visually evaluated for weed control on May 25 and June 23, 2006 (Table). Effective herbicide by weed treatments included chlorsulfuron, imazapic, and glyphosate on wild radish; clopyralid and glyphosate on prickly lettuce; and fluazifop and glyphosate on ripgut brome. On May 3, 2007, about one year after treatment, percent cover was visually estimated. Most of the plots at this time were dominated by ripgut brome, with cover ranging from 85 to 98%. Three of the herbicide treatments, imazapic, fluazifop, and glyphosate, reduced grass cover, with increased cover of broadleaf weeds and bare ground (Table).

Table 1. Herbicide treatments and visual evaluations for annual weed control, San Diego, CA.

		Weed control						Cover			
		May 25, 2006			June 23, 2006			May 3, 2007			
Herbicide	Rate[1]	WR[2]	PL	RB	WR	PL	RB	BM	PL	RB	BG
	lb/A	%	%	%	%	%	%	%	%	%	%
Triclopyr	1	42	50	2	73	50	0	16	4	79	1
Clopyralid	0.12	5	31	5	1	88	0	2	0	98	0
Chlorsulfuron	0.024	90	31	0	99	42	0	13	1	86	0
Aminopyralid	0.05	42	54	4	27	50	4	11	0	86	3
Imazapic	0.125	61	17	0	99	5	12	9	7	32	52
Fluazifop	0.19	0	0	39	0	0	98	18	6	54	22
Clethodim	0.12	0	0	17	0	0	54	5	4	86	5
Glyphosate	0.75	96	79	100	100	98	100	30	18	30	22
Untreated control		0	0	0	0	0	0	5	2	85	8

1 Rate for triclopyr, imazapyr, and glyphosate are ae, others are ai.

[2] WR – wild radish, PL – prickly lettuce, RB – ripgut brome, BM – black mustard, BG – bare ground

Purple loosestrife control with aminopyralid applied alone or with 2,4-D or triclopyr. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Purple loosestrife (lythrum) was introduced as an ornamental into North America in the early 1800s. Although slow to spread in the relatively dry climate of North Dakota, the plant was added to the state noxious weed list in 1999 and currently infests approximately 250 A in 22 counties. Nearly all infestations are located in aquatic sites such as rivers, streams, and drainage areas where most herbicides cannot be used. The purpose of this research was to evaluate aminopyralid applied alone or with 2,4-D or triclopyr for purple loosestrife control.

The experiment was located in a green area along a drainage ditch within the city limits of Fargo, ND. Purple loosestrife had invaded the area which otherwise had a near complete cover of cattails. Herbicides were applied with a single nozzle back-pack sprayer and plants were sprayed until wet (approximately 75 gpa). Herbicides were applied on July 6, 2006 when purple loosestrife was in the bloom growth stage and ranged from 3 to 5 feet tall. Purple loosestrife and associated vegetation was sprayed until wet but run-off was avoided. The experimental design was a randomized complete block with three replicates. Plots were 30 feet long and 5 feet wide in the first rep and 30 by 10 feet wide in the second and third reps. Control was visually evaluated using percent stand reduction compared to the untreated control. Glyphosate at 1.5% (herbicide:water v:v) and triclopyr at 1% (v:v) were included as standard treatments for comparison.

In general, aminopyralid provided long-term purple loosestrife control at lower rates than the standard treatments of glyphosate or triclopyr (Table). For instance, aminopyralid applied at 0.2% (v:v) provided 86% purple loosestrife control 13 MAT compared to only 56 and 23% with glyphosate or triclopyr, respectively. Purple loosestrife control increased as the aminopyralid rate increased and averaged 36, 54, and 86% control 13 MAT when applied at 0.05, 0.1, and 0.2% (v:v), respectively. Purple loosestrife control increased when 2,4-D but not triclopyr was applied with aminopyralid compared to aminopyralid alone at comparable use rates. Cattails were killed by glyphosate but unaffected by any other treatment in the study (data not shown).

Aminopyralid provided very good purple loosestrife control at much lower use rates than currently used herbicide treatments. Also, aminopyralid is safe to use under or near many tree species commonly found in areas infested by purple loosestrife.

Table. Purple loosestrife control with aminopyralid compared to triclopyr or glyphosate applied during the full bloom growth stage on July 6, 2006 in Fargo, ND.

Treatment	Rate		Evaluation/months after treatment			
			1	2	11	13
	— % solution —	–oz/A[1] -	% control			
Aminopyralid + X-77	0.05 + 0.25	1.2	91	83	72	36
Aminopyralid + X-77	0.1 + 0.25	2.4	97	90	85	54
Aminopyralid + X-77	0.2 + 0.75	4.8	99	97	97	86
2,4-D/aminopyralid[2] + X-77	0.223 + 0.027 + 0.75	1.8 + 0.9	99	97	97	77
Triclopyr/aminopyralid[3] + X-77	0.435 + 0.075 + 0.75	5.2 + 0.9	76	73	66	28
Triclopyr/aminopyralid[3] + X-77	0.66 + 0.09 + 0.75	7.9 + 0.11	91	88	82	63
Glyphosate + X-77	1.5 + 0.75	72	95	98	88	56
Triclopyr + X-77	1 + 0.75	48	84	82	63	23
LSD (0.05)			13	17	21	29

[1] Herbicide rate estimation was based on an average of 75 gpa applied, but actual rate was dependent on purple loosestrife and associated vegetation height.

[2] Commercial formulation - Forefront by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.

[3] Experimental formulation - GF-1883 by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.

Thistle control with aminopyralid. Carl E. Bell, Vanelle Peterson, Bruce Kidd, and John Ekhoff. (Cooperative Extension, University of California, San Diego, CA 92123; Dow AgroSciences, Mulino, OR 97042; Dow AgroSciences, Murrieta, CA 92562; and California Department of Fish and Game, San Diego, CA 92123). Two field studies were conducted in San Diego, CA in 2007 to evaluate aminopyralid in comparison to clopyralid, glyphosate, chlorsulfuron, and triclopyr applied postemergence for control of blessed milkthistle, Italian thistle, and Russian thistle on the CA Department of Fish and Game Rancho Jamul Ecological Reserve. Both experiments utilized a randomized complete block design. One site, populated with a mixed infestation of blessed milkthistle and Russian thistle, had six replications to account for variability in the weed populations. The other site, located about 200 yards away, had a uniform population of Italian thistle and had four replications. Plot size in both sites was 6 by 25 feet. Herbicides were applied on March 29, 2007 with a CO_2 backpack sprayer using 5 – 8002vs flat fan nozzles on a boom covering 6 feet at 40 psi and a spray volume of 33 gpa. All treatments except glyphosate included non-ionic surfactant at 0.25% v/v. Blessed milkthistle was in the rosette stage of growth and varied from 2 to 12 inches wide. Italian thistle was also in the rosette stage of growth, with rosettes being 2 to 8 inches wide. Russian thistle was small plants, about 2 to 3 inches tall, with multiple leaves. Weather on March 29, 2007 was 65 F, calm, with clear skies. Weed control was visually evaluated on May 3, 2007 (Table). All herbicide treatments controlled blessed milkthistle very well when evaluated about 5 weeks after treatment. Italian thistle control was similar, except for chlorsulfuron. Russian thistle control was excellent with glyphosate and chlorsulfuron and very good (83%) with triclopyr. Aminopyralid and clopyralid did not control Russian thistle adequately (<70%). Plots were sampled for biomass by clipping all vegetation in a one m^2 quadrat on August 14, 2007. There was no living milk thistle or Italian thistle in any of the herbicide treatment plots. The untreated control plots averaged 0.39 kg/m for blessed milkthistle and 0.21 kg/m for Italian thistle. Russian thistle biomass was different between treatments ($P<0.05$). Aminopyralid did not reduce Russian thistle biomass compared to the untreated control or triclopyr. At the two higher rates, aminopyralid was similar to the other treatments, except for chlorsulfuron. The green weight of the Russian thistle in the untreated control was reduced because of the presence of blessed milkthistle.

Table. Milk thistle, Italian thistle, and Russian thistle control with postemergence herbicides in San Diego, CA.

		Weed control			Russian thistle green weight August 14, 2007
Treatement	Rate[1]	Blessed milk-thistle	Italian thistle	Russian thistle	
	lb/A	%	%	%	Kg/m^2
Aminopyralid	0.05	82	98	38	3.9 A[2]
Aminopyralid	0.08	96	99	50	3.0 AB
Aminopyralid	0.1	99	99	66	3.3 AB
Clopyralid	0.25	92	99	66	1.3 BC
Triclopyr	1	93	99	83	2.9 AB
Glyphosate	3	100	100	99	1.4 BC
Chlorsulfuron	0.094	95	76	100	0 C
Untreated control		0	0	0	2.0 ABC

[1] Rates for chlorsulfuron are ai, all others are ae.

[2] Numbers in columns followed by the same letter are not different according to Tukey-Kramer HSD ($P <0.05$).

Cut-stump treatment for Russian olive control. Rodney G. Lym. (Plant Sciences Department, North Dakota State University, Fargo, ND 58105). Russian olive (*Elaeagnus angustifolia* L.) was originally planted in farm shelterbelts, wildlife production areas, and along highways, rivers, and streams in North Dakota in the early 1900s. It is one of the most hardy woody species introduced into the state, but spreads rapidly by seed, and can become invasive. Russian olive can displace native species such as plains cottonwood *(Populus deltoides* var. *occidentalis*) and reduce forage production in pasture and rangeland. Russian olive can grow to 20 to 25 feet in height and is often removed by cutting. However, this species regrows by producing multiple stems from the cut-stump and root crown area, resulting in a denser Russian olive infestation than found prior to removal. The purpose of this study was to evaluate a variety of auxinic herbicides as a cut-stump treatment for control of Russian olive regrowth.

The study was established on the Sheyenne National Grassland in cooperation with the U.S. Forest Service and was located near McLeod, ND. Russian olive originally had been planted as part of a shelter belt but had spread into an adjacent pasture. The trees were 15 to 25 feet tall and ranged in age from approximately 10 to over 50 years old. The trees were cut by Forest Service personnel on April 28, 2006 and herbicides were applied to the stumps on May 26, 2006. Each treatment was applied to 10 trees (reps) and each replicate consisted of similar size tree stumps. The first replicate contained the smallest tree stumps which were 7.5 to 8 inches in diameter while replicate 10 contained the largest diameter stumps which averaged 18.5 to 20 inches.

Herbicides were applied on a percent solution basis in a petroleum based oil (herbicide:oil v:v) with a single nozzle hand-held pump sprayer. Stumps were thoroughly covered to the point of run-off. Control was evaluated by counting the number of shoots arising from the stump and root collar of treated compared to non-treated stumps 2, 12, and 14 months after treatment.

All cut-stump treatments provided excellent control of Russian olive regrowth (Table). An average of 33 stems/stump grew from untreated trees compared to no regrowth from any of the treated stumps except triclopyr at 13.5% (v:v) which averaged 2 stems/stump in August 2006. No regrowth was observed on any treated stump in 2007, compared to an average of 5 and 2 stems/stump in the untreated control in June and August 2007, respectively. Control was similar with 2,4-D ester, triclopyr alone or triclopyr plus aminopyralid or 2,4-D. In conclusion, auxinic herbicides applied in oil provided excellent control of Russian olive regrowth from cut-stumps and can be applied at least 30 days after the tree has been cut.

Table. Control of Russian olive regrowth from stumps and root collar with various auxinic herbicides applied in an oil carrier on May 26, 2006, approximately 30 days after the trees were cut.

		Evaluation date		
Treatment[1]	Rate	8 Aug 06	11 June 07	7 Aug 07
	— % sol'n —	— Stems/stump[2] —		
2,4-D ester	21%	0	0	0
Aminopyralid + triclopyr	2 + 10%	0	0	0
Triclopyr	25%	0	0	0
Triclopyr/2,4-D[3]	11 + 22%	0	0	0
Triclopyr[4]	13.6%	2	0	0
Untreated check	• • •	33	5	2
LSD (0.05)		13	4	NS

[1] Herbicide treatments applied in bark oil solution, Bark oil by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189 on May 26, 2006.

[2] Number of stems regrowing from stump is an average of 10 trees (reps).

[3] Commercial formulation - Crossbow and [4] commercial formulation - Pathfinder II RTU product of triclopyr and oil. Both by Dow AgroSciences LLC, 9330 Zionsville Road, Indianapolis, IN 46268-1189.

Frill-cut herbicide application for control of Russian olive. Ron Patterson, Dennis Worwood, and Steve Dewey. (Utah State University, Logan, UT 84322) The goal of this field research project was to determine effective herbicides and rates for control of mature Russian olive trees using the frill-cut method of application. Treatments were made to single trees in a complete randomized block design with three replications. Trees ranged in caliper size from 5 to 8 inches, measured one foot above the ground. Single-trunked trees were selected to limit potential variability associated with trees having two or more trunks originating at ground level. Horizontal cuts were made in tree trunks using a conventional hatchet on October 12, 2005, approximately two weeks after the first fall frost. Cuts were made at a downward angle (about 45 degrees), penetrating the bark but not cutting deeper than approximately 0.5 inch into live wood. The number of cuts per tree corresponded to tree diameter (1 cut per inch of trunk diameter). Cuts were made within three feet of the ground, and were staggered to avoid girdling the trees. Herbicide was applied to each tree within less than 5 minutes of making the cuts. Herbicides were applied directly into the cuts using a metered syringe. Each tree was treated with one of three rates (1.0, 1.5, or 2.0 cc per inch of trunk diameter) of Habitat (28.7 percent imazapyr), 2,4-D amine (47.3 percent dimethylamine salt of 2,4-dichlorophenoxyacetic acid), or Roundup (41 percent glyphosate). Control was evaluated on September 5, 2006, by visual evaluation of the amount of live foliage occurring on each tree (Table). All treatments resulted in excellent control when evaluated approximately one year after treatment. A follow-up study has been initiated to evaluate effectiveness of frill-cut applications made at times of the year other than fall.

Table. Control of Russian olive using the frill-cut method of herbicide application.

Treatment	Rate	Control
	cc/inch[1]	%
2,4-D amine	1.0	98
2,4-D amine	1.5	97
2,4-D amine	2.0	100
Roundup PRO®	1.0	93
Roundup PRO®	1.5	100
Roundup PRO®	2.0	100
Habitat®	1.0	97
Habitat®	1.5	98
Habitat®	2.0	98
Non-Treated	--	--
LSD (0.05)		NS

[1] Cubic centimeters of formulated product applied per inch of trunk diameter

Herbicide evaluation for onionweed control. Carl E. Bell[1], Jessica Vinge[2], and Markus Spiegelberg[2]. ([1]Cooperative Extension, University of California, San Diego, CA 92123; [2]Center for Natural Lands Management, San Diego, CA 92107). A field study was conducted in San Diego, CA in 2007 to compare four herbicides to chlorsulfuron for control of onionweed (Table). In particular, we were interested in finding an effective herbicide on onionweed, but one that does not have as long a soil residual as chlorsulfuron. The experiment utilized a completely randomized design with four replications. Plot size was 5 by 10 feet. Herbicides were applied on February 16, 2007 with a CO_2 backpack sprayer using 3 - 8002vs flat fan nozzles on a boom covering 5 feet at 25 psi for a spray volume of 26 gpa. Onionweed at time of application was variable, ranging from 20 to 30 leaves, 2 to 12 inches tall, with no flowers. Few other plant species were present in the treatment plots. Weather at time of application was 65 F, clear skies, and calm. Plots were visually evaluated for onionweed control on April 19 and August 15, 2007 (Table). Of the herbicides tested, only chlorsulfuron provided good control of onionweed.

Table. Herbicide treatments and visual evaluations for onionweed control, San Diego, CA.

		Onionweed control	
Herbicide	Rate	April 19, 2007	August 15, 2007
	lbai/A	%	%
Clorsulfuron	0.094	99	93
Glyphosate	4	42	50
Glyphosate	8	54	73
Triclopyr	1	10	35
Triclopyr	2	38	42
Halosulfuron	0.035	50	27
Halosulfuron	0.070	42	17
Halosulfuron + dicamba	0.03 + 0.14	38	12
Halosulfuron + dicamba	0.06 + 0.28	31	31
Untreated control		0	0

<u>Imazapyr and glyphosate for giant reed control.</u> Carl E. Bell, and Bill Neill. (Cooperative Extension, University of California, San Diego, CA 92123; Riparian Repairs, Anaheim, CA 92807). A field experiment was initiated on April 28, 2006 to compare imazapyr and glyphosate, alone and in combination, for control of giant reed. The treatment site was at the Los Angeles County Whittier Narrows Regional Park in El Monte, CA. Plot size varied from six feet by 15 feet to six feet by 25 feet because of differences in giant reed clumps. Giant reed at this site had been cut down with a bulldozer a few months previously and the re-emerging stalks were six to ten feet tall at time of application. The experiment used a randomized complete block design with four replications. Herbicides were applied as a foliar spray applied to all giant reed stalks using a CO_2 pressured sprayer with a 5 - 8002vs nozzles on a 6 foot wide boom. Pressure was 40 psi and spray volume was 36.9 gpa. Weather at time of application was 60° F, cloudy, and a 0 to 2 mph breeze. Non-ionic surfactant at 0.25% v/v was added to all imazapyr alone treatments. The experiment was evaluated for plant height and giant reed control on June 27, 2006 (Table), about two months after treatment. At this time, all of the herbicide treatments had reduced plant height compared to the untreated control. The visual rating of giant reed control was similar between treatments, ranging from 50 to 79%. A second evaluation was made on May 17, 2007, about 13 months after treatment. This evaluation included a visual rating of control, height of living stalks, biomass of living stalks within a one meter square quadrat within each plot, and the number of living stalks within this same quadrat. At this time, all of the herbicide treatments controlled giant reed very well compared to the untreated control. Among the treatments, the low rate of glyphosate alone (1.9 lb/A) seemed to be less effective. In this case, the height of the giant reed stalks 13 months after treatment was different than the other herbicides and the untreated control ($P > 0.05$).

Table. Giant reed control with imazapyr and glyphosate in El Monte, CA.

		Control		Height[2]		Biomass[2]	Living stalks[2]
Treatment	Rate[1]	6/ 27/06	5/ 17/07	6/27/06	5/17/07	5/17/07	5/17/07
	Lb/A	%	%	feet	feet	Kg/m^2	$No./m^2$
Imazapyr	1.0	50	99	6.0 B[1]	1.67 C	0.83 B	4.0 B
Glyphosate	3.8	54	98	6.25 B	1.25 C	0.16 B	0.75 B
Imazapyr	0.5	73	98	5.5 B	2.0 C	0.45 B	4.25 B
Glyphosate	1.9	66	87	6.0 B	7.0 B	1.75 B	6.0 B
Imazapyr + glyphosate	0.5 + 1.9	79	99	5.5 B	1.75 C	0.41 B	5.75 B
Imazapyr + glyphosate	0.25 + 0.95	69	93	5.5 B	4.25 BC	1.06 B	4.25 B
Untreated control		0	0	11.25 A	25.0 A	17.3 A	33.25 A

[1] Rates for glyphosate are acid equivalent (ae), and are active ingredient (ai) for imazapyr.

[2] Numbers in columns followed by the same letter are not different according to Tukey-Kramer HSD ($P < 0.05$).

Relative response of goatsrue *(Galega officinalis)* to herbicide treatments. Michelle Oldham, and Corey V. Ransom. (Plant, Soils, Climate Department, Utah State University, Logan, UT, 84322-4820) Goatsrue response to herbicide treatments was evaluated in greenhouse trials. Eight herbicides were tested, 2,4-D amine, dicamba, chlorsulfuron, picloram, imazapyr, imazamox, aminopyralid, and triclopyr. Each herbicide was applied at doses of 0.125X, 0.25X, 0.5X, 1X, and 2X, where X is equal to a selected field use rate. Plants were sprayed when between 5 and 12 inches in height. Treatments were applied in a laboratory booth sprayer through a single 8002 nozzle at 20 gpa and 30 psi. Eight weeks after treatment, above ground biomass was harvested, dried and converted to a percentage of the untreated control. These data were fit to a logarithmic dose response curve. I_{50} values, the relative rate of each herbicide required to reduce biomass by 50%, were derived from the dose response curves. Goatsrue was most sensitive to the ALS inhibitors chlorsulfuron and imazapyr, with I_{50} values of 0.07X (3.7g ai ha^{-1}) and 0.16X (90 g ai ha^{-1}) respectively; the synthetic auxin, picloram, was also quite effective with an I_{50} value of 0.27X (153 g ae ha^{-1}). 2,4-D and imazamox were not applied at a high enough rates to reduce biomass by 50%.

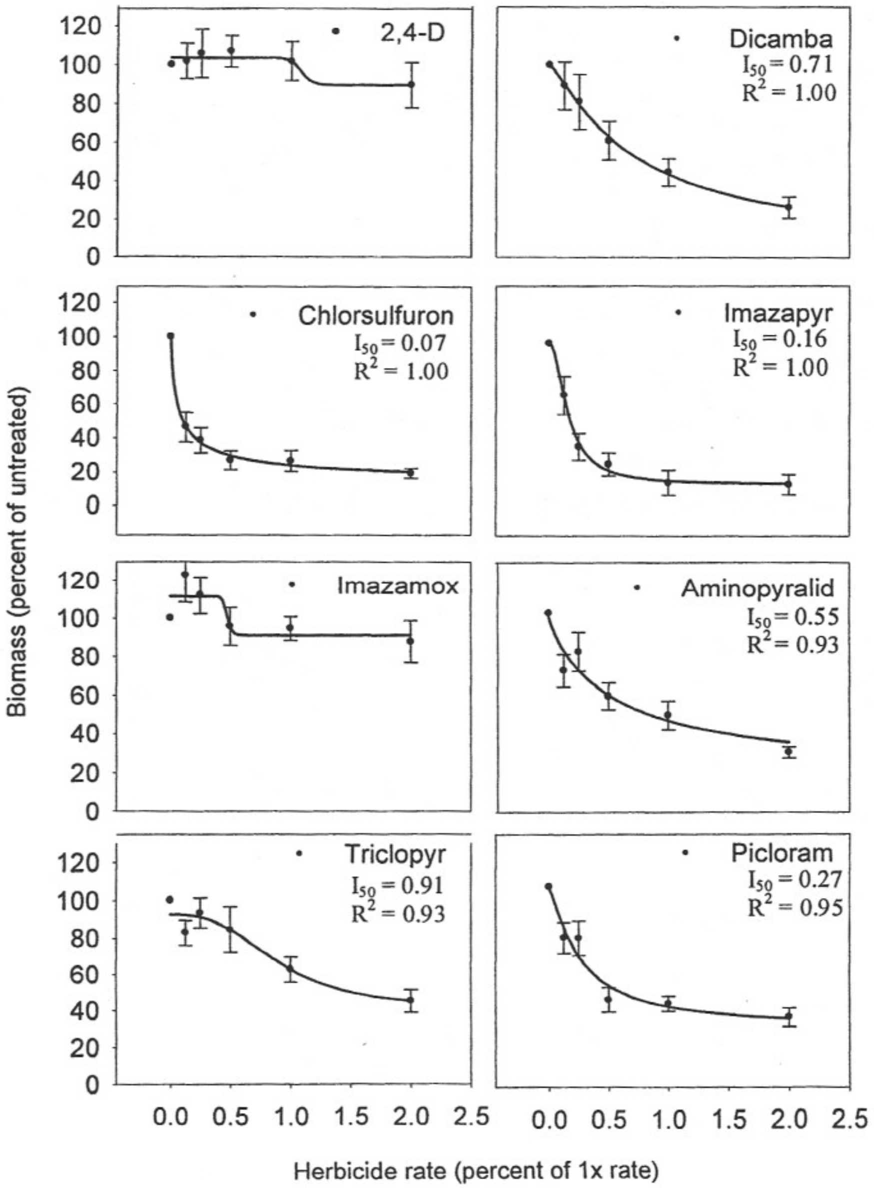


Figure. Response of Goatsrue to increasing rates of herbicide.

Depth of emergence for *Galega officinalis* seed. Michelle Oldham and Corey V. Ransom. (Plant, Soils and Climate Department, Utah State University, Logan UT, 84322-4820) To determine the depth from which goatsrue seeds can emerge, seeds were planted in pots at twelve different seed depths; 0, 0.5, 1, 2, 3, 4, 5, 6, 8, 10, 12 and 14 cm. A completely randomized block design was used consisting of 12 treatments with six replications. The trial was repeated. Ten scarified seeds were buried to appropriate depth in millville silt loam field soil in each pot (18 cm high by 16 cm wide). The pots were maintained at moist soil conditions with overhead sprinklers in a greenhouse and were monitored for seedling emergence for 30 days. As expected, an inverse relationship between depth of burial and seedling emergence was observed. Seeds buried under 0.5 cm of soil had very high emergence at 93%; emergence remained high for 1, 2 and 3cm depths at 90, 89, and 87% respectively. Emergence declined rapidly below 8 cm with no emergence at 12 and 14 cm depths. Seeds placed on the soil surface had high germination at 87%, however only 15% became established (data not shown in graph). This data demonstrates that soil disturbance which moves goatsrue seed from the soil surface may be beneficial for seeding establishment. However, burial of seeds at depths of 12 cm or greater can prevent goatsrue seedling emergence.

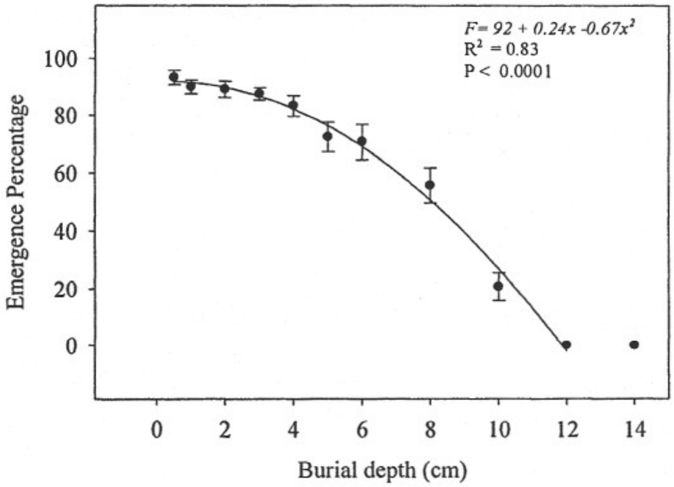


Figure. *Galega officinalis* seedling emergence at increasing depths.

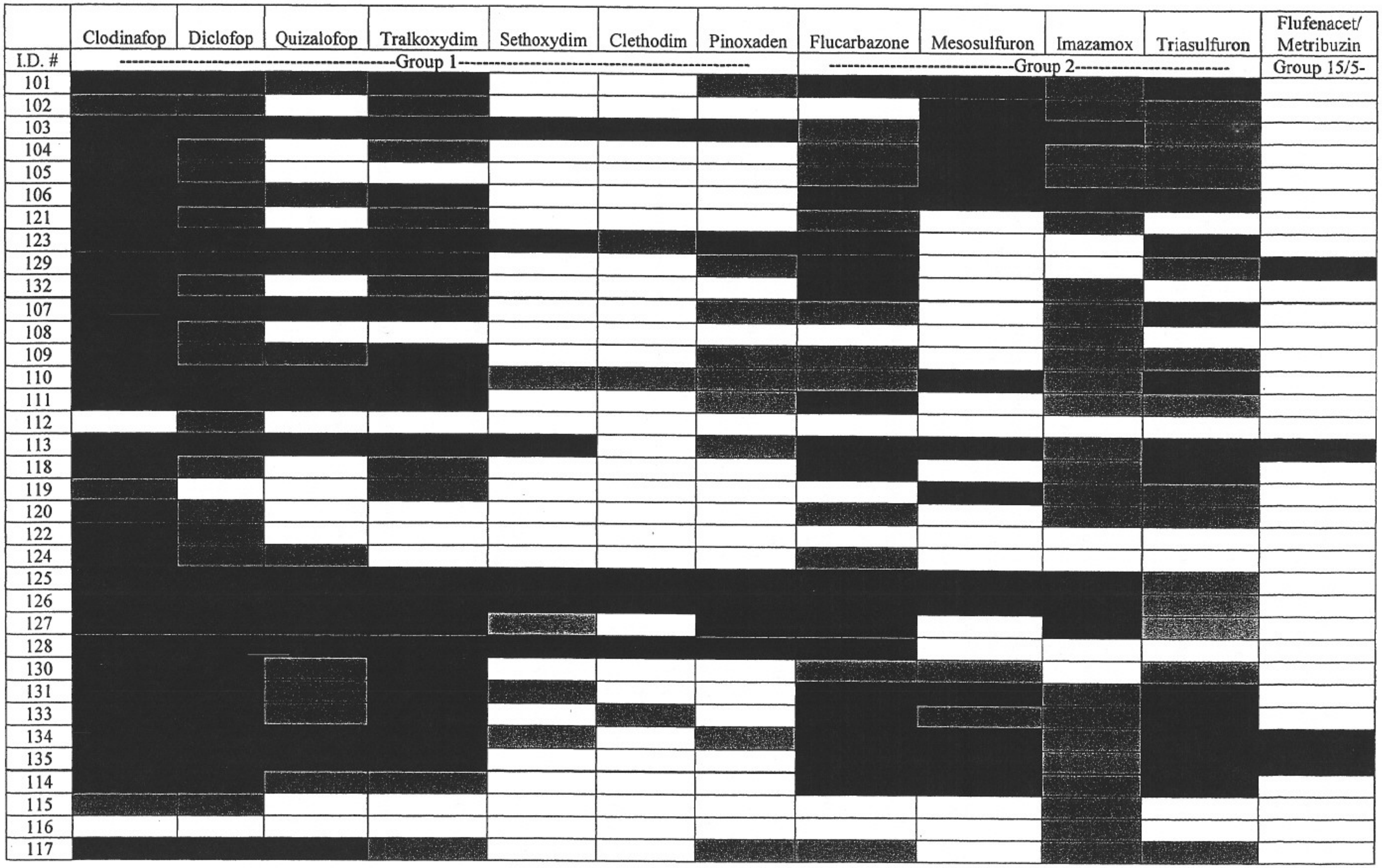
A survey of Italian ryegrass (*Lolium multiflorum*) herbicide resistance in northern Idaho and eastern Washington. Seth A. Gersdorf and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Italian ryegrass is a prevalent weed in Pacific Northwest (PNW) wheat production systems with known resistance to ACCase inhibitor herbicides (Group 1). The objective of this study is to determine the frequency of Group 1, 2 (ALS inhibitors), and 15 (Unknown site of action) herbicide resistance, including cross and multiple resistance patterns in Italian ryegrass populations collected from farm fields throughout eastern Washington and northern Idaho. In 2006, Italian ryegrass seed was collected at maturity in 12 selected fields in Whitman County, Washington and in 23 fields in Latah County, Idaho (35 total samples). In 2007, Italian ryegrass seed was collected in 2 fields in Whitman, 2 fields in Walla Walla, and 5 fields in Spokane Counties, Washington. In Idaho, seed was collected from 20 fields in Nez Perce, 4 fields in Latah, 6 fields in Lewis, and 1 field in Benewah Counties (40 total samples from Washington and Idaho). Combined from 2006 and 2007, 75 total samples were collected to be screened (Figure 2). Seeds were collected by walking in a "W" pattern and collecting seeds every 3 to 20 feet depending on the size of the infestation in each field. Sampling occurred in the center section of the infestation. Seeds collected in each field were bulked to form a single sample and were tested in the greenhouse for frequency of resistance or susceptibility to several herbicides commonly used to control Italian ryegrass in PNW wheat production systems (Table 1). Herbicides have been selected to determine patterns of cross resistance in herbicide groups 1 and 2 and multiple resistance in herbicide groups 1, 2, and 15/5.

Table 1. Herbicides used in greenhouse to test for cross and multiple resistance of Italian ryegrass populations.

Herbicide[1]	Rate	Group No.	Herbicide family	Timing[2]
	lb ai/A			
flufenacet/metribuzin	0.425	15/5	oxyacetamide	pre
triasulfuron	0.026	2	sulfonylurea	pre
mesosulfuron	0.009	2	sulfonylurea	post
flucarbazone	0.027	2	sulfonylaminocarbonyltriazolinone	post
imazamox	0.031	2	imidazolinone	post
clodinafop	0.063	1	aryloxyphenoxypropanoate	post
diclofop	0.500	1	aryloxyphenoxypropanoate	post
quizalofop	0.055	1	aryloxyphenoxypropanoate	post
tralkoxydim	0.180	1	cyclohexanedione	post
sethoxydim	0.188	1	cyclohexanedione	post
clethodim	0.094	1	cyclohexanedione	post
pinoxaden	0.054	1	phenylpyrazoline	post

[1] Methylated seed oil (MSO) at 1.5 pt/A was applied with the mesosulfuron and sethoxydim treatments. A nonionic surfactant (R-11) at 0.25% v/v and urea ammonium nitrate (UAN) at 5% v/v was applied with the flucarbazone and imazamox treatments. A nonionic surfactant (R-11) at 0.25% v/v was applied with the quizalofop treatment. Supercharge (NIS/COC) at 0.5% v/v was applied with the tralkoxydim treatment. A crop oil concentrate (Moract) at 1% v/v was applied with the clethodim treatment.
[2] Pre= preemergence and post= postemergence.

Populations were put in three different categories based on visual evaluations which were resistant, intermediate, and susceptible. Intermediate populations exhibited a low level of resistance and were significantly different than the susceptible populations, but not resistant to the extent of the resistant populations. The 35 samples collected in 2006 have been screened and 30 have been found to be resistant to at least one Group 1 herbicide (Figure 1). Twenty-four populations are resistant to at least one Group 2 herbicide, and 4 populations are resistant to the Group 15/5 herbicide. Twenty-two populations were found to be resistant to both Group 1 and 2 herbicides. Four populations are resistant to both Group 2 and 15/5 herbicides and the same 4 populations have multiple resistance to Group 1, 2, and 15/5 herbicides. The 2006 populations are in the process of being screened again in the greenhouse to confirm results. The 2007 I. ryegrass samples will be screened twice with the same 12 herbicides.



	Clodinafop	Diclofop	Quizalofop	Tralkoxydim	Sethoxydim	Clethodim	Pinoxaden	Flucarbazone	Mesosulfuron	Imazamox	Triasulfuron	Flufenacet/ Metribuzin
I.D. #	----Group 1----							----Group 2----				Group 15/5-
101	■	■	▨	■	□	□	▨	■	■	▨	■	□
102	▨	▨	□	▨	□	□	□	□	■	▨	▨	□
103	■	■	■	■	■	■	■	▨	■	■	▨	□
104	■	▨	□	▨	□	□	□	▨	■	▨	▨	□
105	■	▨	□	□	□	□	□	▨	■	▨	▨	□
106	■	■	▨	■	□	□	□	■	■	■	■	□
121	■	▨	□	▨	□	□	□	▨	□	▨	□	□
123	■	■	■	■	■	▨	■	■	□	□	■	□
129	■	■	■	■	□	□	▨	■	□	□	▨	■
132	■	▨	□	▨	□	□	□	■	□	▨	□	□
107	■	■	■	■	□	□	▨	▨	□	▨	■	□
108	■	▨	□	□	□	□	□	□	□	▨	□	□
109	■	▨	▨	■	□	□	▨	▨	□	▨	▨	□
110	■	■	■	■	▨	▨	▨	▨	■	▨	■	□
111	■	■	■	■	□	□	▨	■	□	▨	▨	□
112	□	▨	□	□	□	□	□	□	□	□	□	□
113	■	■	■	■	■	□	▨	■	■	▨	■	■
118	■	▨	□	▨	□	□	□	■	□	▨	■	□
119	▨	□	□	▨	□	□	□	□	■	▨	▨	□
120	■	▨	□	□	□	□	□	▨	□	▨	▨	□
122	■	▨	□	□	□	□	□	□	□	□	□	□
124	■	▨	▨	□	□	□	□	▨	□	□	□	□
125	■	■	■	■	■	■	■	■	■	■	▨	□
126	■	■	■	■	■	■	■	■	■	■	▨	□
127	■	■	■	■	▨	□	■	■	□	■	▨	□
128	■	■	■	■	■	■	■	■	□	□	□	□
130	■	■	▨	■	□	□	□	▨	▨	□	▨	□
131	■	■	▨	■	▨	□	□	■	■	▨	■	□
133	■	■	▨	■	□	▨	□	■	▨	▨	■	□
134	■	■	■	■	▨	□	▨	■	■	▨	■	■
135	■	■	■	■	□	□	□	■	■	▨	■	■
114	■	■	▨	▨	□	□	□	■	■	▨	■	□
115	▨	▨	□	□	□	□	□	□	□	▨	□	□
116	□	□	□	□	□	□	□	□	□	▨	□	□
117	■	■	■	▨	□	□	▨	▨	□	▨	▨	□

Figure 1. Resistance matrix based on visual evaluations of 35 populations screened in the greenhouse with 12 herbicides. The populations were grouped by geographic location. Black = resistant, Grey = intermediate, White = susceptible.

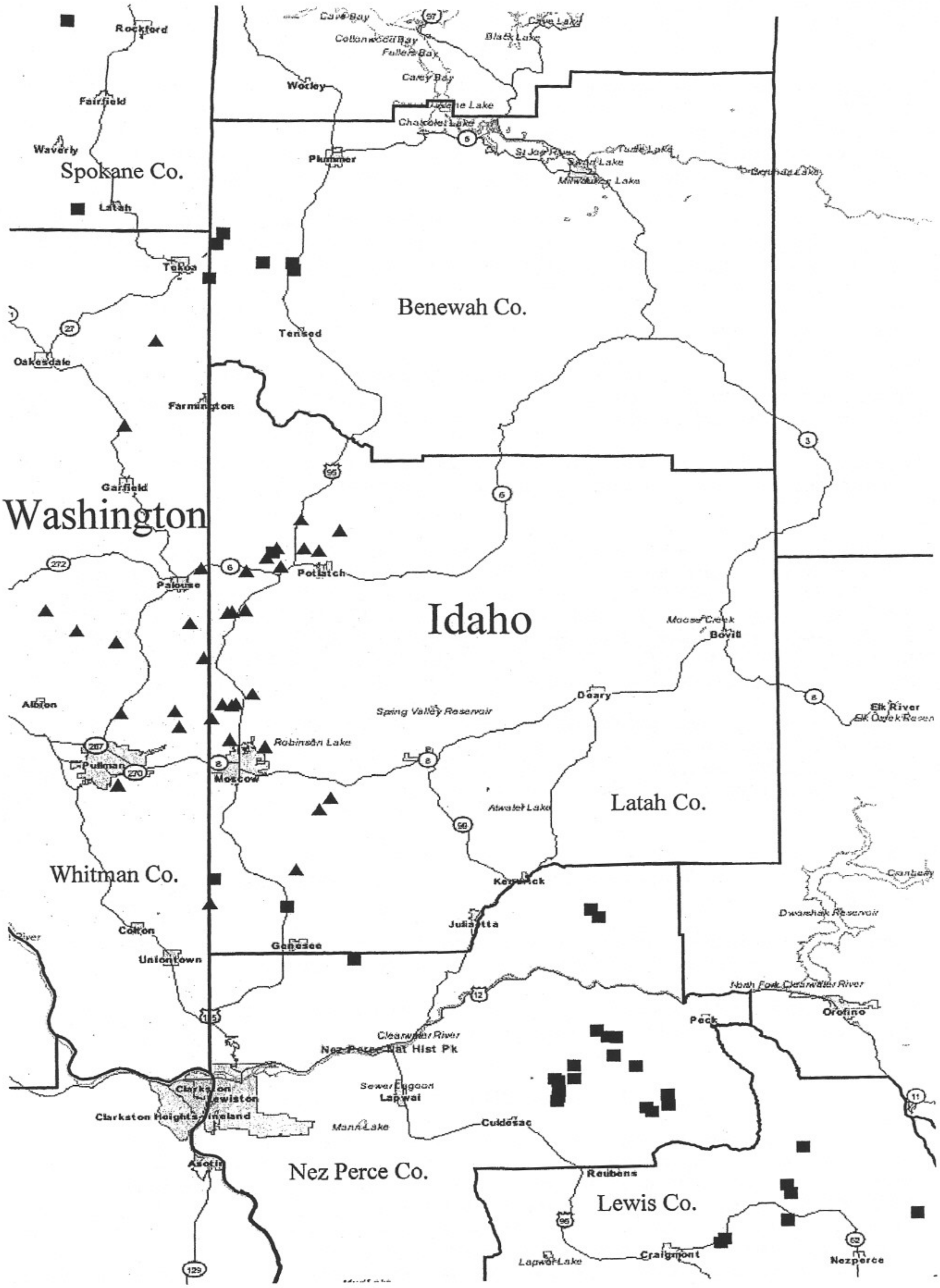


Figure 2. Location of I. ryegrass populations collected in 2006 (triangles) and 2007 (squares).

Seedling emergence of yellow woodsorrel in eastern South Dakota. Randy L. Anderson. (USDA-ARS, Brookings SD 57006). Pest management is becoming more difficult in the corn-soybean rotation in eastern South Dakota, which can be partially attributed to a lack of crop diversity. Therefore, scientists in the region are exploring alternative rotations with the goal of diversifying the corn-soybean rotation. One trend noted with these rotation studies is the invasion of yellow woodsorrel (*Oxalis stricta* L.), especially if no-till practices are used.

The botanical characteristics of yellow woodsorrel have been summarized by Doust et al. (Can. J. Plant Sci. 65:691; 1985). It is a perennial species that is common in garden nurseries, lawns, croplands, and roadsides in eastern Canada, especially in the Corn Belt region of Ontario. A unique trait of this species is its seed dispersal; seed capsules rupture at maturity and disperse seeds more than 2 m from the parent plant. Herbicides commonly used on grass lawns, such as 2,4-D and dicamba are only marginal effective on yellow woodsorrel, whereas the most effective control tactic in cropland is tillage.

In eastern South Dakota, yellow woodsorrel also is found in lawns and grass roadsides. It generally grows to a height of less than 8 inches tall, thus it often is not noticed. It is not prevalent in conventionally tilled fields, but yellow woodsorrel has increased rapidly in no-till cropping systems.

The objective of this study was to characterize the emergence pattern of yellow woodsorrel in cropland during the growing season and to quantify the impact of tillage management on seedling emergence.

Methodology: A seedling emergence study assessing the weed community in this region was started in 2004, and yellow woodsorrel was prominent in the weed community. The study included both no-till and tilled sites. The tilled sites were chisel plowed in the fall of each year, before soil freezing; no tillage occurred in the following year. During the growing season, weed seedling emergence was recorded weekly in each of six 0.5 m^2 sites for each tillage treatment. After counting, weeds were removed by hand. This study was repeated at new locations in each of four years during 2004 to 2007. The field used for all sites was in a corn-soybean rotation; therefore, sites were established twice in each crop across the 4 years.

A seedling emergence pattern for yellow woodsorrel was calculated by converting seedling density observed each week to a percentage of seasonal emergence for the growing season, then developing an emergence curve for the season by cubic spline interpolation. Data were averaged across replication, tillage treatment, and years. A standard deviation was calculated for weekly means by assessing means across years.

Results: Yellow woodsorrel began emerging in early May and continued for 14 weeks (see Figure below). Approximately 80% of seedlings emerged during the six-week interval between May 9 and June 15, but seedlings continued to emerge during July.

Comparing no-till and conventional tillage, the total number of seedlings that emerged yearly was 3 times higher in no-till. The emergence pattern, however, did not differ between tillage systems (data not shown).

The growth period of yellow woodsorrel was quite short. In established stands, seedlings began flowering 4 weeks after emergence and dispersing seeds after 8 weeks of growth.

Observations Related to Weed Management

We have noticed that yellow woodsorrel is prominent in glyphosate-tolerant corn and soybean, especially if weed management consists of only one glyphosate application after planting and no residual herbicides. In contrast, yellow woodsorrel does not invade alfalfa, even when yellow woodsorrel is established in grass alleyways next to alfalfa. We speculate that the growth cycle of alfalfa is not favorable for yellow woodsorrel seedlings to survive and establish plants. In eastern South Dakota, alfalfa usually starts growth in early April, with the first cutting for hay occurring in mid-June. The early growth of alfalfa apparently prohibits early season survival of yellow woodsorrel, whereas alfalfa regrows rapidly after the first cutting, thus suppressing establishment of yellow woodsorrel seedlings that emerge in late June and early July.

Another trend was noted in a second study of weed seedling emergence where weeds established at harvest of cool-season crops were recorded. Yellow woodsorrel was present in winter wheat and spring wheat at 6 to 9 seedlings/m^2; in contrast, seedlings were not present in canola stubble at harvest. Because yellow woodsorrel plants were still seedlings, we speculate that the seedlings emerged late in the growing season of the wheat crops.

Because of these trends with alfalfa and canola, we suggest that crop diversity in rotations may provide opportunities to restrict invasion of yellow woodsorrel into no-till rotations.

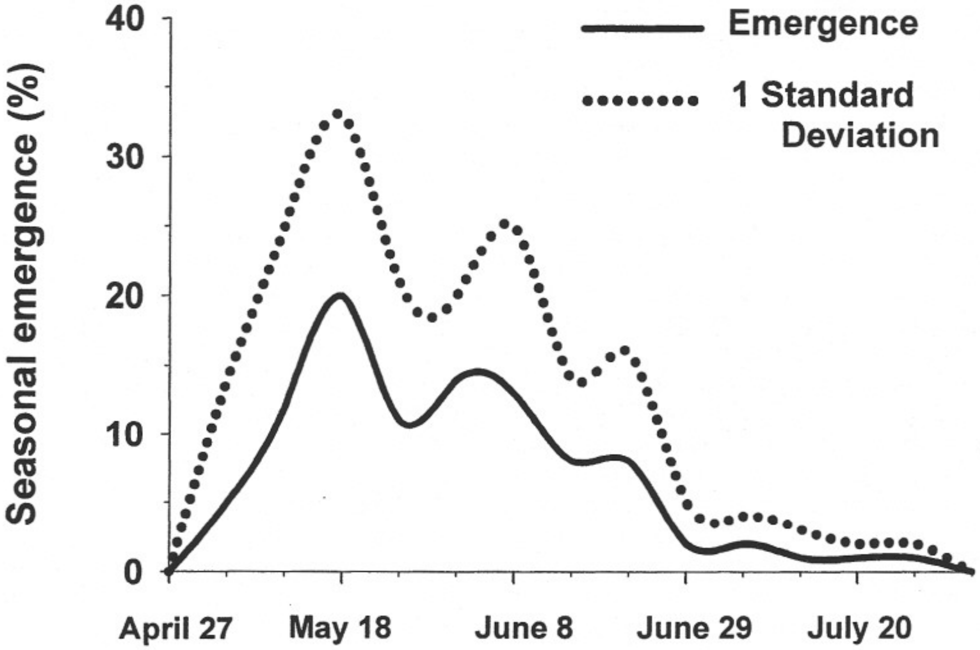


Figure 1. Seedling emergence of yellow woodsorrel; data averaged across tillage system and years. Study conducted at Brookings SD.

Brassicaceae meal type, application rate, and planting time effects on emergence and growth of fresh carrots and control of common lambsquarters. Lydia A. Clayton and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established at University of Idaho Plant Science Farm near Moscow, Idaho to evaluate *Sinapis alba* L. 'IdaGold' (yellow mustard) and *Brassica napus* L. 'Sunrise' (canola) seed meal at five rates on emergence and growth of 'Nelson' carrot and control of common lambsquarters at four planting times. The plots were 1 by 2.5 m arranged in a randomized complete split-block with four replications, two sub-plots, and included an untreated check. Main plots were four planting times, each containing two meal type treatments at five rates (0.5, 1, 2, 3, and 4 mt/ha). Sub-plots were weed treatments (hand-weeded and non-weeded). Common lambsquarters (*Chenopodium album* L.) seeds were broadcast seeded into non-weeded subplot at 1,000 seeds/m^2. Seed meal was applied surface broadcast on May 17, 2007 followed by 3.2 mm of water using a cone sprayer calibrated to deliver 2 L/ha at 276 KPa at 1 km/hr. Carrot seed was planted at a rate of 1 seed/cm using a Hege seven row planter at a depth of 12.7 mm on May 18, 20, 23 and 29. Plots were irrigated by planting time and irrigated consistently across planting times throughout the growing season. Carrot emergence counts were taken in each plot in the same sequence as planting at 30 DAT. Common lambsquarter biomass was collected at 47 and 74 DAT and measured as weight/plant/m^2. One-meter row (m row) of carrots was harvested in each sub-plot in the same sequence as planting at 89, 92, 95, and 102 DAT. Harvested carrots were graded into marketable and non-marketable groups. Carrots not meeting the criteria of 10.2 cm in length, 2.5 cm in width, or containing forking, hairy roots, or insect damage were grouped as non-marketable. Marketable fresh root weight and number of carrots per one m/row of each sub-plot were measured.

Marketable carrot root weight and number were not different between hand-weeded versus non-weeded treatments (data not shown). Averaged over planting dates, carrot emergence was greater with canola seed meal application rate of 0.5 mt/ha than 1 mt/ha, and both rates had greater emergence than all other rates (Table 1). Average carrot emergence for yellow mustard seed meal rates of 0.5 and 1 mt/ha were not different from each other, but were greater than all other rates (Table 2). Carrot emergence number was less than the untreated check for all treatments, except for canola seed meal at 0.5 mt/ha at 12 DAT. Carrot emergence increased with increasing DAT, but decreased with increasing application rates for both canola and yellow mustard seed meal treatments. Averaged over planting date, carrot marketable root weight was greatest for the canola seed meal application rate of 0.5 mt/ha and least at 4 mt/ha (Table 3). Average carrot marketable root weight for yellow mustard seed meal application rates of 0.5 and 1 mt/ha were not significantly different from each other, but were greater than all other rates (Table 4). Carrot marketable root weight was less than the untreated check for all seed meal treatments, except canola at 0.5 mt/ha at 12 DAT. Carrot marketable root weight decreased with increasing application rate, but increased with increasing DAT for both canola and yellow mustard seed meal treatments. Averaged over planting date, the carrot marketable root number was greatest for canola seed meal applied at 0.5 mt/ha and least at 4 mt/ha (Table 5). Average carrot marketable number was significantly greater for 0.5 and 1 mt/ha yellow mustard seed meal rates compared to all other rates (Table 6). Carrot marketable root number was less than the untreated check for all treatments, except for canola seed meal at 0.5 mt/ha at 12 DAT. Carrot marketable root number decreased with increasing application rate, but increased with increasing DAT for both canola and yellow mustard seed meal treatments. Overall, average carrot emergence number, marketable root weight, and marketable root number tended to increase with decreasing seed meal rate and increasing DAT planting times for both canola and yellow mustard seed meal treatments. Additionally, average carrot emergence number, marketable root weight, and marketable root number were less than the untreated check for all treatments, except for canola at 0.5 mt/ha at 12 DAT.

Averaged over planting dates, common lambsquarter biomass collected at 47 DAT for all canola seed meal rates was greater than the untreated check (Table 7). Common lambsquarter biomass collected at 47 DAT, was less with a canola seed meal application rate of 1 mt/ha than 0.5 mt/ha, and both rates had less biomass than all other rates. Common lambsquarters growth likely was responding to the 5-6 % nitrogen contained in the canola seed meal. Averaged over planting dates, common lambsquarter biomass collected at 47 DAT for yellow mustard seed meal rates was less than the untreated check, except for 0.5 mt/ha (Table 8). Average common lambsquarter biomass collected at 47 DAT were not different for yellow mustard seed meal application rates of 3 and 4 mt/ha, but were less than all other rates. Common lambsquarter biomass collected at 74 DAT and averaged over planting dates for canola seed meal rates was greatest at 0.5 mt/ha, least at 1 mt/ha, and none were significantly different from the untreated control (Table 9). Common lambsquarter biomass collected at 74 DAT and averaged over planting dates for yellow mustard seed meal rates was greatest at 2 mt/ha, least at 1 mt/ha, and none were significantly different from the untreated control (Table 10). Overall, common lambsquarter biomass at 47 DAT tended to decrease with increasing yellow mustard seed meal rates across all planting times and tended to increase with increasing canola seed meal rates across all planting times. Common lambsquarter biomass at 74 DAT showed no trend for either canola or yellow mustard seed meal treatments.

Table 1. The effect of canola seed meal on the emergence of carrots in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2]*	1	3	6	12	Rate means**
------mt/ha------	----------------------------number/m row			--------------------------------	
Canola					
0.5	9	19	20	42	20 (3.99)
1	3	5	6	29	7 (1.91)
2	1	2	2	24	3 (1.17)
3	1	1	3	13	3 (1.08)
4	1	1	2	9	2 (0.75)
Timing mean***	4 (1.33)	5 (1.60)	7 (1.90)	22 (3.10)	
Untreated check	56 (4.03)	65 (4.17)	70 (4.24)	34 (3.52)	54 (3.99)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.
*LSD (timing*rate) = 4 (1.45) **LSD (rate) = 2 (0.61) ***LSD (timing) = 2 (0.49)

Table 2. The effect of yellow mustard seed meal on emergence of carrots in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2]*	1	3	6	12	Rate means**
------mt/ha------	----------------------------number/m row			--------------------------------	
Yellow mustard					
0.5	7	22	10	16	15 (2.68)
1	2	11	7	26	8 (2.10)
2	1	2	3	16	3 (1.17)
3	1	2	1	7	2 (0.78)
4	1	1	1	6	2 (0.50)
Timing mean***	3 (1.23)	6 (1.83)	7 (1.73)	15 (2.68)	
Untreated check	56 (4.03)	65 (4.17)	70 (4.24)	34 (3.52)	54 (3.99)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.
*LSD (timing*rate) = 4 (1.48) **LSD (rate) = 2 (0.64) ***LSD (timing) = 2 (0.52)

Table 3. The effect of canola seed meal on the root weight for marketable carrots in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2]*	1	3	6	12	Rate means**
------mt/ha------	----------------------------------g/m row			-----------------------------	
Canola					
0.5	408	671	1023	1331	781 (6.66)
1	8	43	184	949	88 (4.48)
2	32	36	22	831	67 (4.21)
3	17	6	14	831	33 (3.51)
4	1	2	8	532	10 (2.26)
Timing mean***	36 (3.58)	48 (3.87)	92 (4.51)	880 (6.78)	
Untreated check	1156 (7.05)	1007 (6.91)	1230 (7.11)	1001 (6.91)	1094 (6.99)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.
*LSD (timing*rate) = 10 (2.27) **LSD (rate) = 3 (0.94) ***LSD (timing) = 2 (0.59)

Table 4. The effect of yellow mustard seed meal on the root weight for marketable carrots in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2]*	1	3	6	12	Rate means**
------mt/ha------	---------------------------------g/m row-----------------------------				
Yellow mustard					
0.5	381	307	336	41	358 (5.88)
1	9	417	378	1070	197 (5.28)
2	33	12	17	529	27 (3.19)
3	19	47	6	214	24 (3.31)
4	10	5	2	100	10 (2.27)
Timing mean***	32 (3.47)	85 (4.44)	56 (4.03)	414 (6.02)	
Untreated check	1156 (7.05)	1007 (6.91)	1230 (7.11)	1001 (6.91)	1094 (6.99)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.

*LSD (timing*rate) = 11 (2.35) **LSD (rate) = 3(1.01) ***LSD (timing) = 4 (1.28)

Table 5. The effect of canola seed meal on the number of marketable carrots in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2]*	1	3	6	12	Rate means**
------mt/ha------	----------------------------number/m row--------------------------------				
Canola					
0.5	6	6	10	15	8 (2.05)
1	1	2	3	10	3 (1.02)
2	1	1	1	12	2 (0.86)
3	1	1	1	8	2 (0.53)
4	1	1	1	4	1 (0.05)
Timing mean***	2 (0.65)	2 (0.87)	3 (1.05)	10 (2.27)	
Untreated check	16 (2.80)	16 (2.74)	16 (2.80)	13 (2.58)	15 (2.73)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.

*LSD (timing*rate) = 4 (1.39) **LSD (rate) =1 (0.37) ***LSD (timing) = 1 (0.35)

Table 6. The effect of yellow mustard seed meal on the number of marketable carrots in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2]*	1	3	6	12	Rate means**
------mt/ha------	----------------------------number/m row--------------------------------				
Yellow mustard					
0.5	5	5	6	7	6 (1.75)
1	1	4	4	11	4 (1.33)
2	1	1	1	6	1 (0.38)
3	1	2	1	3	1 (0.39)
4	1	1	1	3	1 (0.02)
Timing mean***	2 (0.68)	2 (0.90)	3 (1.01)	6 (1.80)	
Untreated check	16 (2.80)	16 (2.74)	16 (2.79)	13 (2.58)	15 (2.73)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.

*LSD (timing*rate) = 4 (1.49) **LSD (rate) = 1 (0.23) ***LSD (timing) = 2 (0.58)

Table 7. The effect of canola seed meal on common lambsquarter biomass collected at 47 DAT in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2*]	1	3	6	12	Rate means**
------mt/ha------	----------------------------g/m^2-------------------------------				
Canola					
0.5	0.88	0.66	1.35	0.81	0.89 (-0.12)
1	0.32	0.91	1.42	0.84	0.77 (-0.26)
2	1.03	0.86	1.33	0.77	0.97 (-0.03)
3	1.12	1.08	1.26	1.25	1.17 (0.16)
4	1.21	1.05	2.15	0.83	1.23 (0.21)
Timing mean***	0.79 (-0.24)	0.82 (-0.19)	1.04 (0.03)	0.84 (-0.17)	
Untreated check	0.60 (-0.51)	0.94 (-0.06)	0.96 (-0.04)	0.65 (-0.41)	0.61 (-0.49)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.
*LSD (timing*rate) = 4 (1.49) **LSD (rate) = 2 (0.41) ***LSD (timing) = 2 (0.73)

Table 8. The effect of yellow mustard seed meal on common lambsquarter biomass collected at 47 DAT in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2*]	1	3	6	12	Rate means**
------mt/ha------	---------------------------- g/m^2-------------------------------				
Yellow mustard					
0.5	0.84	0.95	0.77	0.79	0.86 (-0.16)
1	0.61	1.07	0.22	0.67	0.55 (-0.59)
2	0.74	0.63	0.14	0.42	0.41 (-0.90)
3	0.65	0.16	0.31	0.34	0.32 (-1.13)
4	0.28	0.17	0.08	0.30	0.18 (-1.70)
Timing mean***	0.59 (-0.53)	0.47 (-0.76)	0.27 (-1.31)	0.50 (-0.70)	
Untreated check	0.60 (-0.51)	0.94 (-0.06)	0.96 (-0.04)	0.65 (-0.41)	0.61 (-0.49)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.
*LSD (timing*rate) = 6 (1.82) **LSD (rate) = 2 (0.61) ***LSD (timing) = 2 (0.76)

Table 9. The effect of canola seed meal on common lambsquarter biomass collected at 74 DAT in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2*]	1	3	6	12	Rate means**
------mt/ha------	----------------------------g/m^2-------------------------------				
Canola					
0.5	1.02	0.93	0.11	0.79	0.91 (-0.10)
1	0.05	0.04	0.03	0.03	0.05 (-2.96)
2	0.38	0.03	0.14	0.22	0.14 (-1.96)
3	0.05	0.05	0.09	0.14	0.07 (-2.64)
4	1.02	0.14	0.03	0.08	0.13 (-2.00)
Timing mean***	0.23 (-1.48)	0.09 (-2.43)	0.07 (-2.61)	0.15 (-1.93)	
Untreated check	0.17 (-1.80)	0.07 (-2.73)	0.12 (-2.13)	0.15 (-1.92)	0.12 (-2.14)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.
*LSD (timing*rate) = 17 (2.82) **LSD (rate) = 4 (1.29) ***LSD (timing) = 4 (1.42)

Table 10. The effect of yellow mustard seed meal on common lambsquarter biomass collected at 74 DAT in a 2007 field study near Moscow, Idaho.

	Planting dates (DAT)[1]				
Treatments[2*]	1	3	6	12	Rate means[**]
------mt/ha------	---------------------------- g/m^2	-------------------------------			
Yellow mustard					
0.5	0.51	0.07	0.07	0.18	0.15 (-1.81)
1	0.05	0.04	0.01	0.08	0.04 (-3.35)
2	1.31	0.05	0.05	0.19	0.16 (-1.85)
3	0.05	0.04	0.04	0.15	0.06 (-2.84)
4	0.17	0.03	0.10	0.25	0.11 (-2.22)
Timing mean[***]	0.19 (-1.67)	0.05 (-3.02)	0.05 (-3.01)	0.16 (-1.85)	
Untreated check	0.17 (-1.80)	0.07 (-2.73)	0.12 (-2.13)	0.15 (-1.92)	0.12 (-2.14)

[1] Days after meal application.

[2] Statistical inferences based on natural log transformation (parenthetical values), all values reported untransformed.

*LSD (timing*rate) = 18 (2.82) **LSD (rate) = 6 (1.8206) ***LSD (timing) = 4 (1.4853)

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