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FOREWORD

The 2007 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.

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

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Control of downy brome in great basin wildrye. 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 October 20, 2005 in southern Colorado to evaluate the response of Great Basin wildrye and downy brome to postemergence herbicides. Soil type was a Ramper 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 October 20, 2005 with crop oil concentrate and Uran 32 at 1% v/v. Treatments were evaluated on April 11, 2006.

All treatments gave poor control of downy brome except hexazinone plus metsulfuron at 0.5 plus 0.009 lb ai/A which gave 88% control.

Table. Control of downy brome with postemergence herbicides in great basin wildrye.

		Weed control[b]
Treatments[a]	Rate	BROTE
	lb ai/A	------%-------
Nicosulfuron + metsulfuron	0.0313+0.009	67
Nicosulfuron + metsulfuron	0.047+0.009	67
Nicosulfuron + metsulfuron	0.063+0.009	75
Diuron + metsulfuron	0.8+0.009	28
Diuron + metsulfuron	1.6+0.009	42
Hexazinone + metsulfuron	0.25+0.009	38
Hexazinone + metsulfuron	0.375+0.009	37
Hexazinone + metsulfuron	0.5+0.009	88
Terbacil + metsulfuron	0.4+0.009	48
Terbacil + metsulfuron	0.8+0.009	53
Flucarbazone + metsulfuron	0.026+0.009	20
Flucarbazone + metsulfuron	0.052+0.009	27
Weedy check	0	0

[a] Treatments were applied with a COC and Uran 32 at 1.0% v/v.

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

Control of downy brome in great basin wildrye with chlorsulfuron combinations. 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 October 18, 2005 in southern Colorado to evaluate the response of Great Basin wildrye and downy brome to chlorsulfuron combinations. Soil type was a Ramper 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 October 18, 2005 with crop oil concentrate and Uran 32 at 1% v/v. Treatments were evaluated on April 11, 2006.

Sulfometuron at 0.047 and 0.035 lb ai/A and rimsulfuron at 0.031 in combination with chlorsulfuron at 0.023, 0.017 lb ai/A gave good to excellent control of downy brome. Sulfometuron at 0.047 and 0.035 lb ai/A in combination with chlorsulfuron at 0.023 and 0.017 lb ai/A caused Great Basin wildrye injury of less than 10%.

Table. Control of downy brome with chlorsulfuron combinations in great basin wildrye.

		Weed control[b]
Treatments[a]	Rate	BROTE
	lb ai/A	------%-------
Sulfometuron + chlorsulfuron	0.047+ 0.023	94
Sulfometuron + chlorsulfuron	0.035+0.017	92
Sulfometuron + chlorsulfuron	0.023+0.011	82
Rimsulfuron + chlorsulfuron	0.008+0.023	55
Rimsulfuron + chlorsulfuron	0.016+0.023	79
Rimsulfuron + chlorsulfuron	0.031+0.023	86
Metsulfuron + chlorsulfuron	0.038+0.047	57
Weedy check	0	0

[a] Treatments were applied with a COC and Uran 32 at 1.0% v/v.

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

Annual grass control with sulfometuron methyl and chlorsulfuron. John Wallace, Tim Prather, and Larry Lass (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Boise, Idaho in roadside vegetation to evaluate the efficacy of sulfometuron methyl and chlorsulfuron mixtures and sulfometuron methyl alone for control of annual grasses including downy brome (*Bromus tectorum* L.) and medusahead (*Taeniatherum caput-medusa* (L.) Nevski). 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 data.

Location	Ada County, Idaho
Target weed	Smooth brome, Medusahead
Weed growth stage	1-2 inches
Application date	April 6, 2005
Air Temp (F)	44
Relative humidity (%)	71
Wind (mph, direction)	1-3, SE
Cloud cover (%)	30
Soil temp at 2 inches (F)	45

Annual grass control was evaluated on April 4, 2006, 12 months after treatment (MAT). Downy brome and medusahead control ranged from 68 to 99% and 93 to 100%, respectively (Table 2). Herbicide mixtures of sulfometuron methyl and chlorsulfuron did not result in greater control in comparison to sulfometuron methyl alone. High rates of sulfometuron methyl (1.125 oz ai/A) provided greater control of downy brome than low rates (0.375 oz ai/A), but did not affect medusahead control.

Table 2. Annual grass control with various herbicides near Boise, Idaho in 2005-2006.

Treatment[1]	Rate	Annual grass control (12 MAT) BRTE[2]	TACA8
	oz ai / A	----------------%----------------	
Sulfometuron methyl + chlorsulfuron	1.125 + 0.5625	92	100
Sulfometuron methyl + chlorsulfuron	0.75 + 0.375	97	100
Sulfometuron methyl + chlorsulfuron	0.5625 + 0.2813	95	100
Sulfometuron methyl + chlorsulfuron	0.375 + 0.1875	82	99
Sulfometuron methyl	1.125	99	100
Sulfometuron methyl	0.75	88	100
Sulfometuron methyl	0.5625	93	100
Sulfometuron methyl	0.375	68	97
Untreated check	0	0	0
Tukey's Studentized Range HSD (0.05)		23.3	3.9

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

[2] BRTE = downy brome, TACA8 = medusahead

Hoary cress control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) Hoary cress or whitetop (CARDR) is an aggressive perennial weed that spreads both by seed and creeping roots. It is a problem in Colorado in disturbed sites such as roadsides, hay meadows, and on native rangeland.

An experiment was established near Longmont, CO to evaluate CARDR control. The experiment was designed as a randomized complete block with four replications. Metsulfuron or metsulfuron tank mix treatments (Table 2) were applied on May 18, 2005 when CARDR was in early flower growth stage and imazapic was sprayed May 26, 2005 when CARDR was full bloom. All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles at 21 gal/A and 14 psi. Other application information is presented in Table 1. Plot size was 10 by 30 feet. Crop oil concentrate was added at 32 fl oz/a to all treatments.

Visual evaluations for control compared to non-treated plots were collected in June and November 2005, and May and November 2006 (Table 2). June 2005 and May 2006 evaluations were on CARDR flowering plants while November evaluations in 2005 and 2006 were on CARDR fall regrowth. Treatments with metsulfuron controlled 60 to 75% of CARDR approximately 40 days after treatment (DAT) and 83 to 100% of CARDR in November 2005. There was a rate response from metsulfuron plus chlorsulfuron plus 2,4-D ester in 2006. The lowest rate of this tank mix (0.2 + 0.2 + 8 oz ai/a, respectively) controlled 63% of CARDR while the highest rate of this tank mix (0.6 + 0.8 + 8 oz ai/a) controlled 96% of CARDR in November 2006 (approximately 18 months after treatment).

Metsulfuron plus 2,4-D ester controlled CARDR similarly to the same rates of metsulfuron plus chlorsulfuron tank mixes in 2005; however, residual CARDR control dropped with metsulfuron plus 2,4-D ester compared to the chlorsulfuron tank mixes in 2006. Metsulfuron plus chlorsulfuron plus 2,4-D ester out performed metsulfuron plus 2,4-D ester the year after application (63 to 96% CARDR control compared to 50 to 59% CARDR control, respectively).

Imazapic controlled CARDR slowly, 22% control, 1 MAT, but controlled 85% of CARDR at the November 2005 evaluation. CARDR control with imazapic dropped to 73% by the November 2006 evaluation, which was similar to CARDR control (63 to 82%) with the low or medium rates of the metsulfuron plus chlorsulfuron plus 2,4-D ester tank mix.

This study site had an extremely dense stand of CARDR (40 to 60 shoots/ft^2). Plots were bare ground where there was CARDR control. In areas with dense, single specie's of CARDR stands it may be necessary to reseed the area after control to prevent re-invasion of CARDR and other invasive species. Competitive grasses would likely increase residual control of CARDR. This study will be evaluated in 2007 for CARDR control longevity.

Table 1. Application data for hoary cress control in Colorado.

Environmental data		
Application date	May 18, 2005	May 26, 2005
Application time	10:30 AM	10:00 AM
Air temperature, F	61	70
Relative humidity, %	36	28
Wind speed, mph	0	0

Application date	Species	Common name	Growth stage	Height ---(in.)---
May 18, 2005	CARDR	hoary cress	early flower	6 to 17
May 26, 2005	CARDR	hoary cress	full bloom	6 to 17

Table 2. Hoary cress control in Colorado.

Herbicide[1]	Application Rate	Hoary cress control			
		June 2005	November 2005	May 2006	November 2006
	oz ai/A	(%)			
Metsulfuron + chlorsulfuron + 2,4-D ester	0.2 + 0.2 + 8	60	88	66	63
Metsulfuron + chlorsulfuron + 2,4-D ester	0.3 + 0.4 + 8	78	96	83	82
Metsulfuron + chlorsulfuron + 2,4-D ester	0.6 + 0.8 + 8	77	100	93	96
Metsulfuron + 2,4-D ester	0.2 + 8	70	83	59	50
Metsulfuron + 2,4-D ester	0.3 + 8	75	85	63	59
Metsulfuron + 2,4-D ester	0.6 + 8	75	91	73	59
Imazapic	2	22	85	75	73
LSD (0.05)		14	15	16	15

[1] Crop oil concentrate added to all treatments at 32 oz/a.

Control of meadow hawkweed with aminopyralid and surfactant in abandoned pasture near Santa, ID. Linda Wilson, John Wallace, Tim Prather and Larry Lass (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Santa, Idaho to evaluate meadow hawkweed (*Hieracium caespitosum* Dumort) control with aminopyralid or clopyralid applied at the bolting stage with various surfactants. Surfactants included an organosilicone and methylated seed oil blend, ammonium sulfate, and a non-ionic surfactant. The experiment was designed as a randomized complete block with four replications and arranged as a split plot so surfactants were side by side for each rate. 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 data

Location	Santa, ID
Target weed	Meadow hawkweed
Weed growth stage	Bolting
Application date	May 24, 2005
Air Temp (F)	54
Relative humidity (%)	46
Wind (mph, direction)	3-5, E
Cloud cover (%)	100
Soil temp at 2 inches (F)	56

Meadow hawkweed control was evaluated 12 months after treatment (MAT) on May 23, 2006 (Table 2). The type of surfactant did not affect meadow hawkweed control at each herbicide treatment. Applications of clopyralid at 5 oz ae/A and aminopyralid applied at the rates of 0.75, 1.25, and 1.75 oz ae/A provided similar meadow hawkweed control. Aminopyralid applied at 0.3 oz ae/A resulted in lower meadow hawkweed control in comparison to other treatments. Canopy cover of graminoids and forbs was also evaluated 12 MAT. The primary forbs located within the study area included woods strawberry, sulfur cinquefoil, and oxeye daisy, and the primary graminoids included Idaho fescue, bluebunch wheatgrass, and timothy. The type of surfactant and herbicide treatment did not affect graminoid canopy cover 12 MAT. The application of clopyralid resulted in greater forb canopy cover in comparison to aminopyralid at 1.25 and 1.75 oz ae/A, but was similar to lower rates of aminopyralid. All aminopyralid rates resulted in similar forb canopy cover.

Table 2. Meadow hawkweed control with the application of aminopyralid or clopyralid using various surfactants at the bolting stage near Santa, ID in 2005-2006.

Treatment	Rate	Meadow hawkweed control 12 MAT[1]	Cover (0.125 m^2) Graminoids	Forbs
	oz ae / A	%	---------%---------	
Aminopyralid	0.3	36	56	3.5
Aminopyralid + NIS[2]	0.3	31	63	4.0
Aminopyralid + Blend[3]	0.3	39	43	3.8
Aminopyralid + Ammonium sulfate	0.3	58	50	3.8
Aminopyralid	0.75	99	63	3.5
Aminopyralid + NIS	0.75	96	67	3.8
Aminopyralid + Blend	0.75	95	61	3.3
Aminopyralid + Ammonium sulfate	0.75	99	68	3.8
Aminopyralid	1.25	99	66	2.0
Aminopyralid + NIS	1.25	100	72	1.5
Aminopyralid + Blend	1.25	100	68	2.0
Aminopyralid + Ammonium sulfate	1.25	100	71	1.3
Aminopyralid	1.75	99	67	1.5
Aminopyralid + NIS	1.75	75	75	1.5
Aminopyralid + Blend	1.75	100	75	1.8
Aminopyralid + Ammonium sulfate	1.75	100	69	1.3
Clopyralid	5	93	48	5.0
Clopyralid + NIS	5	96	51	5.5
Clopyralid + Blend	5	96	61	5.3
Clopyralid + Ammonium sulfate	5	98	61	5.8
Check	0	0	37	2.5
Tukey's Studentized Range HSD (0.05)		37	54	5.5

[1] Months after treatment

[2] NIS = 90% non-ionic-surfactant (R-11)

[3] Blend = 100% organo-silicone/MSO (Syl-Tac)

Meadow hawkweed control using aminopyralid and other selective herbicides in an abandoned pasture near Santa, ID. Linda Wilson, John Wallace, Tim Prather and Larry Lass. (Plant Science Divison, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Santa, Idaho to evaluate meadow hawkweed (*Hieracium caespitosum* Dumort) control with aminopyralid, clopyralid, and a mixture of clopyralid and triclopyr applied at three growth stages; spring (bolting stage), summer (flowering stage), and fall (senescence). 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 data

Location	Santa, ID	Santa, ID	Santa, ID
Target weed	Meadow hawkweed	Meadow hawkweed	Meadow hawkweed
Weed growth stage	Bolting	Flowering	Senescence
Application date	May 24, 2005	June 24, 2005	October 21, 2005
Air Temp (F)	54	57	38
Relative humidity (%)	46	57	71
Wind (mph, direction)	3-5, E	N/A	0
Cloud cover (%)	100	25	Foggy
Soil temp at 2 inches (F)	56	N/A	42

Meadow hawkweed control was evaluated on May 23, 2006 in plots that were treated at the bolting stage twelve months after treatment (12 MAT), the flowering stage (11 MAT), and fall senescence (7 MAT) (Table 2). Herbicide treatments at the bolting and flowering stage provided greater meadow hawkweed control than fall senescence treatments. Meadow hawkweed control did not differ in comparison between bolting and flowering treatments. The type of herbicide and herbicide rate did not affect meadow hawkweed control. Biomass samples ($0.125m^2$) were collected in herbicide plots on June 23, 2006 and were separated into meadow hawkweed, graminoids, and forbs in the laboratory. Herbicide treatments at each growth stage significantly reduced meadow hawkweed biomass in comparison to the untreated check. Meadow hawkweed biomass did not differ between treatments at each growth stage or herbicide type. Herbicide treatments at the bolting stage resulted in greater graminoid biomass than the untreated check, but did not differ from the flowering and fall senescence treatments. Herbicide type did not affect graminoid biomass in comparison to the untreated check. Herbicide treatments did not affect forb biomass.

Table 2. Meadow hawkweed control with aminopyralid and other herbicides in an abandoned pasture near Santa, Idaho in 2006.

				Biomass ($0.125\ m^2$)		
Treatment[1]	Rate	Growth Stage	Hawkweed Control	Meadow hawkweed	Graminoids	Forbs
	oz ae / A		%	g		
Aminopyralid	0.75	bolt	98	0.4	28.0	0.1
Aminopyralid	1.75	bolt	99	0.0	30.8	0.7
Clopyralid	5	bolt	96	1.5	24.1	0.4
Triclopyr/clopyralid	14	bolt	96	0.4	29.7	0.7
Aminopyralid	0.75	flower	99	0.0	15.0	0.3
Aminopyralid	1.75	flower	98	0.0	26.8	0.0
Clopyralid	5	flower	80	7.5	8.9	2.7
Triclopyr/clopyralid	14	flower	91	0.1	24.8	0.0
Aminopyralid	0.75	senescence	22	9.9	19.6	0.0
Aminopyralid	1.75	senescence	26	2.7	14.2	2.0
Clopyralid	5	senescence	25	12.1	6.3	0.4
Triclopyr/clopyralid	14	senescence	26	6.3	11.6	0.3
Untreated check			0	22.2	5.8	0.1
Tukey's Studentized Range HSD (0.05)			25.7	14.8	36.3	3.7

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

<u>Spotted knapweed, Canada thistle, and western snowberry control with metsulfuron and chlorsulfuron applied alone or with other herbicides.</u> Rodney G. Lym (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Previous research has found that metsulfuron controls some troublesome weeds, such as houndstongue (*Cynoglossum officinale* L.), that are difficult to control with commonly used auxin-type herbicides in pasture and rangeland. Chlorsulfuron tends to have a wider weed control spectrum and longer residual than metsulfuron. The purpose of this research was to evaluate metsulfuron applied alone or with chlorsulfuron or various auxin herbicides for control of spotted knapweed, Canada thistle, and western snowberry (buckbrush) (*Symphoricarpos occidentalis* Hook.).

The first study evaluated spotted knapweed control with metsulfuron alone or with chlorsulfuron. The experiment was established on June 6, 2005, on a dense infestation near Hawley, MN. Treatments were applied using a hand-held boom sprayer delivering 17 gpa at 35 psi. The plots were 10 by 25 feet and replicated four times in a randomized complete block design. Spotted knapweed was in the rosette to early-bolt growth stage and 4 to 14 inches tall. Control was based on a visual estimate of percent stand reduction as compared to the untreated check.

Metsulfuron alone or with chlorsulfuron did not provide satisfactory control of spotted knapweed (Table 1). Picloram at 4 oz/A provided an average of 90% control 2 and 3 MAT (months after treatment), which declined to 78% 12 MAT. Picloram caused approximately 30% grass injury 1 MAT (data not shown).

The second study evaluated Canada thistle control with metsulfuron and chlorsulfuron and was established near Eckleson, ND, on June 15, 2005. The experiment was designed as previously described except the plots were 10 by 30 feet. Canada thistle was beginning to bolt, was 8 to 18 inches tall, and there was a dense grass under-story.

Metsulfuron alone or with chlorsulfuron averaged 76% 1 and 2 MAT and generally did not provide season-long Canada thistle control (Table 2). Control declined to 26% 3 MAT with all treatments, except metsulfuron plus chlorsulfuron at 0.15 + 0.76 oz/A which averaged 80%. Grass injury was minimal and grass recovered within 2 MAT (data not shown). Canada thistle control with clopyralid averaged 99, 90, and 61% 2, 3, and 12 MAT, respectively.

The third experiment evaluated western snowberry control with metsulfuron plus 2,4-D and was established on June 6, 2005, near Walcott, ND. The plots were 15 by 30 feet with three replications, and the western snowberry was 12 to 36 inches tall and beginning to flower. Metsulfuron at 0.15 or 0.3 oz/A with 2,4-D at 4 oz/A provided 99% western snowberry control 15 MAT with no observed grass injury (Table 3).

In summary, metsulfuron applied alone or with chlorsulfuron did not provide satisfactory control of spotted knapweed and generally less than season-long control of Canada thistle. Metsulfuron plus 2,4-D provided excellent western snowberry control for at least two seasons after application and would be cost-effective for use in pasture and rangeland.

Table 1. Spotted knapweed control with metsulfuron applied alone or with chlorsulfuron on June 6, 2005, near Hawley, MN.

		Months after treatment			
Treatment[1]	Rate	1	2	3	12
	oz/A	% control			
Metsulfuron	0.15	0	3	10	1
Metsulfuron	0.3	0	15	9	1
Metsulfuron	0.6	4	40	21	0
Metsulfuron + chlorsulfuron	0.15 + 0.045	2	3	3	0
Metsulfuron + chlorsulfuron	0.3 + 0.09	5	15	5	0
Metsulfuron + chlorsulfuron	0.6 + 0.20	0	33	3	0
Picloram	4	31	92	89	78
LSD (0.05)		15	15	14	9

[1]Methylated seed oil at 1 qt/A, Scoil by AGSCO, Grand Forks, ND, was applied with all treatments except picloram included X-77 surfactant at 0.25%, by Ortho, Marysville, OH.

Table 2. Canada thistle control with metsulfuron applied alone or with chlorsulfuron on June 15, 2005, near Eckelson, ND.

		Months after treatment			
Treatment[1]	Rate	1	2	3	12
	oz/A	% control			
Metsulfuron	0.15	66	73	19	4
Metsulfuron	0.3	78	71	16	6
Metsulfuron	0.6	85	90	52	18
Metsulfuron + chlorsulfuron	0.0375 + 0.19	73	49	17	4
Metsulfuron + chlorsulfuron	0.075 + 0.38	76	82	28	11
Metsulfuron + chlorsulfuron	0.15 + 0.76	72	96	80	33
Clopyralid	8	99	99	90	61
LSD (0.05)		16	22	16	13

[1]Methylated seed oil at 1 qt/A, Scoil by AGSCO, Grand Forks, ND, was applied with all treatments except clopyralid included X-77 surfactant at 0.25%, by Ortho, Marysville, OH.

Table 3. Western snowberry control with metsulfuron applied with 2,4-D on June 6, 2005, near Walcott, ND.

Treatment[1]	Rate	Months after treatment			
		1	2	12	15
	— oz/A —	— % control —			
Metsulfuron + 2,4-D ester	0.15 + 4	99.5	100	97	99
Metsulfuron + 2,4-D ester	0.3 + 4	100	100	99	99
Untreated		0	0	0	0
LSD (0.05)		1	0.1	2	1

[1]Methylated seed oil at 1% v/v, Scoil by AGSCO, Grand Forks, ND, was applied with both treatments.

Control of rush skeletonweed with aminopyralid near Horseshoe Bend, Idaho. John Wallace, Tim Prather, and Larry Lass. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). Two experiments were established near Horseshoe Bend, Idaho on Idaho Parks and Recreation land to evaluate the control of rush skeletonweed (*Chondrilla juncea* L.) using spring (POST-rosette) and winter treatments (PRE-rosette) of aminopyralid, clopyralid, and picloram. The experiments were 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	Horeshoe Bend, ID
Target weed	Rush skeletonweed	Rush skeletonweed
Weed growth stage	POST (rosette)	PRE (rosette)
Application date	April 6, 2005	February 1, 2006
Air Temp (F)	58	57
Relative humidity (%)	41	80
Wind (mph, direction)	3, W	0
Cloud cover (%)	10	50
Soil temp at 2 inches (F)	48	46

In April 2005, herbicide treatments were applied after rosette-formation (POST) had occurred. Control was evaluated visually on May 31 (1 MAT), July 14, 2005 (2 MAT), April 4, 2006 (12 MAT) for POST-rosette treatments. All herbicide treatments provided satisfactory rush skeletonweed control one and two MAT (Table 2). Control ranged from 92 to 100% one and two MAT. Rush skeletonweed had recolonized the study area across all herbicide treatment plots 12 MAT. Each herbicide treatment did not differ from the untreated check 12 MAT.

Table 2. Rush skeletonweed control with aminopyralid, clopyralid, and picloram timed to POST-rosette formation near Horseshoe Bend, Idaho in 2005-2006.

Treatment[1]	Rate	Timing	Rush skeletonweed control 1 MAT[2]	2 MAT	12 MAT
	oz ae / A		%	%	%
Aminopyralid	0.75	POST	93	93	0
Aminopyralid	1	POST	92	99	0
Aminopyralid	1.25	POST	99	99	0
Aminopyralid	1.5	POST	95	99	0
Aminopyralid	1.75	POST	100	100	0
Clopyralid	6	POST	100	97	0
Picloram	8	POST	100	100	0
Untreated check			0	0	0
Tukey's studentized range HSD (0.05)			8	6	0

[1] 100% organo-silicone/MSO (Syl-Tac) at 0.25% v/v was applied with all treatments

[2] Months after treatment

In February 2006, herbicide treatments were applied prior to rosette-formation (PRE). Control was evaluated visually on March 8 (1 MAT) and April 4, 2006 (2 MAT) for PRE-rosette treatments. All herbicide treatments provided satisfactory control one MAT (Table 3). Control ranged from 82 to 93%. Control did not statistically differ in pairwise comparisons of herbicide treatments one MAT. Applications of clopyralid provided less control of rush skeletonweed in comparison to picloram and all rates of aminopyralid two MAT. Aminopyralid rates did not differ in rush skeletonweed control and were similar to picloram two MAT. One year after treatment data is not available.

Table 3. Rush skeletonweed control with aminopyralid, clopyralid, and picloram timed to PRE-rosette formation near Horseshoe Bend, Idaho in 2006.

			Rush skeletonweed control	
Treatment[1]	Rate	Timing	1 MAT[2]	2 MAT
	oz ae / A		%	
Aminopyralid	0.75	PRE	83	96
Aminopyralid	1	PRE	90	100
Aminopyralid	1.25	PRE	88	100
Aminopyralid	1.5	PRE	91	98
Aminopyralid	1.75	PRE	93	100
Clopyralid	6	PRE	84	50
Picloram	8	PRE	81	100
Untreated check			0	0
Tukey's studentized range HSD (0.05)			18	30

[1] 100% organo-silicone/MSO (Syl-Tac) at 0.25% v/v was applied with all treatments
[2] Months after treatment

Leafy spurge control with picloram applied with imazapic or dicamba plus diflufenzopyr. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Research at North Dakota State University has shown that picloram applied with 2,4-D plus imazapic or with diflufenzopyr provided better long-term leafy spurge control than picloram applied alone or with 2,4-D. The purpose of this research was to compare picloram applied with imazapic or diflufenzopyr at various rates and two timings for leafy spurge control.

The study was established at the Albert Ekre Research Center near Walcott, ND. The spring treatments were applied on June 6, 2005 and in a separate experiment the fall treatments were applied on September 14, 2005. Leafy spurge in spring was treated in the true-flower growth stage or in fall was treated when regrowth was 1 to 2 inches. Diflufenzopyr alone is not commercially available, so the commercial mixture of dicamba plus diflufenzopyr (Overdrive) was used. All treatments were applied with a hand-held sprayer delivering 8.5 gpa at 35 psi. Both experiments were a randomized complete block design with four replicates, and plots were 10 by 30 feet. Control was based on a visual estimate of percent stand reduction as compared to the untreated check.

Picloram applied with imazapic or with dicamba plus diflufenzopyr provided better leafy spurge control than picloram or picloram plus 2,4-D for both application dates (Table). Picloram applied with dicamba plus diflufenzopyr in the spring provided the best long-term control which averaged 88% in May and 77% in Sept. 2006 [(12 and 15 mo after treatment (MAT)] compared to 42 and 31%, respectively, for the standard picloram plus 2,4-D. In general, leafy spurge control with picloram plus imazapic spring-applied was similar regardless of rate and averaged 63% 1 yr after treatment.

Long-term leafy spurge control for fall-applied treatments was improved when picloram was applied with imazapic or dicamba plus diflufenzopyr compared to picloram or picloram plus 2,4-D. However, unlike the spring-applied treatments control increased similarly whether imazapic or dicamba plus 2,4-D was applied with picloram. Control with these combination treatments averaged 89% in May (9 MAT) and 62% in Aug. 2006 (12 MAT) compared to an average of 53 and 26% with picloram and picloram plus 2,4-D, respectively. Also, leafy spurge control tended to decline when imazapic was reduced from 1 to 0.75 oz/A in combination with picloram.

In summary, long-term leafy spurge control was improved when picloram was applied with imazapic or with dicamba plus diflufenzopyr compared to the standard treatments of picloram or picloram plus 2,4-D. The combination of picloram plus dicamba plus diflufenzopyr provided better long-term control than picloram plus imazapic when spring- but not fall-applied. These combinations cost approximately twice as much as picloram plus 2,4-D at 4 + 16 oz/A, but land managers may only need to retreat every other year rather than annually. The savings from reduced treatment costs and reduction in labor force likely will be equal to or greater than the increased herbicide costs.

Table. Picloram applied alone or with various other herbicides for leafy spurge control in the spring or fall near Walcott, ND.

Treatment	Rate	Evaluation date		
		1 Sept 05	30 May 06	15 Aug 06
Spring applied (6 June 05)	— oz/A —	— % control —		
Imazapic + picloram + MSO[1]	1 + 4 + 1 qt	97	57	48
Imazapic + picloram + MSO	1 + 6 + 1 qt	99	77	56
Imazapic + picloram + MSO	0.75 + 4.5 + 1 qt	87	66	46
Imazapic + picloram + MSO	0.75 + 6 + 1 qt	97	62	48
Imazapic + picloram + MSO	1 + 8 + 1 qt	100	64	51
Imazapic + picloram + 2,4-D + MSO	1 + 4 + 16 + 1 qt	89	51	32
Dicamba + diflufenzopyr[2] + picloram + MSO	2 + 0.8 + 4 + 1 qt	98	85	74
Dicamba + diflufenzopyr[2] + picloram + MSO	2 + 1.1 + 6 + 1 qt	98	92	79
Picloram + 2,4-D	4 + 16	31	42	31
Picloram	6	16	8	4
LSD (0.05)		14	18	20
Fall applied (14 Sept. 05)				
Imazapic + picloram + MSO[1]	1 + 4 + 1 qt		92	67
Imazapic + picloram + MSO	1 + 6 + 1 qt		90	69
Imazapic + picloram + MSO	0.75 + 4.5 + 1 qt		83	49
Imazapic + picloram + MSO	0.75 + 6 + 1 qt		84	54
Imazapic + picloram + MSO	1 + 8 + 1 qt		95	67
Imazapic + picloram + 2,4-D + MSO	1 + 4 + 16 + 1 qt		89	56
Dicamba + diflufenzopyr[2] + picloram + MSO	2 + 0.8 + 4 + 1 qt		85	66
Dicamba + diflufenzopyr[2] + picloram + MSO	2 + 1.1 + 6 + 1 qt		90	68
Picloram + 2,4-D	4 + 16		56	28
Picloram	6		50	24
LSD (0.05)			25	22

[1]Methylated seed oil at 1 qt/A, Scoil by AGSCO, Grand Forks, ND.
[2]Dicamba plus diflufenzopyr was the commercial formulation Overdrive by BASF, Research Triangle Park, NC.

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 and displaced native vegetation. 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, and September 2006 (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. 2,4-D acid sprayed in fall controlled 90% of EPHMY compared to 100% EPHMY control with spring-applied 2,4-D acid. 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 the entire root systems are pulled. There was 88 or 99% EPHMY control when pulled in fall or spring, respectively. 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). A few EPHMY seedling plants emerged from seed and some plants broke off at the root crown so it may be necessary to handpull more than one time. 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.

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

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

Canada thistle control by aminopyralid in North Dakota. Luke W. Samuel and 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. The purpose of this research was to evaluate aminopyralid alone or with 2,4-D applied in the spring or fall for Canada thistle control.

Aminopyralid at rates ranging from 0.75 oz ae/A to the labeled use rate of 1.75 oz/A was spring- or fall-applied in all experiments. Herbicides were applied 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 at three locations in North Dakota. Control was visually evaluated using percent stand reduction compared to the untreated control.

Canada thistle control with aminopyralid applied alone in spring or fall was evaluated in Theodore Roosevelt National Park (TRNP) near Medora, ND. Treatments were applied June 20, 2005 or September 29, 2004. Spring-applied treatments were to Canada thistle 15 to 24 inches tall in the early-bolt growth stage. Fall-applied treatments were to Canada thistle rosettes, mature plants, and fall regrowth 18 to 24 inches tall. The location consisted of a solid stand of Canada thistle with few desirable perennial grass species. Canada thistle stem density averaged 5 stems/ft^2 across all treatments.

Canada thistle control 3 mo after treatment (MAT) when spring-applied tended to increase as herbicide rate increased (Table 1). Aminopyralid at 0.75 and 1.75 oz/A, and picloram at 6 oz/A averaged 77, 86, and 91% control, respectively, while aminopyralid at 1.25 oz/A averaged 70% control. This uneven control was not observed when aminopyralid was fall-applied as Canada thistle control 12 MAT was similar regardless of rate. Spring-applied aminopyralid 12 MAT, provided an average of 42% Canada thistle control 12 MAT compared to spring- and fall-applied picloram at 73% and 48%, respectively. The high initial Canada thistle stem density and few desirable grass species likely influenced aminopyralid efficacy 12 MAT due to limited soil residual of aminopyralid and little or no competition for emerging seedlings. Canada thistle density in the experiment borders remained high following treatment and was a potential source for reinfestation by both seed and vegetative regrowth.

A second study to evaluate aminopyralid applied alone or with 2,4-D for Canada thistle control was established at three locations in North Dakota, near Fargo, Jamestown, and TRNP. The locations at Fargo was untilled cropland, at Jamestown was a conservation area, and at TRNP was rangeland. Treatments were applied at Fargo on June 9 or October 3, 2005, at Jamestown June 27 or September 26, 2005, and at TRNP September 27, 2005 or June 6, 2006. Spring-applied treatments at Fargo were to Canada thistle rosettes and bolted plants 9 to 18 inches tall, at Jamestown to rosette to pre-bud plants 12 to 30 inches tall, and at TRNP to bolted Canada thistle 12 to 24 inch tall. Fall-applied treatments in Fargo were to Canada thistle rosettes and fall regrowth 6 to 24 inches tall, which had been mowed in July 2005, and in Jamestown and TRNP to post-bloom plants with fall regrowth 12 to 18 and 48 to 60 inches tall. Canada thistle stem density prior to treatment averaged 3, 1, and 4 stems/ft^2 for the Fargo, Jamestown, and TRNP sites, respectively.

Canada thistle control 12 MAT within treatments was similar across locations and was generally better when fall-applied compared to spring-applied. For example, control 12 MAT with fall-applied aminopyralid at 1.75 oz/A, aminopyralid plus 2,4-D, and picloram averaged 96, 93, and 89% across locations compared to 85, 79, and 78% control when spring-applied, respectively (Table 2). Long-term Canada thistle control 15 MAT was better spring-applied with aminopyralid than picloram. Control tended to be higher at Jamestown compared to Fargo, possibly due to increased competition from perennial grasses at Jamestown rather than annual grasses at Fargo. Canada thistle control with aminopyralid plus 2,4-D was similar to aminopyralid alone.

In summary, aminopyralid and aminopyralid plus 2,4-D controlled Canada thistle at much lower use rates than picloram. Control 12 MAT was generally better when aminopyralid was fall-applied compared to spring-applied regardless of treatment. Aminopyralid control of Canada thistle may be influenced by Canada thistle density and cover, and with the presence of competition from perennial or annual grass species. In general, aminopyralid provided better long-term Canada thistle control when other plant species were present regardless of Canada thistle density.

Table 1. Canada thistle control with aminopyralid and picloram applied in the spring (June 2005) or fall (September 2004) at Theodore Roosevelt National Park near Medora, ND.

		Months after treatment			
Treatment[1]	Rate	3	9	12	21
	oz/A	% control			
June 2005					
Aminopyralid	0.75	77		41	
Aminopyralid	1.25	70		30	
Aminopyralid	1.75	86		55	
Picloram	6	91		73	
September 2004					
Aminopyralid	0.75		97	39	6
Aminopyralid	1.25		100	36	20
Aminopyralid	1.75		100	48	21
Picloram	6		99	48	24
LSD (0.05)		15	1	36	NS

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

Table 2. Canada thistle control with aminopyralid and picloram applied in June or September 2005 at Fargo and Jamestown, and applied in September 2005 or June 2006 in Theodore Roosevelt National Park near Medora, ND.

		3 mo after treatment				12 mo after treatment				15 mo after treatment			
Treatment[1]	Rate	Fargo	Jamestown	TRNP[2]	Mean	Fargo	Jamestown	TRNP	Mean	Fargo	Jamestown	TRNP	Mean
	— oz/A —	% control											
Spring-applied													
Aminopyralid	1.25	99	95	98	97	90	92	-	91	54	92	-	73
Aminopyralid	1.75	100	96	98	98	86	85	-	85	65	81	-	73
Aminopyralid + 2,4-D[3]	1.25 + 10	99	95	97	97	80	78	-	79	66	70	-	68
Picloram	6	96	97	97	97	66	91	-	78	16	86	-	51
Fall-applied													
Aminopyralid	1.25					83	85	92	87				
Aminopyralid	1.75					95	94	100	96				
Aminopyralid + 2,4-D[3]	1.25 + 10					95	86	98	93				
Picloram	6					86	86	96	89				
LSD (0.05)		2	NS	NS	NS	14	NS	7	9	25	19	-	15

[1]Surfactant Activator 90 at 0.25% v/v was applied with all treatments, Loveland Products Inc., Greeley, CO 80632.
[2]Abbreviation: TRNP = Theodore Roosevelt National Park.
[3]Commercial formulation B ForeFront by Dow AgroSciences, Indianapolis, IN 46268.

Control of Russian thistle 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 December 20, 2005 at the Navajo Agricultural Products Industry hybrid poplar tree farm, Farmington, NM to evaluate the response of Russian thistle 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, 2005 and were evaluated on August 22, 2006.

Sulfometuron at 0.035, 0.07, 0.03, 0.06 and 0.09 lb ai/A in combination with either metsulfuron or chlorosulfuron at 0.09, 0.018, 0.02, 0.04, and 0.06 lb ai/A gave excellent control of Russian thistle. No noticeable hybrid poplar injury was noticed with any of the treatments.

Table. Control of Russian thistle in hybrid poplar.

		Weed control[a]
Treatments	Rate	Solni
	lb ai/A	------%-------
Sulfometuron + metsulfuron	0.035+0.009	100
Sulfometuron + metsulfuron	0.07+0.018	100
Sulfometuron + metsulfuron	0.105+0.027	87
Sulfometuron + chlorosulfuron	0.03+0.02	100
Sulfometuron + chlorosulfuron	0.06+0.04	100
Sulfometuron + chlorosulfuron	0.09+0.06	100
Terbacil + diuron	0.8+1.6	60
Terbacil + diuron	1.2+1.6	73
Terbacil + diuron	1.6+1.6	63
Simazine	1.6	70
Weedy check	0	0

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

Control of yellow toadflax with various herbicides and application timings in North Dakota. Rodney G. Lym. (Department of Plant Sciences, North Dakota State University, Fargo, ND 58105). Yellow toadflax has increased in North Dakota from an estimated infestation of 69 acres in 1997 to more than 850 acres in 2005 and may begin to spread rapidly in the future. Unfortunately, current herbicide treatments do not consistently control yellow toadflax. The purpose of this research was to evaluate various timings and use rates of several herbicides applied alone and in combination for yellow toadflax control.

Two experiments were established on a dense stand of yellow toadflax on a U.S. Fish and Wildlife Service Waterfowl Production Area in Barnes County, North Dakota, in 2005. 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. Yellow toadflax control was evaluated visually using percent stand reduction compared to the untreated check.

Treatments in the first experiment included picloram plus 2,4-D and/or imazapic, imazapic alone, or metsulfuron plus dicamba and were applied to yellow toadflax in the vegetative (June 6), flowering (July 26), or fall regrowth (Sept. 26) stages. No treatment regardless of application timing provided satisfactory yellow toadflax control (Table 1). Picloram at 16 oz/A applied during the flowering stage provided the best control, which averaged 76% 1 yr following treatment. However, control declined rapidly and only averaged 24% in August 2006.

The second experiment evaluated aminopyralid or picloram alone or with 2,4-D applied when yellow toadflax was in the flowering growth stage on July 26, 2005. No treatment provided satisfactory yellow toadflax control (Table 2). Control was similar whether aminopyralid or picloram were applied alone or with 2,4-D.

Treatments evaluated in this study did not satisfactorily control yellow toadflax. Currently, the most widely used herbicide to control yellow toadflax is picloram, often applied at 16 oz/A, which will reduce yellow toadflax topgrowth for approximately 1 yr.

Table 1. Yellow toadflax control with various herbicides and application timings at a waterfowl production area in Barnes County, ND.

		Evaluation date			
		2005		2006	
Application timing/treatment	Rate	Aug. 4	Sept. 6	July 5	Aug. 31
	oz/A	% control			
Vegetative (June 6, 2005)					
Picloram + 2,4-D	8 + 16	25	3	8	3
Imazapic + MSO[1] + 28% N	2 + 1 qt + 1 qt	23	4	7	0
Picloram + imazapic + 2,4-D + MSO	8 + 1 + 16 + 1 qt	10	6	3	0
Metsulfuron + dicamba + 2,4-D[2] + MSO	0.3 + 4 + 11.6 + 1%	4	3	0	0
Flowering (July 26, 2005)					
Picloram + 2,4-D	8 + 16		20	3	6
Imazapic + MSO + 28% N	2 + 1 qt + 1 qt		20	4	4
Picloram + imazapic + 2,4-D + MSO	8 + 1 + 16 + 1 qt		22	4	8
Metsulfuron + dicamba + 2,4-D + MSO	0.3 + 4 + 11.6 + 1%		19	0	0
Picloram	16		24	76	24
Fall regrowth (Sept. 26, 2005)					
Picloram + 2,4-D	8 + 16			25	5
Imazapic + MSO + 28% N	2 + 1 qt + 1 qt			0	0
Picloram + imazapic + 2,4-D + MSO	8 + 1 + 16 + 1 qt			22	8
Metsulfuron + dicamba + 2,4-D + MSO	0.3 + 4 +11.6 + 1%			0.5	0
Untreated				0	0
LSD (0.05)		19	8	19	11

[1]Methylated seed oil at 1 qt/A, Scoil by AGSCO, Grand Forks, ND, was applied with all treatments except picloram.

[2]Dicamba plus 2,4-D was the commercial formulation Weedmaster by BASF, Research Triangle Park, NC.

Table 2. Yellow toadflax control with aminopyralid or picloram either alone or with 2,4-D applied during the flowering growth stage on July 26, 2005, at a waterfowl production area in Barnes County, North Dakota.

		Evaluation date		
		2005	2006	
Treatment	Rate	Sept. 6	July 25	Aug. 31
	—— oz/A ——	——	% control	——
Aminopyralid + X-77[1]	1.25 + 0.25%	4	0	0
Aminopyralid + X-77	1.75 + 0.25%	6	2	0
Aminopyralid + MSO	1.25 + 1 qt	5	0	0
Aminopyralid + Kinetic	1.25 + 0.25%	6	0	0
Aminopyralid + 2,4-D[2] + X-77	10.7 + 1.32 + 0.25%	9	0	0
Aminopyralid + 2,4-D[2] + X-77	13.9 + 1.72 + 0.25%	16	8	0
Picloram	16	10	18	3
Picloram + 2,4-D	8 + 16	16	0	0
LSD (0.05)		8	4	NS

[1]X-77 surfactant, by Ortho, Marysville, OH; methylated seed oil, Scoil by AGSCO, Grand Forks, ND; Kinetic by Helena Chemical, Collierville, TN.

[2]Aminopyralid plus 2,4-D was a a premix formulation coded GF-1004, by Dow Chemical, Indianapolis, IN.

Ventenata control with triasulfuron and imazapic on the Palouse Prairie. John Wallace and Tim Prather (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Moscow, Idaho on degraded Palouse Prairie remnant to evaluate the efficacy of triasulfuron and imazapic for control of ventenata (*Ventenata dubia* (Leers) Coss.). Other annual grasses included in evaluations were downy brome (*Bromus tectorum* L.), field brome (*Bromus arvensis* L), and rat-tail fescue (*Vulpia myuros* (L.) K.C. Gmel.). The experiment was designed as a randomized complete block with four replications. Plot size was 12 by 124 feet. All treatments were applied with a tractor-mounted sprayer at 15 gpa (Table 1).

Table 1. Application data.

Location	Moscow, ID
Target weed	Ventenata
Weed growth stage	Fall
Application date	October 12, 2005
Air Temp (F)	57
Relative humidity (%)	98
Wind (mph, direction)	2-3, W
Cloud cover (%)	n/a
Soil temp at 12 inches (F)	49

Annual grass control was evaluated on June 20, 2006. Annual grass density (0.125 m^2) was quantified using line-transect sampling in each treatment plot. Application of triasulfuron and imazapic resulted in similar ventenata densities. Both herbicides decreased ventenata density in comparison to the untreated check. Application of imazapic resulted in lower downy brome and field brome densities in comparison to the triasulfuron treatment, which did not differ in comparison to the untreated control. Application of triasulfuron and imazapic resulted in lower densities of rat-tail fescue in comparison with the untreated check.

Table 2. Annual grass control with various herbicides near Moscow, Idaho in 2005-2006.

		Density (0.125 m^2)			
Treatment	Rate	VEDU[1]	BRTE	BRAR	VUMY
	oz ai / A	#			
Triasulfuron	0.38	0.3	7.8	6.5	10.7
Imazapic [2]	1.7	0.3	0.5	1.1	2.8
Untreated check		12.7	4.7	7.6	39.5
Tukey's Studentized Range HSD (0.05)		6.0	4.4	5.0	23.5

[1] VEDU = Ventenata, BRTE = downy brome, BRAR = field brome, VUMY = rat-tail fescue

[2] Imazapic in oz ae/A

Bur chervil control with selective herbicides on Idaho rangeland. John Wallace and Tim Prather. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Lapwai, ID in roadside vegetation to evaluate bur chervil (*Anthriscus caucalis* M-Bier.) control with various herbicides. 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 data

Location	Lapwai, ID
Target weed	bur chervil
Weed growth stage	rosette
Application date	March 21, 2006
Air Temp (F)	73
Relative humidity (%)	20
Wind (mph, direction)	1-5, S
Cloud cover (%)	40
Soil temp at 2 inches (F)	60

Bur chervil control was evaluated on April 20 and May 19, 2006. All rates of herbicide and herbicide combinations provided excellent control two months after treatment (MAT) (Table 2). The high rate of triasulfuron provided greater control than the low rate. Control did not differ statistically in comparison between high and low rates in all other herbicide treatments two months after treatment. Bur chervil mortality prevented seed production in each herbicide treatment except for the low rate of triasulfuron two months after treatment.

Table 2. Bur chervil control with various herbicides near Lapwai, Idaho in 2006.

Treatment [1]	Rate	Bur chervil control 1 MAT[2]	2 MAT
	oz ai / A[3]	%	
Triasulfuron	0.21	85	91
Triasulfuron	0.35	98	100
Triasulfuron/dicamba	1.40	96	100
Triasulfuron/dicamba	2.35	94	100
Metsulfuron methyl	0.30	100	100
Metsulfuron methyl	0.60	100	100
Metsulfuron methyl + dicamba/2,4-D	0.15 + 6.4	99	100
Metsulfuron methyl + dicamba/2,4-D	0.60 + 25.5	99	100
Metsulfuron methyl + aminopyralid	0.30 + 1.0	100	100
Metsulfuron methyl + aminopyralid	0.60 + 1.0	100	100
Chlorsulfuron	0.75	98	100
Chlorsulfuron	1.5	100	100
Aminopyralid	1.0	75	99
Untreated Check		0	0
Tukey's Studentized Range HSD (0.05)		21.4	11.7

[1] 100% organo-silicone/MSO (Syl-Tac) at 0.25% v/v was applied with all treatments
[2] Months after treatment
[3] Dicamba/2,4-D and aminopyralid rates in oz ae/A

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 any escaped ornamental that has spread rapidly in pasture and rangeland in Central 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 at late bolt growth stage. 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 at approximately 30 and 60 days after treatment (DAT), Tables 2.

Visual evaluations for control compared to non-treated plots were collected in August and September 2006 at approximately 30 and 60 days after treatment (DAT), Table 2. All treatments controlled 46 to 71% of ARTAB approximately 30 DAT. Metsulfuron plus chlorsulfuron tank mixed with clopyralid, aminopyralid, or 2,4-D ester controlled 70 to 88% of ARTAB while metsulfuron plus chlorsulfuron mixed with picloram controlled 54 o 55% of ARTAB, 60 DAT. Clopyralid plus 2,4-D controlled 94% of ARTAB, 60 DAT and provided the best control in 2006.

Treatments in this and an adjacent study have shown that 2,4-D ester added to the tank mixes tended to increase senescence and control of ARTAB. 2,4-D ester is fairly inexpensive and where possible it may be advantageous to add this to the tank mix. There was no perennial grass injury observed with any of these treatments. Visual evaluations for residual control will be conducted in 2007 to determine long-term ARTAB control.

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

Environmental data	
Application date	July 12, 2006
Application time	11:30 am
Air temperature, F	68
Relative humidity, %	46
Wind speed, mph	0 to 2

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

Table 2. Absinth wormwood control in Colorado.

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

[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.

Tolerance of perennial grass following various selective herbicide applications. John Wallace and Tim Prather (Plant Science Division, Unversity of Idaho, Moscow, ID 83844-2339). An experiment was established near Moscow, Idaho to evaluate various cool season perennial grasses for crop tolerance when using combinations of metsulfuron methyl, chlorsulfuron, dicamba, and 2,4-D. A previously established perennial grass study in CRP was utilized to test multiple grass species. Perennial grasses included Ruebens Canada bluegrass (*Poa compressa* L.), Manchar smooth brome (*Bromus inermis* Leyss), Covar sheep fescue (*Festuca ovina* L.), Secar bluebunch wheatgrass (*Pseudoroegneria spicata* (Pursh) A. Love), and Oahe intermediate wheatgrass (*Thinopyrum intermedium* (Host) Barkworth & D.R. Dewey). The experiment was designed as a randomized complete block with four replications arranged as a split plot so grass species were side by side for each rate. Plot size was 8 x 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer at 15 gpa (Table 1).

Table 1. Application data

Location	Moscow, ID
Target plant	Perennial grasses
Plant growth stage	early summer
Application date	May 16, 2006
Air Temp (F)	82
Relative humidity (%)	23
Wind (mph, direction)	1-3, E
Cloud cover (%)	20
Soil temp at 2 inches (F)	62

Perennial grass injury was evaluated visually on June 21 (data not shown) and July 21, 2006. Perennial grass injury was minimal following applications of metsulfuron methyl, chlorsulfuron, and 2,4-D/Dicamba combinations two months after treatment (MAT) (Table 2). The high rate of metsulfuron methyl + 2,4-D/Dicamba and both rates of metsulfuron methyl + chlorsulfuron injured perennial grasses in comparison to the untreated check, but perennial grass injury did not statistically differ in pairwise comparisons of herbicide treatments. Applications of metsulfuron methyl combined with chlorsulfuron and 2,4-D ester resulted in greater injury to Covar sheep fescue in comparison to the low and high rates of metsulfuron methyl and 2,4-D/Dicamba combinations. Biomass was harvested on August 8, 2006 to determine the effects of herbicide treatments on perennial grass yields (Table 3). Yields did not differ across herbicide treatments in comparison to the untreated check for each perennial grass species.

Table 2. Perennial grass injury following various selective herbicide applications near Moscow, ID in 2006.

Treatment[1]	Rate	Perennial grass injury				
		[2]POCO	BRIN	FEOV	PSSP	THIN
	oz ai/ A	%				
Metsulfuron methyl + 2,4-D/dicamba[3]	0.15 + 6.4	1.3	1.3	0.0	0.0	0.0
Metsulfuron methyl + 2,4-D/dicamba	0.3 + 12.8	1.3	0.0	1.3	0.0	0.0
Metsulfuron methyl + 2,4-D/dicamba	0.6 + 25.6	2.8	1.8	0.0	0.0	0.0
Metsulfuron methyl + chlorsulfuron	0.2 + 0.25	3.3	0.5	5.8	0.0	0.0
Metsulfuron methyl + chlorsulfuron + 2,4-D ester	0.3 + 0.38 + 4.7	3.3	0.0	6.3	0.0	0.0
Untreated Check		0.0	0.0	0.0	0.0	0.0
Tukey's studentized range HSD (0.05)		4.7	4.0	6.1	0.0	0.0

[1] MSO 1.0% v/v was applied with all treatments

[2]POCO = Reubens Canada bluegrass, BRIN = Manchar smooth brome, FEOV = Covar sheep fescue, PSSP = Secar bluebunch wheatgrass, THIN = Oahe intermediate wheatgrass

[3]2,4-D/Dicamba and 2,4-D ester in oz ae/A

Table 3. Perennial grass biomass following various selective herbicide applications near Moscow, ID in 2006.

Treatment[1]	Rate	Perennial Grass Biomass (0.125 m^2)				
		[2]POCO	BRIN	FEOV	PSSP	THIN
	oz ae / A	g				
Metsulfuron methyl + 2,4-D/dicamba[3]	0.15 + 6.4	76	78	81	108	93
Metsulfuron methyl + 2,4-D/dicamba	0.3 + 12.8	74	79	81	112	94
Metsulfuron methyl + 2,4-D/dicamba	0.6 + 25.6	75	80	80	100	94
Metsulfuron methyl + chlorsulfuron	0.2 + 0.25	78	77	80	98	96
Metsulfuron methyl + chlorsulfuron + 2,4-D ester	0.3 + 0.38 + 4.7	74	79	81	100	97
Untreated Check		76	77	82	104	95
Tukey's studentized range HSD (0.05)		8	8	7	21	16

[1] MSO 1.0% v/v was applied with all treatments

[2]POCO = Reubens Canada bluegrass, BRIN = Manchar smooth brome, FEOV = Covar sheep fescue, PSSP = Secar bluebunch wheatgrass, THIN = Oahe intermediate wheatgrass

[3]2,4-D/Dicamba and 2,4-D ester expresses as oz ae/A

Evaluation of rimsulfuron for pre-emergence weed control in Marion blackberries. Diane Kaufman and Jason Harpole. (North Willamette Research and Extension Center, Oregon State University, 15210 NE Miley Rd, Aurora, OR 97002) A field trial was established at the North Willamette Research and Extension Center (NWREC) in a three-year old planting of 'Marion' blackberry to evaluate the effects of multiple years of rimsulfuron application on plant growth, vigor, and yield. Herbicides were applied using a CO_2 backpack sprayer equipped with a 3-nozzle boom (TeeJet 8002 flat fan nozzles) at 40 psi and a rate of 50 gallons of water per acre.

Plots six feet wide by 30 feet long (5 plants/plot) were arranged in a randomized complete block design with four replications. Treatments were applied on April 9, 2005 and March 29, 2006. Due to mild spring temperatures, some primocanes had already begun to emerge prior to the 2005 application, and ranged from 1 to 4 inches in height at time of treatment. Treatments were applied prior to primocane emergence in 2006. Treatments consisted of three rates of rimsulfuron compared to an industry standard application of diuron plus napropamide. Because this was intended as a pre-emergence application, rather than a cane-burning application, no surfactant was added to any treatments. Plants were monitored for primocane growth during the summers of 2005 and 2006, with final cane measurements recorded prior to training in mid-August each year. There were no signs of damage to fruiting canes from any rate of rimsulfuron in 2005 or 2006.

Table 1. Primocane growth following herbicide application after primocane emergence (2005) or before primocane emergence (2006).

Treatment	Rate	Primocane height 6/7/05	Primocane height 6/6/06	Number of primocanes/plant 8/15/05	Number of primocanes/plant 8/15/06	Ave cane ht 8/15/05	Ave cane ht 8/15/06
	lb ai/A	inches	inches	#/plant	#/plant	ft	ft
Rimsulfuron	0.0156	31.3	76	8.5	8.7	14.2	-----
Rimsulfuron	0.0312	25.5	72	8.8	9.2	11.4	-----
Rimsulfuron	0.0624	16.9	70	8.4	6.9	11.0	22.4
Diuron+ napropamide	2.0+2.0	73.5	76	4.8	10.9	24.6	20.1
LSD (0.05)		6.7	ns	2.3	3.7	4.2	ns

When applied after some primocanes had emerged (4/9/05), the middle and high rates of rimsulfuron caused a slight burn along margins of primocane leaves, but no apparent damage to the primocanes themselves. Although there was no actual burn back of primocanes from any rate of rimsulfuron in 2005, primocane growth in plots treated with rimsulfuron was significantly less on June 6, 2005 than in plots treated with the diuron + napropamide standard. When applied prior to primocane emergence (3/29/06), there was no delay in primocane growth and no differences among treatments in primocane height on June 6, 2006. In August, 2005 there were significantly more canes in plants treated with rimsulfuron than in plants treated with the diuron + napropamide standard. However, canes were nearly twice as long in plots treated with diuron + napropamide than in plots treated with rimsulfuron. In August, 2006 there were fewer primocanes in plants treated with the high rate of rimsulfuron than in plants treated with diuron + napropamide. Primocane number tended to remain fairly consistent in 2005 and 2006 in plots treated with the low or middle rates of rimuslfuron. However there was an increase in cane number in 2006 in plants treated with diuron + napropamide, and a decrease in cane number in 2006 in plants treated with the high rate of rimsulfuron for a second year. There were no differences in primocane height in 2006 among plots treated with the high rate of rimsulfuron and the diuron + napropamide standard.

Yield data was collected over four picks in July, 2006. Fruit was hand-harvested from a 7-foot length of row. Yields tended to be lower than usual due to fruiting cane damage from a late winter cold snap.

Table 2. First year yield data from plants treated the previous spring (April, 2005)

Treatment	Rate	Total yield
	lb ai/A	grams
Rimsulfuron	0.0156	9,909
Rimsulfuron	0.0312	10,201
Rimsulfuron	0.0624	9.505
Diuron + napropamide	2 + 2	7,288
LSD (0.05)		2,399

Total yield was higher in plots treated with the low and middle rates of rimsulfuron than in plots treated with diuron + napropamide. It, therefore appears that in 2006, a larger number of shorter canes resulted in higher yields than a smaller number of longer canes. Yield data will be collected in 2007 and treatments will be continued for another year.

Weed control was excellent (90-100%) in all treatments through mid-August in 2005 and 2006 (data not shown).

Evaluation of rimsulfuron for use in blueberries. Diane Kaufman and Jason Harpole. (North Willamette Research and Extension Center, Oregon State University, 15210 NE Miley Rd, Aurora, OR 97002) A field trial was established at the North Willamette Research and Extension Center (NWREC) in an eight year old planting of 'Bluecrop' blueberries. Herbicides were applied using a CO_2 backpack sprayer equipped with a 2-nozzle boom (TeeJet 8002 flat fan nozzles) at 40 psi and a rate of 40 gallons of water per acre.

Plots five feet wide and 28 feet long (7 plants/plot) were arranged in a randomized complete block design with four replications. Herbicides were applied March 29, 2006, prior to bud-break. Treatments consisted of a single rate of rimsulfuron compared to an industry standard application of diuron. Yield data was collected during July by hand-picking all fruit on the middle five plants per plot. Quality of weed control was evaluated every two weeks from April to mid-August by visually comparing weed populations in treatment rows with an untreated row beside it.

Table. Blueberry yield

Treatment	Rate	Pick #1	Pick #2	Pick #3	Total yield
	lb ai/A	grams	grams	grams	grams
Rimsulfuron	0.0625	5592.5	4880	4412.5	14885
Diuron	2.00	5735	3960	4285	13980
Significance		ns	ns	ns	ns
LSD (0.05)					

There were no differences in yield among treatments and no apparent phytotoxicity to blueberry plants from rimsulfuron.

Annual bluegrass, quackgrass,dandelion, common chickweed, and annual sowthistle were the predominant weeds in untreated rows. Weed control was excellent (90-100%) in all treated plots from April to mid-August.

Evaluation of post-emergence herbicides in strawberries. Diane Kaufman, Ed Peachey, and Jason Harpole. (North Willamette Research and Extension Center, Oregon State University, 15210 NE Miley Rd, Aurora, OR 97002) A study was established in newly planted 'Totem' strawberry to evaluate the effect of three post-emergence herbicides, applied over strawberry plants 10 weeks after planting, on strawberry plant growth, vigor, and first year yield. Strawberry plants were planted on raised beds in a Quatama silt loam soil with 5% organic matter at the North Willamette Research and Extension Center (NWREC) on June 15, 2005. With the exception of weedy control plots, all plots were treated with an industry-standard treatment of sulfentrazone + pendimethalin for pre-emergence weed control one day after planting. Post-emergence treatments were applied over the tops of strawberry plants August 23, 2005 using a CO_2 backpack sprayer equipped with a 4-nozzle boom (TeeJet 8002 flat fan nozzles) at 40 psi and a rate of 20 gallons of spray per acre. Plots 4 rows wide (13.3 feet) by 25 feet long were arranged in a randomized complete block design with four replications. A non-ionic surfactant (Preference at 0.25%v/v) was added to the flucarbazone-sodium and V10142.

Strawberry plants were visually rated for signs of phytotoxicity on August 30 and September 26, 2005, and measurements of plant growth were recorded on October 7, 2005.

Table 1. Phytotoxicity ratings and growth measurements of strawberry plants.

Treatment	Rate	Phytotoxicity[1] Rating	Phytotoxicity[1] rating	Number of leaves	Number of runners	Plant diameter
	lb ai/A	August 30	September 26			cm
Phenmedipham+ desmedipham	0.4875	0.3	0.0	13.75	7.88	31.6
Flucarbazone-sodium	0.033	3.0	3.4	8.88	3.19	28.5
V10142	0.10	3.3	2.0	13.00	2.62	26.5
Untreated control	-----	0.0	0.0	12.62	6.78	31.9
LSD (0.05)		0.4	0.2	3.74	2.07	ns

1 Phytotoxicity ratings are based on a scale of 0 – 5 with 0 = no damage and 5 = dead

There was very little damage from phenmedipham + desmedipham. Flucarbazone-sodium and V10142 caused considerable damage soon after application, causing new leaves to be yellowish in color, often with red veins and leaf margins. Even mature, fully expanded leaves had some reddening of veins and leaf margins on 8/30/05. By the 9/26 evaluation date, plants treated with V10142 had begun to recover, with young leaves turning green and beginning to expand. However, plants treated with flucarbazone-sodium showed no sign of improvement, with leaves severely stunted and discolored. On October 7, there were significantly more leaves on plants treated with phenmedipham + desmedipham or V10142 than on plants treated with flucarbazone-sodium. There were significantly more runners on plants treated with phenmedipham + desmedipham or the untreated control than on plants treated with flucarbazone-sodium or V10142. In addition to having more runners, runners present were also healthy and pegging normally in plots treated with phenmedipham + desmedipham. Runners in plots treated with flucarbazone-ethyl or V10142 were often darkly discolored with small, yellowish colored leaves and poor pegging. There were no differences among treatments in overall size of plants.

Fruit was hand harvested 3 times from a 5- foot length of row per plot in June, 2006. Yields tended to lower than normal due to winter damage from a late winter cold snap.

Table 2. First year yield data, June, 2006.

Treatment	Rate	Total marketable yield	Adjusted berry size
	lb ai/A	grams/5 foot row	grams
Phenmedipham + desmedipham	0.4875	843	11.6
Flucarbazone-sodium	0.033	274	10.8
V10142	0.10	700	11.8
Untreated control		524	10.9
LDS (0.05)		412	ns

Marketable yield was significantly lower in plots treated with flucarbazone-sodium than in plots treated with phenmedipham + desmedipham or V10142. Because of phytotoxicity to strawberry plants and damage to runners from V10142, it is unlikely that it would be acceptable to Oregon strawberry growers.

Broadleaf weed control in lima beans. Rick A. Boydston. (USDA-ARS, Prosser, WA 99350) A study was conducted at Paterson, WA in 2006 to evaluate herbicide options for broadleaf weed control in lima beans. The trial was conducted on a Quincy sand, pH 6.8, 0.4% O.M. under center pivot sprinkler irrigation. The experimental design was a randomized complete block with four replications. Lima beans, var. 'M15' were planted May 26, 2006, in 22 inch rows and seed spaced 2.3 inches within the row. The field was infested with a natural population of hairy nightshade, black nightshade, common lambsquarters, and pigweed. Preemergence (PRE) herbicide treatments were applied May 31, 2006 and postemergence (POST) treatments were applied June 26, 2006 when lima beans had three trifoliate leaves and were 5 to 8 inches tall. All POST treatments followed s-metolachlor applied PRE at 1 lb ai/a and included NIS at 0.25% (v/v) spray solution. Herbicides were applied with a backpack CO_2 sprayer delivering 20 gpa. Weed control and lima bean injury were rated at 2 and 4 weeks after POST treatments were applied. Lima beans were harvested August 30, 2006 from the center two rows of each plot by 10 ft. All plants from the harvested area were weighed and a ten plant subsample from each plot was weighed and all pods removed by hand. All pods from the ten plant subsample were weighed and then a 20 pod subsample was shelled and bean: pod weight ratio determined.

PRE treatments of dimethenamid-p at 0.66 lb ai/a or s-metolachlor at 1.3 lb ai/a did not injure lima beans appreciably (Table 1). Both herbicides controlled black nightshade and pigweed 93% or more (Table 2). However, hairy nightshade and common lambsquarters control with dimethenamid-p or s-metolachlor ranged from 89 to 93%, and escape weeds were enough to reduce lima bean yield in dimethenamid-p treated plots compared to weed free checks (Tables 1 and 2).

Imazmox plus bentazon or bentazon alone applied POST gave excellent control of all broadleaf weeds with little or no injury to lima beans (Tables 1 and 2). Cloransulam-methyl controlled all broadleaf weeds 98% or more except common lambsquarters and did not injure lima beans (Table 2). Fomesafen injured lima beans at all rates tested and stunted the beans season long (Table 1). Fomesafen controlled black nightshade, hairy nightshade, and pigweed well, but control of common lambsquarters was only 87 to 91% at 4 WAT (Table 2). Uncontrolled weeds in nontreated checks reduced lima bean yield by 95% compared to weed free checks and averaged only 0.12 ton/acre (Table 1). Among POST herbicide treatments, lima bean yield was greatest and similar to weed free checks with imazamox plus bentazon or bentazon alone (Table 1). Lima bean yield was slightly lower in plots treated with cloransulam-methyl, probably due to common lambsquarters escapes. Lima bean yield in plots treated with fomesafen was lowest and similar to that of nontreated weedy checks due to excessive herbicide injury and stunting (Table 1).

Table 1. Lima bean injury, pod yield, and shelled bean yield after treating with PRE and POST herbicide treatments at Paterson, WA in 2006.

Treatment	Rate	Lima bean injury July 10, 2006	Lima bean injury July 24, 2006	Lima bean pod yield	Lima bean shelled bean yield
	lb ai/A	------- % -------		----- T/A -----	
Dimethenamid-p	0.66	0	0	2.7	1.2
s-Metolachlor	1.3	1	1	3.1	1.5
s-Metolachlor, imazamox + bentazon	1, 0.03 + 1	5	0	6.4	2.9
s-Metolachlor, bentazon	1, 1	1	0	5.8	2.7
s-Metolachlor, fomesafen	1, 0.13	18	18	3.4	1.3
s-Metolachlor, fomesafen	1, 0.19	26	33	2.5	0.9
s-Metolachlor, fomesafen	1, 0.25	41	50	1.7	0.4
s-Metolachlor, cloransulam-methyl	1, 0.016	1	0	4.3	1.9
Nontreated weedy check	--	0	0	0.3	0.1
s-Metolachlor + hand weeded check	1	0	0	4.7	2.2
LSD (0.05)		7.1	11.1	1.6	0.74

Table 2. Broadleaf weed control in lima beans on July 24, 2006 after treating with various PRE and POST herbicide treatments at Paterson, WA.

Treatment	Rate	Hairy nightshade control	Black nightshade control	Common lambsquarters control	Redroot pigweed control
	lb ai/A	------------------------	------------------------ %	------------------------	------------------------
Dimethenamid-p	0.66	89	99	90	93
s-Metolachlor	1.3	93	96	92	96
s-Metolachlor, imazamox + bentazon	1, 0.03 + 1	99	99	99	100
s-Metolachlor, bentazon	1, 1	100	100	99	98
s-Metolachlor, fomesafen	1, 0.13	98	100	90	100
s-Metolachlor, fomesafen	1, 0.19	95	100	87	100
s-Metolachlor, fomesafen	1, 0.25	97	100	91	100
s-Metolachlor, cloransulam-methyl	1, 0.016	99	98	92	98
Nontreated weedy	--	0	0	0	0
s-Metolachlor + hand weeded	1	100	100	100	100
LSD (0.05)		4.1	2.0	7.5	4.7

Brassicaceae meal type, application rate, and planting time effects on growth of fresh carrots. 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 'IdaGold' yellow mustard and 'Athena' canola seed meal at five rates on weed control and 'Nelson' carrot growth at four planting times. The plots were 1 by 2.5 m arranged in a randomized complete split-block, split-plot with four replications 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). Seed meal was applied surface broadcast on May 30, 2006 followed by 3.2 mm of water using a cone sprayer calibrated to deliver 2 L/ha at 276 KPa at 1km/hr. Carrot seed was planted at a rate of 1 seed/cm, using a Hege seven row planter on May 30, June 2, and June 6. On June 6 and 7, heavy rains collapsed seed furrows and seed was too deep to emerge. Plots were re-tilled on June 13. On June 19, meal and 3.2mm of water were reapplied. Carrot seed was planted June 20, June 22, June 26, and June 30 using the same method as before adjusting seeding depth to 12.7 mm. Plots were irrigated for 30 minutes using drip irrigation system delivering 2 L/hr immediately following each planting date. Plots were irrigated by planting time and irrigated consistently across planting times throughout growing season. One meter row (m row) of carrots was harvested in two sub-plots in the same sequence as planting at 84, 86, 90, and 95 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 was not different between hand-weeded versus non-weeded treatments (data not shown). Carrot marketable root weight decreased with increasing application rate of canola and yellow mustard seed meal (Table 1). Adjacent rates for canola seed meal were not different from one another. Yellow mustard seed meal application rates of 0.5 and 1 mt/ha were significantly different from one another, and from all other rates. Carrot marketable root weight was less than the untreated check for all treatments, except for canola seed meal at 0.5 mt/ha at an 11 DAT planting date. Carrot marketable root number decreased with increasing application rate of canola and yellow mustard seed meal, but adjacent rates for canola seed meal were not different from one another (Table 2). The number of marketable carrots was significantly less for 0.5 and 1 mt/ha yellow mustard seed meal rates compared to all other rates. Carrot marketable root number was less than untreated check for all treatments, except for canola seed meal at 0.5 mt/ha at 1 and 11 DAT planting dates.

Table 1. The effect of canola and mustard seed meal on the root weight for marketable carrots in 2006 field study near Moscow, Idaho.

Treatments[2]	Planting dates (DAT)[1] 1	3	7	11	Mean
------mt/ha------	---------------------------------g/m row----------------------------				
Canola					
0.5	879	591	535	957	741
1	545	619	646	835	661
2	489	345	529	815	545
3	304	215	301	830	413
4	230	162	319	765	369
Yellow mustard					
0.5	674	685	721	744	706
1	444	459	392	824	530
2	193	253	191	749	347
3	111	134	171	653	267
4	111	83	32	371	149
Untreated Check	1002	875	945	979	950
Mean	453	402	435	775	
LSD (0.05)		106			148

[1] Days after meal application.
[2] Treatments by seed meal type in mt/ha.

Table 4. The effect of canola and mustard seed meal on the number of marketable carrots in 2006 field study near Moscow, Idaho.

Treatments[2]	Planting dates (DAT)[1] 1	3	7	11	Mean
------mt/ha------	----------------------------number/m row--------------------------------				
Canola					
0.5	12	8	8	14	10
1	7	8	8	11	9
2	6	4	7	11	7
3	4	3	4	11	5
4	3	2	4	9	4
Yellow mustard					
0.5	8	8	10	10	9
1	6	6	5	11	7
2	2	3	2	9	4
3	1	2	2	8	3
4	2	1	1	4	2
Untreated Check	14	12	15	14	14
Mean	6	5	6	10	
LSD (0.05)		2			2

[1] Days after meal application.
[2] Treatments by meal type in mt/ha.

Brassicaceae meal type, application method, and irrigation effects on carrot and annual weeds. Lydia A. Clayton and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in a greenhouse at University of Idaho, Moscow, ID in winter 2005 to evaluate the effect of Brassicaceae meal type, application method, and irrigation on growth of pelleted and unpelleted 'Nelson' carrot, mayweed chamomile, prickly lettuce, and common lambsquarters. Greenhouse flats were 20 by 28 by 5 cm, arranged in a randomized complete block design with four replications. Meal treatments were 'Athena' canola, 'Pacific Gold' Oriental mustard, and 'IdaGold' yellow mustard applied surface broadcast or pre-plant incorporated at 0.5 mt/ha and an untreated check. Initial irrigation of 3.2, 6.4, 9.5, and 12.7 mm of water was applied immediately after meal treatment and flats were then watered daily after 24 hours. Ten seeds of pelleted and unpelleted 'Nelson' carrot, mayweed chamomile, prickly lettuce and common lambsquarters were planted in rows in each flat five DAT. Greenhouse temperatures were set at 23/12° C day and night, respectively, with a photoperiod of 16/8 hours day and night, respectively. Seedlings were collected by species 33 DAT. Seedling biomass was dried at 15° C for 72 hours and weighed. Data are presented as a percent of control based on biomass per plant.

Pre-plant incorporated and pre-emergence application methods did not affect plant biomass when pooled across seed meal type and irrigation amount (data not shown). Yellow mustard meal reduced plant biomass more than canola or Oriental mustard meal for unpelleted carrot seed, mayweed chamomile, common lambsquarters, and prickly lettuce (Table 1). Oriental mustard meal significantly reduced biomass of common lambsquarters compared to canola but not for any other species in the study. Initial irrigation amount did not affect pelleted carrot seed biomass (Table 2). Biomass of unpelleted carrot, mayweed chamomile, common lambsquarters, and prickly lettuce generally was reduced most by 3.2 and 12.7 mm of initial irrigation compared to 6.4 and 9.5 mm.

Table 1. Effect of Brassicaceae meal type on plant biomass in greenhouse studies conducted in 2005. Data are pooled over application method and initial irrigation amount.

Meal Treatment[1]	Pelleted carrot[2]	Unpelleted carrot[2]	Mayweed chamomile[2]	Common lambsquarters[2]	Prickly lettuce[2]
mt/ha			% of control		
Canola	94[a]	156[a]	67[a]	11[a]	24[a]
Oriental mustard	64[a]	60[ab]	19[a]	0.2[b]	5[a]
Yellow mustard	39[a]	31[b]	2[b]	0[c]	0.26[b]

[1]All meal types applied at 0.5 mt/ha rate.
[2] Means followed by the same letter(s) are not significantly different according to a LSD (α=0.05) test performed on logarithmic transformed data calculated as a percent of the control. Un-transformed means are shown.

Table 2. Effect of irrigation in a Brassicaceae meal type study on plant biomass in greenhouse studies conducted in 2005. Data are pooled over application method and seed meal type.

Irrigation Treatment[1]	Pelleted carrot[1]	Unpelleted carrot[1]	Mayweed chamomile[1]	Common lambsquarters[1]	Prickly lettuce[1]
mm			% of control		
3.2	53[a]	50[ab]	2[c]	0.04[b]	1[b]
6.4	70[a]	194[a]	29[ab]	0.12[ab]	30[a]
9.5	81[a]	75[ab]	87[a]	0.9[a]	4[ab]
12.7	48[a]	28[b]	6[bc]	0.13[ab]	1[b]

[1] Means followed by the same letter(s) are not significantly different according to a LSD (α=0.05) test performed on logarithmic transformed data calculated as a percent of the control. Un-transformed means are shown.

Carrot and parsnip tolerance to s-metolachlor and dimethenamid-P. Ed Peachey and Robert McReynolds. (Horticulture Department, Oregon State University, Corvallis, OR 97331) The objective of the study was to compare crop tolerance of carrots and parsnips to two soil and early postemergent herbicides. S-metolachlor was recently registered for use on root crops, but provides poor control of hairy nightshade, and looses effectiveness if rainfall is excessive after application.

Two rows of carrots and two rows of parsnips were planted on May 1 in 6 ft beds with 18 inches between rows. S-metolachlor and dimethenamid-P herbicide rates for similar treatments (PES, EPOST, or PES + EPOST) were based on equivalent herbicide costs/acre. Herbicides were applied to 6 ft by 30 ft plots with each treatment replicated 4 times in a RCBD. Linuron (0.5 lbs ai/A) was applied EPOST on May 31 after the initial weed ratings to reduce competition with the crop, and plots were kept weed free thereafter with cultivation and hand hoeing. Carrots and parsnips were harvested on August 8 from 10 ft of the middle row of each plot.

Carrots were much more tolerant than parsnips to both herbicides. Both carrots and parsnips suffered less injury from s-metolachlor than dimethenamid-P. Weed control was better with dimethenamid-P than s-metolachlor at cost-equivalent rates. Dimethenamid-P caused unacceptable yield reductions in both carrots and parsnips. The split application of s-metolachlor (PES + EPOST) may have improved weed control slightly compared to PES only, but carrot yield was substantially reduced at the 2X (Tr. 6).

Table 1. Herbicide application and soil data.

Application date	May 2	May 29
Application timing	Preemergence surface (PES)	Early postemergence (EPOST)
Crop stage	Planted May 1; 3/4 inch deep	Carrots and parsnips 1.5 - 2 leaf
Start/end time	6-7 AM	8-9:30 AM
Air temp/ soil surface	45/50°F	60/67°F
Relative humidity	85%	90%
Wind direction/velocity	N 1-3	SW 0-1
Cloud cover	0	80
Soil moisture	Dry	Very wet
Plant moisture	-	Wet
Sprayer/PSI	Backpack, 4-8002 nozzles, 30 PSI, 20 GPA	Backpack, 4-8002 nozzles, 30 PSI, 20 GPA
Soil inc. method/implement	Irrigation of 0.5 in	Rainfall on May 31, 2 days after application
Soil texture	Silt loam	
Soil pH	5.2	
CEC	29.3 meq/q100g soil	
OM	3.5%	

Table 2. Effect of s-metolachlor and dimethenamid-P on parsnip and carrot growth, yield and weed control, Corvallis, OR, 2006.

	Herbicide	Timing	Rate	Crop stand (10 DA[1] EPOST)		Phytotoxicity (1 WA[1] EPOST)		Stunting (1 WA EPOST)		Weed control	Crop yield			
											Parsnip		Carrot	
				Parsnip	Carrot	Parsnip	Carrot	Parsnip	Carrot		Roots	Wt.	Roots	Wt.
			lb ai/A	% of check		----- 0-10 -----		----- 0-100 % ----		%	#/10 ft of row	t/A	#/10 ft of row	t/A
1	S-met[2]	PES	0.64	58	103	0.5	0.0	18	20	79	37	2.8	79	12.9
2	S-met	PES	1.28	58	102	1.0	0.0	43	30	83	38	2.8	73	11.1
3	S-met	EPOST	1.28	79	104	1.3	0.3	13	18	13	46	3.2	65	11.4
4	S-met	EPOST	2.56	97	78	3.5	1.3	36	40	25	17	0.6	61	7.7
5	S-met	PES + EPOST	0.64 1.28	56	89	0.5	0.0	33	35	88	33	1.7	69	10.4
6	S-met	PES + EPOST	1.28 2.56	33	69	1.8	1.5	60	40	89	15	0.5	60	6.2
7	Dimeth-P[2]	PES	0.38	55	50	0.5	0.0	43	73	95	40	3.2	34	3.9
8	Dimeth-P	PES	0.75	14	13	0.5	0.7	88	89	98	6	0.7	10	1.5
9	Dimeth-P	EPOST	0.75	62	101	1.5	0.8	8	29	13	37	1.8	64	5.0
10	Dimeth-P	EPOST	1.5	101	82	1.8	0.0	15	33	20	32	1.3	41	3.3
11	Dimeth-P	PES + EPOST	0.375 0.75	47	64	1.3	0.3	55	67	94	25	1.1	33	2.1
12	Dimeth-P	PES + EPOST	0.75 1.5	5 0	5 0	-	-	93	98	100	0	0	0.5	0.1
15	Linuron	POST	0.5	100	100	0	0	0	0	18	61	4.6	68	12.1
16	Hand weeded + linuron			78	102	0	0	8	10	50	63	4.8	77	14.5
LSD (0.05)				22	27	0.9	0.9	21	22	38	13	0.9	19	2.5

[1] DA, days after; WA, weeks after.
[2] S-met (s-metolachlor) and dimeth-P (dimethenamid-P).

Postemergence herbicides for controlling three horseweed growth stages in wine grapes. Mick Canevari, Paul Verdegaal, Don Colbert and Randall Wittie (Cooperative Extension, University of California, Stockton, CA 95205). Steven Colbert (DuPont Crop Protection, Escalon, CA 95320). A field study was established to evaluate postemergence applications of rimsulfuron, gylphosate, paraquat, glufosinate ammonium and flumioxazin in controlling three horseweed (ERICA) growth stages in an established merlot grape vineyard. Oxyfluorfen or oryzalin were tank mixed with the above herbicides for soil residual or to burn down existing weed species. These herbicides have no postemergence activity on horseweed. No Foam A (NIS) was added to all herbicide treatments at 0.25% V/V. A single 6 by 63 ft (3 ft spray swath on both sides of the vine row) area was sprayed on April 6, 2006 with 64 F air temperature and 45% relative humidity. All herbicide treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 40 gpa. Eight to eleven horseweed plants were flagged at each growth stage: small = 4 to 6 lf, 1 to 1.5 inch diameter, medium = 10 to 14 lf, 2 to 3 inch diameter and large = 16 to 20 lf, 3 to 5 inch height and bolting. Number of dead plants were counted and reported as percent control on April 21, April 28 and May 10, 2006 (Table).

No treatment visibly injured the wine grapes (data not shown). Rimsulfuron, paraquat and gylphosate were most effective in controlling the smaller horseweed plants. Flumioxazin gave poor control on all horseweed growth stages. The most effective treatment was glufosinate, 90 to 100% control of horseweed on all growth stages.

Table. Effect of herbicide treatment on horseweed growth stage in an established merlot vineyard.

		Horseweed growth stage control days after treatment (DA)								
		Small			Medium			Large		
Treatment	Rate	15DA	22DA	34DA	15DA	22DA	34DA	15DA	22DA	34DA
	lb ai/A	%								
Rimsulfuron + oxyfluorfen[1]	0.0625 + 1.0	56	78	80	23	75	55	0	0	11
Glyphosate[2] + oxyfluorfen + oryzalin	1.0 + 1.0 + 4.0	100	100	100	33	42	50	0	50	50
Paraquat[3] + oryzalin	1.0 + 4.0	56	80	82	20	25	22	0	14	17
Glufosinate + oryzalin	1.0 + 4.0	36	100	90	25	100	100	33	67	100
Flumioxazin + oxyfluorfen	0.375 + 1.0	10	11	14	11	13	13	0	0	0
Untreated	-	0	0	0	0	0	0	0	0	0

[1]Goal Tender 4F.
[2]Roundup Weathermax 5.5SL.
[3]Gramoxone Inteon 2E.

Yellow nutsedge control in wine grapes with rimsulfuron, glyphosate and imazsulfuron. 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, imazsulfuron 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 30 gpa (Table 1). Herbicide treatments were applied on February 16 and April 4, 2006. Yellow nutsedge control was visually evaluated April 4, May 10, June 13 and July 12, 2006 (Table 2).

Table 1. Application information.

	February 16, 2006	April 14, 2006
Crop stage	Dormant	Bud break, 1 to 2 inch shoot
Yellow nutsedge stage	90% not emerged, 10% early postemergence, 1 to 2.5 lf, 0.5 to1 inch	20% 1 to 3 lf, 0.5 to 1.5 inch 80% 4 to 5 lf, 3 to 4 inch
Air temperature (F)	55	61
Cloud cover (%)	0	80
Wind (mph)	0	1.5
Relative humidity (%)	40	95

No treatment visibly injured the wine grapes (data not shown). On the final rating date July 12, 2006 rimsulfuron applied alone on February 16 or on April 14, 2006 gave 58 and 8% yellow nutsedge control, respectively. Rimsulfuron applied on February 16th followed by a sequential application of rimsulfuron or glyphosate on April 14, 2006 gave 72 and 67% yellow nutsedge control, respectively. Glyphosate 1.5 lb ai/A alone showed no activity on the nutsedge. Imazsulfuron 0.5 lb ai/A applied on February 16th gave 87% control of the yellow nutsedge.

Table 2. Yellow nutsedge control in bearing merlot grapes

		Application	Yellow nutsedge control			
Treatment[1]	Rate	date	4/14	5/10	6/13	7/12
	lb ai/A		....	..........%.	....	
Rimsulfuron	0.0625	2/16	67	67	72	58
Rimsulfuron + rimsulfuron	0.0625 + 0.0625	2.16 4/14	60	78	77	72
Rimsulfuron	0.0625	4/14	-	23	15	8
Rimsulfuron + glyphosate	0.0625 + 1.5	2/16 4/14	73	75	75	67
Glyphosate	1.5	4/14	17	0	0	0
Imazsulfuron	0.5	2/16	98	94	91	87
Untreated	-	-	0	0	0	0
LSD (05)			15	16	16	27

[1]No Foam A (NIS) added to all herbicide treatments 0.25% v/v.
[2]Glyphosate Weathermax 5.5Sl formulation.

Comparisons of three dimethenamid-p rates alone or in two-way tank mixtures and three-way tank-mixtures of dimethenamid-p compared with similar metolachlor or s-metolachlor tank mixtures for weed control and crop safety in potatoes. Pamela J.S. Hutchinson, Daniel M. Hancock, and Oleg V. Alexandrov. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objectives of this study were to 1) compare weed control, especially common lambsquarters control, and crop safety by dimethenamid-p at three rates alone or in two-way tank mixtures and 2) weed control and crop safety by dimethenamid-p in three-way tank mixtures compared with metolachlor or s-metolachlor in three-way tank mixtures with the same tank-mix partners in a field trial conducted at the Aberdeen Research and Extension Center in 2005.

The experimental area was fertilized with 200 lb N, 80 lb P_2O_5, 10 lb Zn /A based on soil tests, before planting 'Russet Burbank' potatoes on April 19, 2005. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.5% organic matter and pH 8.0. 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 5, 2005, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 13, 2005 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, metribuzin at 0.5, pendimethalin at 1.0, ethalfluralin at 0.94, sulfentrazone at 0.047, or flumioxazin 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 by 0.4-inch sprinkler irrigation immediately after application. No potato or weed plants were exposed at time of the PRE application. Weed densities in the untreated checks were 861 redroot pigweed (AMARE), 107 common lambsquarters (CHEAL), 107 hairy nightshade (SOLSA), 32 tame oat (AVESA), and 1 green foxtail (SETVI)/m^2 by June 11, 2005.

Potatoes were sprinkler irrigated as needed throughout the growing season and received additional N and P_2O_5, based on petiole test results, through the irrigation system. Weed control and crop injury was assessed at approximately 2 wk after treatment, at row closure, and at the end of the growing season prior to harvest. Potato vines were desiccated with 0.375 lb/A diquat August 26, 2005. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Sept 13, 2005 and graded according to USDA standards. Percent weed control and crop injury data were arcsine square root transformed to mitigate the skewness of the data. Transformed means were separated with a Duncan's New Multiple Range Test (P=0.05) and weedy and weed-free control means were not included in those analyses. Non-transformed means are shown in the table with transformed mean separations. 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 weedy and weed-free control yields were included in those analyses.

Weed control data from the pre-harvest date are reported as they represent season-long control. Common lambsquarters control by dimethenamid-p alone improved from 27% to 77% when the rate increased from 0.64 to 1.0 lb/A (Table 1). All 2-way mixtures with dimethenamid-p at 0.64 lb/A improved control compared with that rate applied alone. Two-way tank mixtures with that rate and metribuzin, pendimethalin, sulfentrazone, or flumioxazin controlled common lambsquarters 96 to 98% and control was better than the 75 or 87% control by tank mixtures with ethalfluralin or EPTC, respectively. All 2-way tank mixtures of dimethenamid-p at 0.84 or 1.0 controlled common lambsquarters 87% or greater and most of those tank mixtures provided better control than the respective dimethenamid-p rate applied alone.

Hairy nightshade control by the three dimethenamid-p rates applied PRE alone was similar and increased numerically from 87 to 95% as the rate increased from 0.64 to 1.0 lb/A (Table 1). All 2-way tank mixtures except dimethenamid-p at 0.64 or 0.84 lb/A + ethalfluralin, or dimethenamid-p at 0.64 lb/A + pendimethalin provided at least 90% hairy nightshade control. Dimethenamid-p at 0.64 or 0.84 lb/A + metribuzin, sulfentrazone, or flumioxazin controlled hairy nightshade better than the respective dimethenamid-p rate alone and dimethenamid-p at

0.84 lb/A + pendimethalin also controlled hairy nightshade better than that rate alone. Tank mixtures of dimethenamid-p at 1.0 lb/A alone or in 2-way tank mixtures controlled hairy nightshade similarly and control ranged from 95 to 100%. Common lambsquarters control with metolachlor + EPTC + pendimethalin was 67% and less compared with the 96 to 100% control provided by all other 3-way tank mixtures tested (Table 1). The dimethenamid-p 3-way tank mixtures controlled hairy nightshade 93 to 98% while the best control by an s-metolachlor or metolachlor 3-way mix was much less at 78%.

All treatments controlled redroot pigweed 87% or better except the s-metolachlor or metolachlor 3-way tank mixtures with EPTC + pendimethalin which provided 78 or 67%, respectively (Table 1). Green foxtail control ranged from 87 to 99% (Table 1). Tame oat control by all dimethenamid-p 2-way tank mixtures ranged from 77 to 96% and no mixture improved control compared with the respective dimethenamid-p rate applied alone (Table 1). Tame oat control with dimethenamid-p, s-metolachlor, or metolachlor 3-way tank mixtures was similar and at least 92% with the exception of s-metolachlor or metolachlor + EPTC + pendimethalin, which controlled tame oat 82 or 88%, respectively.

Potato injury at row closure ranged from 0 to 7% and consisted of slight stunting and some leaf crinkling, and the dimethenamid-p + sulfentrazone or flumioxazin 2-way tank mixtures caused greater injury than any other treatment (Table 2). Weed control impacted tuber yield more than injury at row closure (Table 2). Improved weed control with 2-way tank mixtures including dimethenamid-p at 0.64 lb/A compared with that rate applied alone seemingly resulted in greater total tuber yields with those 2-way mixtures compared to dimethenamid-p applied alone at that rate. There were fewer differences between yields of dimethenamid-p at 0.84 or 1.0 lb/A applied alone and yields of the 2-way tank mixtures with those rates. Tuber yields of the 3-way tank mixtures including dimethenamid-p, s-metolachlor, or metolachlor were similar with the exception of metolachlor + EPTC + pendimethalin compared with s-metolachlor plus the same tank-mix partners (Table 2). The s-metolachlor mixture generally controlled broadleaf weeds present in the trial better than the metolachlor mixture, and at harvest, the s-metolachlor tuber yields were greater than the metolachlor tuber yields.

Table 1. A comparison of season-long weed control 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 2005.

		Control[1]				
		AMARE	CHEAL	SOLSA	SETVI	AVESA
Treatment	Rate	Aug 31	Aug 31	Aug 31	Aug 31	Aug 31
	lb ai/A	------------------------------------- % ----------------------------------				
dimethenamid-p	**0.64**	92 c-f	27 g	87 de	99 a	88 cde
+ EPTC	3.9	95 a-e	87 cde	90 cde	97 ab	87 c-f
+ metribuzin	0.5	98 abc	98 a	97 abc	97 ab	93 bcd
+ pendimethalin	1.0	87 ef	96 a	87 de	95 b	87def
+ ethalfluralin	0.94	90 def	75 ef	88 cde	95 b	77 fg
+ sulfentrazone	0.047	100 a	98 a	100 a	97 ab	88 cde
+ flumioxazin	0.047	95 a-e	98 a	98 ab	95 b	87 def
dimethenamid-p	**0.84**	93 b-f	73 ef	88 cde	97 ab	95 abc
+ EPTC	3.9	95 a-e	87 cde	93 a-d	96 b	93 bcd
+ metribuzin	0.5	100 ab	100 a	97 ab	97 ab	95 abc
+ pendimethalin	1.0	99 abc	97 a	98 ab	96 b	87 c-f
+ ethalfluralin	0.94	92 c-f	88 bcd	87 de	97 ab	87 c-f
+ sulfentrazone	0.047	98 abc	100 a	98 ab	97 ab	88 cde
+ flumioxazin	0.047	97 a-e	98 a	98 ab	95 b	92 b-e
dimethenamid-p	**1.0**	92 c-f	77 def	95 a-d	95 b	99 a
+ EPTC	3.9	98 a-d	98 a	99 ab	97 ab	93 bcd
+ metribuzin	0.5	97 ab	97 a	98 ab	97 ab	88 cde
+ pendimethalin	1.0	98 a-d	98 a	98 ab	95 b	90 b-e
+ ethalfluralin	0.94	97 a-e	87 cde	95 a-d	96 b	90 b-e
+ sulfentrazone	0.047	97 a-d	100 a	100 a	98 ab	96 ab
+ flumioxazin	0.047	98 a-d	95 ab	100 a	95 b	93 bcd
dimethenamid-p	**0.64**					
+ metribuzin + pendimethalin	0.5 + 1.0	100 a	100 a	98 ab	98 ab	95 abc
+ metribuzin + ethalfluralin	0.5 + 0.94	98 abc	100 a	93 bcd	95 b	96 ab
+ metribuzin + EPTC	0.5 + 3.9	97 a-d	97 a	95 a-d	95 b	95 abc
+ EPTC + pendimethalin	3.9 + 1.0	98 a-e	99 a	98 ab	98 ab	95 abc
+ EPTC + ethalfluralin	3.9 + 0.94	96 a-e	90 bc	95 a-d	87 c	95 abc
s-metolachlor	**1.34**					
+ metribuzin + pendimethalin	0.5 + 1.0	98 abc	100 a	40 hi	98 ab	95 abc
+ metribuzin + ethalfluralin	0.5 + 0.94	90 def	98 a	57 gh	96 b	92 b-e
+ metribuzin + EPTC	0.5 + 3.9	96 a-e	100 a	78 ef	98 ab	96 ab
+ EPTC + pendimethalin	3.9 + 1.0	78 fg	96 ab	63 fg	95 b	82 g
metolachlor	**1.34**					
+ metribuzin + pendimethalin	0.5 + 1.0	95 a-e	98 a	37 i	98 ab	96 ab
+ metribuzin + EPTC	0.5 + 3.9	93 b-f	98 a	57 gh	96 b	96 ab
+ EPTC + pendimethalin	3.9 + 1.0	67 g	67 f	53 gh	95 b	88 efg

[1]AMARE redroot pigweed; CHEAL common lambsquarters; SOLSA hairy nightshade; SETVI foxtail; AVESA tame oat. Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test b (P=0.05) performed on arcsine square root transformed data. Non-transformed means are shown. Untreated control means were not included in the mean separation analyses.

Table 2. Potato crop response to 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 2005.

		Potato crop response		
		Overall injury[a]	Tuber yield[b]	
Treatment	Rate	Jul 11	U.S. No. 1	Total
	lb ai/A	--------%--------	---------- cwt/A	----------
Weedy check	-	-	53.1	146.8
Weed-free control	-	-	285.8	425.8
dimethenamid-p	**0.64**	0 c	206.8	315.8
+ EPTC	3.9	0 c	243.9	400.5
+ metribuzin	0.5	0 c	319.8	448.4
+ pendimethalin	1.0	0 c	259.7	403.8
+ ethalfluralin	0.94	0 c	302.5	403.3
+ sulfentrazone	0.047	5 b	297.1	433.7
+ flumioxazin	0.047	5 b	315.6	441.7
dimethenamid-p	**0.84**	0 c	281.2	385.3
+ EPTC	3.9	0 c	286.9	422.0
+ metribuzin	0.5	0 c	322.1	429.9
+ pendimethalin	1.0	0 c	273.1	413.3
+ ethalfluralin	0.94	0 c	236.4	379.8
+ sulfentrazone	0.047	5 b	315.8	462.0
+ flumioxazin	0.047	5 b	319.1	447.6
dimethenamid-p	**1.0**	0 c	234.5	352.7
+ EPTC	3.9	0 c	351.9	468.0
+ metribuzin	0.5	0 c	264.5	470.3
+ pendimethalin	1.0	0 c	338.1	472.4
+ ethalfluralin	0.94	0 c	249.4	407.0
+ sulfentrazone	0.047	5 b	299.1	427.4
+ flumioxazin	0.047	7 a	285.6	411.5
dimethenamid-p	**0.64**			
+ metribuzin + pendimethalin	0.5 + 1.0	0 c	341.9	477.3
+ metribuzin + ethalfluralin	0.5 + 0.94	0 c	284.7	424.8
+ metribuzin + EPTC	0.5 + 3.9	0 c	249.3	429.9
+ EPTC + pendimethalin	3.9 + 1.0	0 c	253.9	399.2
+ EPTC + ethalfluralin	3.9 + 0.94	0 c	281.8	420.7
s-metolachlor	**1.34**			
+ metribuzin + pendimethalin	0.5 + 1.0	0 c	284.6	388.9
+ metribuzin + ethalfluralin	0.5 + 0.94	0 c	285.9	425.8
+ metribuzin + EPTC	0.5 + 3.9	0 c	310.0	478.2
+ EPTC + pendimethalin	3.9 + 1.0	0 c	217.9	386.0
metolachlor	**1.34**			
+ metribuzin + pendimethalin	0.5 + 1.0	0 c	337.3	455.9
+ metribuzin + EPTC	0.5 + 3.9	0 c	297.5	441.9
+ EPTC + pendimethalin	3.9 + 1.0	0 c	225.9	358.5
LSD (0.05)	-	-	80.0	73.7

[a] Overall crop injury mainly consisted of stunting with some leaf malformation. Ratings were performed Jul 11, 200 at row closure. Means followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (P=0.05) performed on arcsine square root transformed data. Non-transformed means are shown. Untreated control means were not included in the injury mean separation analyses.

[b] U.S. No. 1 tubers are >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.

Comparison of three low sulfentrazone rates alone and in two- and three-way tank mixtures for broad spectrum weed control and crop safety in potatoes. Pamela J.S. Hutchinson, Daniel M. Hancock, and Oleg V. Alexandrov. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objectives of this study were to compare weed control by three rates of sulfentrazone applied preemergence (PRE) alone- including the lowest labeled rate at 0.094 lb ai/A (1X) and two lower-than-labeled rates of 0.07 (¾X) or 0.047 lb ai/A (½X) , with 1) two-way tank mixtures of those three rates with other PRE-applied hairy nightshade herbicides or metribuzin, and 2) three-way tank mixtures of those three rates with other PRE-applied herbicides which provide no hairy nightshade control or only suppression in a field trial conducted in 2005 at the Aberdeen Research and Extension Center in Aberdeen, ID.

The experimental area was fertilized with 200 lb N, 80 lb P_2O_5, 10 lb Zn /A based on soil tests, before planting 'Russet Burbank' potatoes on April 19, 2005. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.5% organic matter and pH 8.0. 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 5, 2005, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 13, 2005 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. Treatments included the three sulfentrazone rates applied alone; in two-way tank mixtures with metribuzin at 0.5, rimsulfuron at 0.023, dimethenamid-p at 0.84, or EPTC at 5.3 lb ai/A; and in three-way tank mixtures with metribuzin at 0.5 lb/A + pendimethalin at 1.0, s-metolachlor or metolachlor at 1.34, or ethalfluralin at 0.94 lb ai/A; and s-metolachlor + pendimethalin or ethalfluralin at the same rates. The treatments were incorporated by 0.4 inches sprinkler irrigation immediately after application. No potato or weeds were exposed at time of the PRE application. Weed densities in the untreated checks were 107 redroot pigweed (AMARE), 107 common lambsquarters (CHEAL), 215 hairy nightshade (SOLSA), 1 tame oat (AVESA) and 1 green foxtail (SETVI)/m^2 by June 11, 2005.

Potatoes were sprinkler irrigated as needed throughout the growing season and received additional N and P_2O_5, based on petiole test results, through the irrigation system. Weed control and crop injury was assessed at approximately 2 wk after treatment, at row closure, and at the end of the growing season prior to harvest. Potato vines were desiccated with 0.375 lb/A diquat August 26, 2005. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Sept 13, 2005 and graded according to USDA standards. Percent weed control and crop injury data were arcsine square root transformed to mitigate the skewness of the data. Transformed means were separated with a Duncan's New Multiple Range Test (P=0.05) and weedy and weed-free control means were not included in those analyses. Non-transformed means are shown in the table with transformed mean separations. 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 weedy and weed-free control yields were included in those analyses.

Weed control data from the pre-harvest date are reported as they represent season-long control. Hairy nightshade control improved from 52 to 95% as the sulfentrazone-alone rate increased from ½X to 1X (Table 1). Two-way tank mixtures of ½X or ¾X sulfentrazone with rimsulfuron or dimethenamid-p and ¾X sulfentrazone + metribuzin provided at least 90% hairy nightshade control and that control was better than control by either of those sulfentrazone rates applied alone. The 1X sulfentrazone rate applied PRE alone, and all 2-way tank mixtures with that rate provided similar control of 96% or greater. Four out of the six 3-way tank mixtures with ½X sulfentrazone resulted in greater hairy nightshade control than control by that rate applied alone or in 2-way tank mixtures with metribuzin or EPTC. None of those 3-way mixtures provided greater than 90% control, however. In fact, the ½X sulfentrazone rate combined with rimsulfuron or dimethenamid-p in 2-way mixtures controlled hairy nightshade better than any of the 3-way combinations with the same ½X rate. Hairy nightshade control by ¾X sulfentrazone + EPTC was 87%, and greater than the 57% control by ½X sulfentrazone + EPTC.

Three out of the six 3-way tank mixtures with the ¾X sulfentrazone rate controlled hairy nightshade greater than 90% and control was better than with that rate in the other 3-way mixtures, or that rate applied alone or in a 2-way mixture with EPTC (Table 1). All 3-way mixtures with the 1X sulfentrazone rate, except sulfentrazone + metribuzin + metolachlor or ethalfluralin, controlled hairy nightshade greater than 90%.

Redroot pigweed control improved from 73 to 93% as the sulfentrazone-alone rate increased from ½X to 1X (Table 1). Sulfentrazone at ½, ¾, or 1X in 2- and 3-way tank-mixtures controlled redroot pigweed 90% or greater except the ½X sulfentrazone rate + EPTC. With the exception of sulfentrazone + EPTC, 2-way mixtures with ½ or ¾X sulfentrazone controlled redroot pigweed better than the respective sulfentrazone rate applied alone. All three sulfentrazone rates alone or in 2- or 3-way tank mixtures provided 98 to 100% common lambsquarters control and there were no differences among treatments (Table 1). Sulfentrazone alone provided less than 40% green foxtail or tame oat control, regardless of rate (Table 1). Green foxtail control improved to 90% or greater with any 2- or 3-way tank mixture tested. The ½X sulfentrazone rate + dimethenamid-p, or with s-metolachlor + ethalfluralin controlled tame oat 85 and 88%, respectively while all other 2- and 3-way mixtures with that rate, and all tank mixtures with ¾ or 1X sulfentrazone controlled tame oat 90% or greater.

All sulfentrazone alone or tank-mixture treatments improved U.S. No. 1 and total tuber yields compared with the untreated, weedy control (Table 2). In general, season-long weed control seemingly affected yield more than mid-season injury since the few treatments with the ¾ or 1X sulfentrazone rate causing greater than 5% injury at row closure did not have the lowest tuber yields.

Overall, sulfentrazone at 0.047 lb/A, which is ½ the lowest-labeled rate, applied PRE in 2-way tank mixtures with the hairy nightshade herbicides rimsulfuron or dimethenamid-p not only provided greater than 90% season-long hairy nightshade control, these 2-way mixtures also provided 98 to100% control of redroot pigweed, common lambsquarters, and green foxtail. This ½X sulfentrazone rate + rimsulfuron or dimethenamid-p also controlled tame oat 96 or 85%, respectively.

More tank-mix partners could be used with sulfentrazone at 0.07 lb/A, which is ¾ the lowest labeled rate, than with the ½X rate for acceptable broad spectrum weed control since the ¾X rate combined with not only rimsulfuron or dimethenamid-p, but metribuzin or EPTC as well, provided 87% to 100% control of the four broadleaf and two grass weeds present in our trial. Moreover, hairy nightshade control was less than 90% when the ½X sulfentrazone rate was combined in 3-way tank mixtures with herbicides that usually only suppress hairy nightshade or do not provide any control. By comparison, sulfentrazone at the ¾X rate in 3-way mixtures with s-metolachlor + metribuzin, pendimethalin, or ethalfluralin controlled hairy nightshade better than 90%. Even the lowest-labeled sulfentrazone rate of 0.094 lb/A should be tank-mixed with a herbicide(s) providing grass control, and in our trial, all but two tank mixtures with any sulfentrazone rate tested provided 90% or greater control of the grasses present.

Table 1. Season-long weed control with three rates of sulfentrazone applied preemergence alone or in two- and three-way tank mixtures at Aberdeen, ID in 2005.

		Control[1]				
		AMARE	CHEAL	SOLSA	SETVI	AVESA
Treatment	Rate	Aug 31	Aug 31	Aug 31	Aug 31	Aug 31
	lb ai /A	--------	--------	%	--------	--------
Sulfentrazone	**0.047**	73 g	99 a	52 k	0 f	0 f
+ metribuzin	0.5	93 b-f	100 a	57 k	97 a-d	92 a-d
+ rimsulfuron	0.023	100 ab	100 a	100 ab	99 abc	96 a-d
+ dimethenamid-p	0.84	100 a	100 a	97 abc	98 abc	85 d
+ EPTC	5.3	80 fg	100 a	57 k	90 de	95 a-d
Sulfentrazone	0.047					
+ metribuzin						
+ pendimethalin	0.5 + 1.0	100 ab	100 a	60 jk	100 a	97 abc
+ metribuzin						
+ s-metolachlor	0.5 + 1.34	96 a-e	100 a	88 efg	100 a	98 abc
+ metribuzin						
+ metolachlor	0.5 + 1.34	92 b-f	100 a	58 jk	100 ab	95 a-d
+ metribuzin						
+ ethalfluralin	0.5 + 0.94	97 a-e	100 a	72 hij	97 a-e	97 abc
+ pendimethalin						
+ s-metolachlor	1 + 1.34	97 a-d	100 a	88 efg	98 abc	93 a-d
+ ethalfluralin						
+ s-metolachlor	0.94 + 1.34	93 a-e	100 a	82 fgh	93 b-e	88 cd
Sulfentrazone	**0.07**	87 efg	100 a	77 gh	7 f	7 f
+ metribuzin	0.5	95 a-d	100 a	90 def	90 de	90 bcd
+ rimsulfuron	0.023	100 ab	100 a	100 ab	100 ab	98 ab
+ dimethenamid-p	0.84	98 abc	100 a	97 abc	100 a	93 a-d
+ EPTC	5.3	92 c-f	100 a	87 efg	92 cde	90 bcd
Sulfentrazone	**0.07**					
+ metribuzin						
+ pendimethalin	0.5 + 1.0	95 a-d	100 a	80 fgh	100 a	92 bcd
+ metribuzin						
+ s-metolachlor	0.5 + 1.34	98 abc	100 a	97 abc	100 a	98 ab
+ metribuzin						
+ metolachlor	0.5 + 1.34	97 a-e	100 a	63 ijk	100 a	95 a-d
+ metribuzin						
+ ethalfluralin	0.5 + 0.94	100 ab	100 a	77 ghi	98 abc	95 a-d
+ pendimethalin						
+ s-metolachlor	1 + 1.34	98 abc	100 a	95 bcd	98 abc	92 bcd
+ ethalfluralin						
+ s-metolachlor	0.94 + 1.34	100 ab	100 a	97 abc	95 a-e	95 a-d
Sulfentrazone	**0.094**	92 c-f	100 a	95 cde	7 f	37 e
+ metribuzin	0.5	90 def	100 a	96 bcd	96 a-e	97 abc
+ rimsulfuron	0.023	100 a	100 a	100 ab	97 a-e	96 a-d
+ dimethenamid-p	0.84	98 a-d	100 a	100 a	100 a	95 a-d
+ EPTC	5.3	93 b-f	100 a	98 abc	90 e	92 bcd
Sulfentrazone	**0.094**					
+ metribuzin						
+ pendimethalin	0.5 + 1.0	100 a	100 a	98 abc	100 a	97 ab
+ metribuzin						
+ s-metolachlor	0.5 + 1.34	100 a	100 a	100 a	100 a	100 a
+ metribuzin						
+ metolachlor	0.5 + 1.34	95 a-d	98 a	87 efg	95 a-e	92 bcd
+ metribuzin						
+ ethalfluralin	0.5 + 0.94	98 a-d	100 a	87 efg	97 a-e	95 a-d
+ pendimethalin						
+ s-metolachlor	1 + 1.34	100 a	100 a	98 abc	95 a-e	92 bcd
+ ethalfluralin						
+ s-metolachlor	0.94 + 1.34	100 ab	100 a	98 abc	98 abc	96 a-d

[1] AMARE redroot pigweed; CHEAL common lambsquarters; SOLSA hairy nightshade; SETVI foxtail; AVESA, tame oat. Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test b (P=0.05) performed on arcsine square root transformed data. Non-transformed means are shown. Untreated control means were not included in the mean separation analyses.

Table 2. U.S. No. 1 and total tuber yields with three rates of sulfentrazone applied preemergence alone or in two- and three-way tank mixtures at Aberdeen, ID in 2005.

Treatment	Rate	Crop injury (Jul 14)[1]	Tuber yield[2] U.S. No. 1	Tuber yield[2] Total
	lb ai/A	---%---	-------cwt/A------	
Weedy check	-	-	66.1	171.0
Weed-free control	-	-	219.4	376.8
Sulfentrazone	**0.047**	5 a-d	283.9	394.3
+ metribuzin	0.5	0 e	279.8	428.6
+ rimsulfuron	0.023	5 cde	278.9	448.9
+ dimethenamid-p	0.84	5 a-d	303.5	434.6
+ EPTC	5.3	3 cde	297.3	445.6
Sulfentrazone	**0.047**			
+ metribuzin + pendimethalin	0.5 + 1.0	0 e	289.4	445.5
+ metribuzin + s-metolachlor	0.5 + 1.34	3 cde	276.1	416.4
+ metribuzin + metolachlor	0.5 + 1.34	0 e	344.9	446.0
+ metribuzin + ethalfluralin	0.5 + 0.94	3 cde	294.0	407.8
+ pendimethalin + s-metolachlor	1 + 1.34	3 cde	345.8	479.4
+ ethalfluralin + s-metolachlor	0.94 + 1.34	3 cde	224.9	370.5
Sulfentrazone	**0.07**	10 abc	252.0	381.5
+ metribuzin	0.5	3 de	319.1	447.1
+ rimsulfuron	0.023	5 b-e	324.9	494.9
+ dimethenamid-p	0.84	7 a-d	287.7	411.3
+ EPTC	5.3	3 cde	292.9	415.2
Sulfentrazone	**0.07**			
+ metribuzin + pendimethalin	0.5 + 1.0	5 b-e	282.2	410.9
+ metribuzin + s-metolachlor	0.5 + 1.34	0 e	327.3	462.6
+ metribuzin + metolachlor	0.5 + 1.34	3 cde	296.9	422.7
+ metribuzin + ethalfluralin	0.5 + 0.94	3 cde	319.7	423.3
+ pendimethalin + s-metolachlor	1 + 1.34	5 b-e	351.2	467.3
+ ethalfluralin + s-metolachlor	0.94 + 1.34	8 a-d	258.8	378.7
Sulfentrazone	**0.094**	15 a	283.9	408.1
+ metribuzin	0.5	2 de	320.4	461.3
+ rimsulfuron	0.023	5 b-e	314.4	437.7
+ dimethenamid-p	0.84	13 ab	303.8	450.4
+ EPTC	5.3	10 abc	317.9	446.0
Sulfentrazone	**0.094**			
+ metribuzin + pendimethalin	0.5 + 1.0	10 abc	280.6	410.9
+ metribuzin + s-metolachlor	0.5 + 1.34	0 e	362.9	485.5
+ metribuzin + metolachlor	0.5 + 1.34	3 cde	285.7	430.6
+ metribuzin + ethalfluralin	0.5 + 0.94	3 cde	333.2	449.6
+ pendimethalin + s-metolachlor	1 + 1.34	5 cde	276.4	405.0
+ ethalfluralin + s-metolachlor	0.94 + 1.34	8 a-d	307.6	470.2
LSD (0.05)		-	56.5	48.5

[1] Crop injury ratings on July 14, 2005 approximately 2 months after treatment. Means followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test (P=0.05) performed on arcsine square root transformed data. Non-transformed means are shown. Untreated control means were not included in the injury mean separation analyses.

[2] U.S. No. 1 tubers are >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.

Comparisons of flumioxazin and rimsulfuron in preemergence two- and three-way tank mixtures for weed control and crop response in potatoes. Pamela J.S. Hutchinson, Daniel M. Hancock, and Oleg V. Alexandrov (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210). The objectives of this trial were to 1) compare weed control and crop response by preemergence (PRE) two-way tank mixtures of flumioxazin, rimsulfuron, EPTC, ethalfluralin, metribuzin, pendimethalin, and s-metolachlor, and 2) compare PRE-applied flumioxazin and rimsulfuron three-way tank mixtures for weed control and crop safety in a field trial located at the Aberdeen Research and Extension Center in 2005.

The experimental area was fertilized with 200 lb N, 80 lb P_2O_5, 10 lb Zn /A based on soil tests, before planting 'Russet Burbank' potatoes on April 19, 2005. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.5% organic matter and pH 8.0. 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 5, 2005, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 19, 2005 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. PRE treatments were incorporated by 0.4-inch sprinkler irrigation immediately after application. No potato or weeds were exposed at time of the PRE application. Weed densities in the untreated checks were 645 redroot pigweed (AMARE), 107 common lambsquarters (CHEAL), 43 hairy nightshade (SOLSA), 1 tame oat (AVESA), and 1 green foxtail (SETVI)/m^2 by June 13, 2005.

Potatoes were sprinkler irrigated as needed throughout the growing season and received additional N and P_2O_5, based on petiole test results, through the irrigation system. Weed control and crop injury was assessed at approximately 2 wk after treatment, at row closure, and at the end of the growing season prior to harvest. Potato vines were desiccated with 0.375 lb/A diquat August 26, 2005. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Sept 16, 2005 and graded according to USDA standards. Percent weed control and crop injury data were arcsine square root transformed to mitigate the skewness of the data. Transformed means were separated with a Duncan's New Multiple Range Test (P=0.05) and weedy and weed-free control means were not included in those analyses. Non-transformed means are shown in the table with transformed mean separations. 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 weedy and weed-free control yields were included in those analyses.

Two-way tank-mix treatments included metribuzin at 0.5 lb ai/A +flumioxazin at 0.047, rimsulfuron at 0.023, EPTC at 3.9, ethalfluralin at 0.94, s-metolachlor at 1.34, or pendimethalin at 1.0 lb ai/A; s-metolachlor + flumioxazin, rimsulfuron, EPTC, ethalfluralin, or pendimethalin; EPTC + flumioxazin, rimsulfuron, ethalfluralin, or pendimethalin; ethalfluralin + flumioxazin or rimsulfuron; pendimethalin + flumioxazin or rimsulfuron; and flumioxazin + rimsulfuron. Three-way tank-mix treatments were flumioxazin with combinations of EPTC, ethalfluralin, metribuzin, pendimethalin, rimsulfuron, and s-metolachlor compared with rimsulfuron tank-mixed with combinations of EPTC, ethalfluralin, metribuzin, pendimethalin, and s-metolachlor. Three-way tank mixture treatments of flumioxazin with metribuzin or EPTC + metolachlor and rimsulfuron with metribuzin + metolachlor at 1.34 lb ai/A.

The best 2-way tank mixtures for hairy nightshade control included flumioxazin or rimsulfuron and these mixtures provided 92% or greater hairy nightshade control, with the exception of flumioxazin + ethalfluralin, which controlled hairy nightshade 82% (Table). All other 2-way tank mixtures provided less than 80% hairy nightshade control. The metribuzin two-way tank mixtures usually provided greater than 90% control of all other weeds present (Table 1). Flumioxazin combined with s-metolachlor, EPTC, pendimethalin, or ethalfluralin did not control redroot pigweed as well as rimsulfuron combined with the same tank-mix partners, while the only difference in common lambsquarters control by flumioxazin compared with rimsulfuron 2-way tank mixtures was flumioxazin + ethalfluralin at 90% compared with rimsulfuron + ethalfluralin at 78% (Table). Green foxtail and tame oat control with rimsulfuron + EPTC or ethalfluralin was greater than flumioxazin with either herbicide, and in addition, flumioxazin + pendimethalin also did not control tame oat as well as rimsulfuron + pendimethalin (Table). Flumioxazin + rimsulfuron provided 96 to 100% control of all weeds present in the trial.

All flumioxazin and rimsulfuron 3-way tank mixtures controlled hairy nightshade at least 92% (Table). Redroot pigweed and common lambsquarters control by all 3-way tank mixtures was at least 90% and the flumioxazin 3-way mixtures provided control similar to the rimsulfuron mixtures with the following exceptions: flumioxazin + s-metolachlor + pendimethalin controlled redroot pigweed 87% compared with 100% by the rimsulfuron 3-way mixture; flumioxazin + EPTC + ethalfluralin, controlled redroot pigweed and common lambsquarters 72 and 75%, respectively, and flumioxazin + EPTC + pendimethalin controlled redroot pigweed 78%, while rimsulfuron with those same tank mix partners provided 100% redroot pigweed and 96% common lambsquarters control (Table).

With the exception of flumioxazin + s-metolachlor + ethalfluralin, which provided 85% control, all rimsulfuron and flumioxazin 3-way tank mixtures controlled green foxtail at least 90% (Table). The flumioxazin or rimsulfuron + metribuzin 3-way tank mixtures all provided 90% or greater tame oat control (Table). In contrast, the rimsulfuron + s-metolachlor 3-way combinations usually controlled tame oat better than similar flumioxazin + s-metolachlor 3-way combinations (Table). Flumioxazin + EPTC + metolachlor controlled tame oat 77% while control was better and ranged from 90 to 98% when flumioxazin or rimsulfuron + EPTC was combined with ethalfluralin or pendimethalin. Flumioxazin combined with rimsulfuron and metribuzin, EPTC, s-metolachlor, ethalfluralin, or pendimethalin provided 90 to 100% of all weeds present except for the 3-way mix with ethalfluralin or s-metolachlor, which controlled tame oat 88% (Table).

Potato crop injury was less than 5% (data not shown). U.S. No. 1 and total tuber yields of flumioxazin compared with rimsulfuron 2-way tank mixtures were similar except rimsulfuron + ethalfluralin, which resulted in greater yields than flumioxazin + ethalfluralin (Table). Flumioxazin 3-way tank mixtures yields were usually comparable with yields of similar rimsulfuron 3-way tank mixtures (Table).

Overall, flumioxazin 2- and 3-way tank mixtures provided hairy nightshade and common lambsquarters control similar to comparable rimsulfuron tank mixtures. In contrast, rimsulfuron tank mixtures generally provided better redroot pigweed control than similar flumioxazin mixtures. Flumioxazin provides little or no grass control and 2-way tank mixtures with EPTC or ethalfluralin did not control green foxtail or tame oat as well as rimsulfuron with those same tank-mix partners in this trial. Flumioxazin + rimsulfuron combinations provided 90% or greater control of almost all the weeds present in the trial. Results in the 2005 trial were generally similar to 2004 trial results.

Table. Comparisons of season-long weed control and crop response with preemergence flumioxazin or rimsulfuron two- and three-way tank mixtures at Aberdeen, ID in 2005.

		Control[1]					Tuber yield[2]	
		AMARE	CHEAL	SOLSA	SETVI	AVESA	U.S.	
Treatment	Rate	Sep 1	Sep 1	Sep 1	Sep 1	Sep 1	No. 1	Total
	lb ai /A	-----	-----	%	-----	-----	cwt/A	
Weedy check	-	-	-	-	-	-	19.5	81.5
Weed-free control	-	-	-	-	-	-	183.8	284.0
Metribuzin	**0.5**							
+ flumioxazin	0.047	98 abc	100 a	95 bcd	96 b-f	98 ab	277.0	372.3
+ rimsulfuron	0.23	100 ab	100 a	98 abc	96 b-f	98 ab	293.3	397.7
+ EPTC	3.9	85 g-j	100 ab	78 fg	97 a-f	95 a-f	257.5	345.3
+ ethalfluralin	0.94	96 a-d	100 a	20 j	96 b-f	87 f-k	287.1	384.8
+ s-metolachlor	1.34	98 abc	98 abc	20 j	92 efg	92 c-i	291.4	378.0
+ pendimethalin	1.0	98 abc	100 a	37 ij	93 d-g	96 a-e	272.6	366.3
s-metolachlor	**1.34**							
+ flumioxazin	0.047	80 g-j	93 bcd	93 b-e	96 b-f	85 g-k	298.0	459.6
+ rimsulfuron	0.023	95 b-e	95 a-d	96 a-d	98 a-d	88 e-k	282.7	415.9
+ EPTC	3.9	85 g-j	60 g	73 g	95 c-f	87 f-k	235.7	343.9
+ ethalfluralin	0.94	73 ijk	60 g	40 i	90 fgh	82 i-l	224.5	305.9
+ pendimethalin	1.0	88 e-h	92 bcd	53 hi	95 c-f	80 jkl	293.4	397.7
EPTC	**3.9**							
+ flumioxazin	0.047	77 h-k	78 ef	98 a-d	80 h	72 l	258.3	375.4
+ rimsulfuron	0.023	93 c-f	87 def	100 ab	97 a-f	87 f-k	271.4	388.5
+ ethalfluralin	0.94	72 jk	73 fg	70 gh	85 gh	83 h-l	252.0	347.4
+ pendimethalin	1.0	73 ijk	93 a-d	70 gh	93 d-g	72 l	317.6	424.5
Pendimethalin	**1.0**							
+ flumioxazin	0.047	75 ijk	98 ab	92 cde	97 a-f	88 e-k	247.9	355.4
+ rimsulfuron	0.023	100 a	98 abc	98 a-d	96 b-f	95 a-f	312.1	407.0
Ethalfluralin	**0.94**							
+ flumioxazin	0.047	63 k	90 cde	82 efg	33 i	40 m	234.7	343.6
+ rimsulfuron	0.023	98 abc	78 ef	95 a-d	98 a-e	98 abc	337.8	457.3
Flumioxazin	**0.047**							
+ rimsulfuron	0.023	100 a	100 a	100 ab	96 b-f	96 a-e	288.3	417.0
Flumioxazin								
+ metribuzin	**0.047 + 0.5**							
+ rimsulfuron	0.023	100 a	100 ab	100 a	100 ab	93 b-h	253.9	352.6
+ EPTC	3.9	100 ab	100 a	97 a-d	98 abc	95 a-e	297.2	411.7
+ ethalfluralin	0.94	97 a-d	100 a	93 b-e	100 a	96 a-e	346.3	435.5
+ pendimethalin	1.0	97 a-d	100 a	98 abc	96 a-e	93 b-h	346.7	452.0
+ s-metolachlor	1.34	100 a	100 a	98 a-d	98 a-e	90 d-j	285.6	374.8
+ metolachlor	1.34	97 a-d	100 a	92 cde	97 a-f	95 a-f	299.1	408.9
Flumioxazin	**0.047**							
+ s-metolachlor	**+ 1.34**							
+ rimsulfuron	0.023	100 ab	97 abc	100 a	98 a-d	88 e-k	276.8	390.6
+ EPTC	3.9	93 c-f	97 abc	100 ab	90 fgh	87 f-k	295.8	407.0
+ ethalfluralin	0.94	90 d-g	90 cde	97 a-d	85 gh	80 jkl	269.7	375.9
+ pendimethalin	1.0	87 f-i	93 bcd	95 a-d	97 a-f	87 f-k	304.7	409.5
Flumioxazin								
+ EPTC	**0.047 + 3.9**							
+ rimsulfuron	0.023	100 a	98 ab	100 ab	98 abc	97 a-d	333.7	438.0
+ ethalfluralin	0.94	72 jk	75 fg	90 def	95 c-f	90 e-j	264.6	335.3
+ pendimethalin	1.0	78 g-k	97 abc	97 a-d	98 a-e	97 a-d	289.6	395.7
+ metolachlor	1.34	80 g-j	93 a-d	98 abc	96 b-f	77 kl	301.3	403.0
Flumioxazin								
+ pendimethalin	**0.047 + 1.0**							
+ rimsulfuron	0.023	100 a	100 a	100 a	98 a-e	90 e-j	311.2	416.6
Flumioxazin	**0.047**							
+ ethalfluralin	**+ 0.94**							
+ rimsulfuron	0.023	100 a	97 abc	100 ab	96 b-f	88 e-k	329.5	444.8
Rimsulfuron								
+ metribuzin	**0.023 + 0.5**							

+ EPTC	3.9	100 a	100 a	99 ab	98 abc	98 a	276.4	376.9
+ ethalfluralin	0.94	100 a	100 a	96 a-d	96 b-f	93 b-h	296.5	404.7
+ pendimethalin	1.0	100 ab	98 ab	97 a-d	95 c-f	97 a-d	272.7	396.7
+ s-metolachlor	1.34	100 ab	100 a	100 ab	98 abc	96 a-e	313.8	414.6
+ metolachlor	1.34	100 a	100 ab	97 a-d	95 c-f	90 d-j	251.9	332.2
Rimsulfuron	**0.023**							
+ s-metolachlor	**+ 1.34**							
+ EPTC	3.9	100 a	97 abc	98 abc	98 a-d	93 b-g	348.6	454.9
+ ethalfluralin	0.94	98 abc	100 ab	95 a-d	90 fgh	96 a-e	254.2	342.7
+ pendimethalin	1.0	100 a	100 a	97 a-d	98 a-d	96 a-e	311.7	419.2
Rimsulfuron								
+ EPTC	**0.023 + 3.9**							
+ ethalfluralin	0.94	100 a	96 abc	100 a	98 abc	98 ab	303.8	400.9
+ pendimethalin	1.0	100 a	100 ab	100 ab	97 a-f	96 a-e	284.8	387.8
LSD (0.05)	-	-	-	-	-	-	79.4	93.1

[1]AMARE, redroot pigweed; CHEAL, common lambsquarters; SOLSA, hairy nightshade; SETVI, foxtail; AVESA, tame oat. Means in the same column followed by the same letter(s) are not significantly different according to a Duncan's New Multiple Range Test b (P=0.05) performed on arcsine square root transformed data. Non-transformed means are shown. Untreated control means were not included in the mean separation analyses.

[2] U.S. No. 1 tubers are >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.

Potato leaf and stem desiccation and redroot pigweed control with various products applied alone or in tank mixtures in single or sequential applications. Pamela J.S. Hutchinson, Oleg V. Alexandrov, and Daniel M. Hancock. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objectives of this trial were to determine potato leaf and stem desiccation over a three week period of various desiccants in single or sequential applications in a field trial conducted at the Aberdeen Research and Extension Center in 2005.

The experimental area was fertilized with 160 lb N, 80 lb P_2O_5, 10 lb Z, and 5 lb/A of Mn /acre, based on soil tests, before planting 'Russet Burbank' potatoes on May 27, 2005. Potatoes were planted 6 inches deep with 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.4% organic matter and pH 8.1. The experimental design was a randomized complete block with three replications and 12 by 30 foot plots.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 30, 2005, just prior to potato emergence. Potatoes were sprinkler irrigated as needed throughout the growing season and received additional N and P_2O_5, based on petiole test results, through the irrigation system.

Single-application desiccation treatments and the first application of sequential treatments were applied at the beginning of natural potato foliage senescence on August 31, 2005. The second application of sequential treatments was made 1 wk later on Sept 7, 2005. Comparisons were made between single applications of commercial sulfuric acid, an experimental sulfuric acid which has been subjected to a proprietary process (Cheltec, Inc.) during formulation (CT-311), and CT-311 formulated with soy oil (CT-311 Soy). Non-sulfuric acid treatments included single or sequential applications of diquat at various rates applied with a non-ionic surfactant (NIS); single applications of glufosinate + ammonium sulfate (AMS) alone or with pyraflufen ethyl (ET), carfentrazone, or endothall + methylated seed oil (MSO); sequential applications of glufosinate + ET + AMS; single applications of endothall at two rates + AMS + MSO; single or sequential applications of carfentrazone at various rates + MSO; single or sequential applications of carfentrazone + diquat + MSO or carfentrazone + endothall + AMS + MSO; single applications of ET at two rates + AMS + MSO; single applications of ET + diquat or endothall + AMS.

The non-sulfuric acid treatments were applied with a tractor-mounted CO_2-pressurized sprayer that delivered 30 gpa at 32 psi. The sulfuric acid treatments were applied with the same sprayer delivering 30 gpa at 38 psi. Desiccation evaluations were conducted 1, 2 and 3 wks after the first application. Redroot pigweed was present in the trial area at a density of 1 per sq ft and was visually rated for control at 3 wks after the first desiccation application. Percent desiccation and weed control data were arcsine square root transformed to mitigate the skewness of the data. Transformed means were separated with a Duncan's New Multiple Range Test (P=0.05). Non-transformed means are shown in the table with transformed mean separations.

At 1 wk after the 1^{st} application, leaf desiccation ranged from 53 to 95% and the single application treatments providing at least 90% leaf desiccation were diquat at 0.5 lb ai/A, commercial sulfuric acid, CT-311 sulfuric acid, glufosinate at 0.0375 + carfentrazone at 0.0083 lb ai/A, carfentrazone at 0.075 or 0.09 lb ai/A, carfentrazone at 0.025 or 0.05 + diquat at 0.025 lb ai/A, or carfentrazone at 0.05 + endothall at 0.5 lb ai/A (Table). Commercial sulfuric acid was the only treatment resulting in greater than 90% stem control at 1 wk after application (Table).

With the exception of ET at 0.0049 lb ai/A alone or + diquat at 0.25 lb ai/A, and glufosinate at 0.1875 + diquat at 0.25 lb ai/A, all single application treatments resulted in at least 90% leaf desiccation at 2 wk after application (Table). Stem desiccation by single application treatments at 2 wk after application ranged from 40 to 92% and only the diquat at 0.375 or 0.5 lb ai/A, commercial or CT-311 sulfuric acid, and carfentrazone at 0.075 or 0.09 lb/A single application treatments resulted in 90% or better stem desiccation (Table). At 2 wk after the 1^{st} and 1 wk after the 2^{nd} application, all sequential treatments resulted in 98 to 100% leaf and 90 to 97% stem desiccation (Table). By 3 wk after application, leaf desiccation by the lowest single-applied rate of ET was 88%, otherwise leaf desiccation by all other single or sequential treatments was 92% or greater. Stem desiccation at this time was at least 90% except for desiccation caused by the lowest rates of endothall or ET which was 87 or 85%, respectively (Table).

Overall, CT-311 sulfuric acid provided at least 93% leaf and 88% stem desiccation 1, 2, and 3 wk after application, and desiccation was comparable to desiccation by commercial sulfuric acid. However, CT-311 Soy sulfuric acid did not provide less leaf or stem desiccation compared with desiccation by commercial sulfuric acid until 3 or 2 wk after application, respectively. A single application of glufosinate at 0.1875 lb/A + carfentrazone provided numerically greater leaf desiccation at 1 and 2 wk after application compared with a single application of glufosinate at 0.1875 lb/A + endothall. The latter treatment also provided slightly less leaf desiccation than glufosinate alone at 0.375, or glufosinate at 0.1875 + ET at 2 wk after application, however, leaf desiccation by all single-application glufosinate treatments was similar at 98 to 100% by 3 wk after application. A single application of glufosinate + carfentrazone provided greater stem desiccation at 2 wk after application compared with A single application of glufosinate + endothall, while all single-application glufosinate treatments provided similar stem desiccation at 1 and 3 wk after application.

Leaf desiccation by single applications of carfentrazone improved numerically from 83 to 92% at 1 wk after application as rates increased from 0.05 to 0.09 lb/A, however at 2 and 3 wk after application, all single-application carfentrazone treatments provided 95% or greater leaf desiccation. At 1 wk after application, a single application of carfentrazone at 0.05 + diquat provided slightly better leaf desiccation compared with a single application of carfentrazone alone at 0.05 lb/A, and in addition, desiccation by that tank mixture was similar to desiccation by single applications of carfentrazone alone at 0.075 or 0.09 lb/A. By 2 and 3 wk after application, however, desiccation by carfentrazone alone at 0.05 lb/A had increased and was comparable to desiccation by all single-applied carfentrazone tank mixtures. No carfentrazone treatment provided greater than 78% stem desiccation at 1 wk after application, however, by 2 wk after the 1st and 1 wk after the 2nd application stem desiccation by all single-applied carfentrazone treatments was 85 to 92%.

Leaf desiccation by a single application of endothall at 1.0 lb/A was better than by endothall at 0.5 lb/A, regardless of rating time. Similarly, single applications of ET at 0.0089 lb/A alone or at 0.0049 lb/A tank-mixed with diquat or endothall usually provided greater leaf and stem desiccation than a single application of ET at 0.0049 lb/A applied alone.

The only sequential application treatments that initially improved potato leaf desiccation compared with single applications of the same desiccants were glufosinate + endothall and carfentrazone alone at 0.075 lb/A. The sequential glufosinate combination provided 98% leaf desiccation 2 wk after the 1st and 1 wk after the 2nd sequential application, while desiccation by that combination applied only once was 88% at that rating date. Stem desiccation by that sequential treatment was better than by the single application on the last two rating dates. Sequential applications of carfentrazone applied alone at 0.075 lb/A provided 99% leaf desiccation 2 wk after the 1st and 1 wk after the 2nd sequential application which was greater than the 92% leaf desiccation by a single application of carfentrazone at 0.075 lb/A on the same rating date. In contrast, all other sequential treatments provided leaf and stem desiccation similar to desiccation by the same desiccants applied only once, regardless of rating date.

Redroot pigweed control was 90% or better at 3 wk after single applications of diquat at 0.5 lb/A or sequential applications of diquat at 0.25 lb/A, a single application of commercial sulfuric acid, all glufosinate treatments, carfentrazone at 0.05, 0.075, or 0.09 applied in sequential treatments and the single application of carfentrazone alone at 0.09 lb/A, carfentrazone + diquat in a single or sequential application, carfentrazone at 0.025 lb/A + endothall applied sequentially, single or sequential applications of carfentrazone at 0.05 + endothall, or ET + diquat or endothall (Table). Single applications of diquat at 0.375, CT-311 sulfuric acid, endothall at 1.0, or carfentrazone at 0.075 lb/A controlled redroot pigweed 85 to 87% while no other single application treatments controlled redroot pigweed better than 80%.

Table. Potato leaf and stem desiccation and redroot pigweed control with single and sequential applications of various products at Aberdeen, ID in 2005.

Treatment[1]	Rate	Application timing[2]	Desiccation[3] Leaf Sep 7	Leaf Sep 15	Leaf Sep 23	Stem Sep 7	Stem Sep 15	Stem Sep 23	Redroot pigweed control 3 WAT
	lb ai/A		---------- % ----------						--- % ---
Untreated control	-	-	*7*	*8*	*37*	*0*	*2*	*12*	-
Diquat	0.375	A	88 a-e	92 e-h	100 a	72 b-e	90 a-e	98 a-d	85 d-g
Diquat	0.5	A	93 ab	98 a-f	98 ab	77 bcd	93 a-e	98 a-d	90 b-e
Diquat	0.25	A							
Diquat	0.25	B	82 def	98 a-e	98 ab	53 d-h	90 a-e	98 a-e	90 b-e
Sulfuric Acid (commercial)	30 GPA	A	95 a	98 abc	100 a	93 a	97 a	100 a	93 a-d
Sulfuric Acid CT-311	30 GPA	A	93 ab	98 a-f	100 a	88 ab	95 a-e	98 a-e	87 c-f
Sulfuric Acid CT-311 Soy	30 GPA	A	80 ef	93 d-g	98 ab	70 b-f	88 a-e	90 ef	75 fgh
Glufosinate + AMS Plus	0.375 + 4.0	A	87 b-e	96 a-g	99 ab	30 hij	87 b-f	96 a-f	93 a-d
Glufosinate + ET	0.1875 + 0.0049								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A	88 a-e	93 c-g	98 ab	60 c-g	85 c-f	93 a-f	92 a-d
Glufosinate + carfentrazone	0.375 + 0.0083								
+ AMS Plus + MSO	+ 4.0 + 1qt/A	A	92 abc	95 a-g	99 ab	50 e-h	86 a-e	93 b-f	93 a-d
Glufosinate + endothall	0.1875 + 0.5								
+ AMS Plus	+ 4.0	A	83 c-f	88 gh	98 ab	40 ghi	70 f	90 ef	90 b-e
Glufosinate + endothall	0.1875 + 0.5	A							
+ AMS Plus	+ 4.0								
Glufosinate + endothall	0.1875 + 0.5								
+ AMS Plus	+ 4.0	B	85 cde	98 a-e	100 a	43 ghi	90 a-e	100 ab	90 b-e
Endothall	0.5								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A	73 f	82 hi	92 c	27 ij	70 f	87 f	80 efg
Endothall	1.0								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A	87 b-e	93 d-g	97 b	47 f-i	82 ef	93 b-f	85 d-g
Carfentrazone + MSO	0.05 + 1 qt/A	A	83 c-f	95 b-g	100 ab	53 d-h	85 c-f	95 a-f	73 gh
Carfentrazone + MSO	0.05 + 1 qt/A	A							
Carfentrazone + MSO	0.05 + 1 qt/A	B	82 def	99 ab	100 a	47 f-i	95 a-d	99 abc	90 b-e
Carfentrazone + MSO	0.075 + 1 qt/A	A	88 a-e	92 fgh	99 ab	70 b-f	90 a-e	98 a-e	87 c-f
Carfentrazone + MSO	0.075 + 1 qt/A	A							
Carfentrazone + MSO	0.075 + 1 qt/A	B	90 a-d	99 a-d	100 a	63 c-g	96 ab	100 ab	96 ab
Carfentrazone + MSO	0.09 + 1 qt/A	A	92 abc	97 a-f	99 ab	70 b-f	91 a-e	95 a-f	95 abc
Carfentrazone + MSO	0.09 + 1 qt/A	A							
Carfentrazone+ MSO	0.09 + 1 qt/A	B	93 ab	98 abc	100 ab	72 b-e	96 abc	98 a-d	95 abc
Carfentrazone + diquat	0.05 + 0.25								
+ MSO	+ 1 qt/A	A	93 ab	98 a-f	100 a	78 abc	92 a-e	98 a-e	93 a-d
Carfentrazone + diquat	0.05 + 0.25								
+ MSO/	+ 1 qt/A	A							
Carfentrazone + diquat	0.05 + 0.25								
+ MSO	+ 1 qt/A	B	90 abc	100 a	100 a	72 b-e	96 abc	100 a	93 a-d
Carfentrazone + endothall	0.025 + 0.5								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A	90 a-d	96 a-g	99 ab	55 c-g	90 a-e	95 a-f	73 gh
Carfentrazone + endothall	0.025 + 0.5								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A							
Carfentrazone + endothall	0.025 + 0.5								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	B	88 a-e	100 a	100 a	57 c-g	96 abc	100 ab	96 ab
Carfentrazone + endothall	0.05 + 0.5								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A	92 abc	96 a-e	99 ab	70 b-f	85 a-e	98 a-e	96 ab
Carfentrazone + endothall	0.05 + 0.5								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A							
Carfentrazone + endothall	0.05 + 0.5								
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	B	95 a	100 a	100 a	77 bcd	97 a	100 a	98 a
ET + AMS Plus	0.0049 + 4.0								
+ MSO	+ 1 qt/A	A	53 g	77 i	88 c	13 j	40 g	85 f	63 h
ET + AMS Plus	0.0089 + 4.0								
+ MSO	+ 1 qt/A	A	82 def	90 fgh	98 ab	47 f-i	85 c-f	92 def	75 fgh
ET + diquat	0.0049 + 0.25								
+ AMS Plus	+ 4.0	A	83 c-f	88 ghi	98 ab	47 f-i	83 def	91 c-f	92 a-d
ET + endothall	0.0049 + 0.5								
+AMS Plus	+ 4.0	A	83 c-f	93 d-g	98 ab	47 f-i	88 a-e	91 c-f	93 a-d

[1] Diquat single or sequential treatments included a non-ionic surfactant at 0.25% v/v; CT-311 is an experimental formulation of sulfuric acid subjected to a proprietary process, and CT-311 Soy is formulated with soy oil (Cheltec, Inc.); all treatments including carfentrazone also included

methylated seed oil (MSO) at 1 qt/A; ET, pyraflufen ethyl, Nichino America, Inc.; AMS Plus, ammonium sulfate (2.6 lb ai/gal) + nonionic surfactant, Agriliance LLC.

[2] A, application on August 31; B, application on September 7, 2005.

[3] Ratings were conducted 1, 2, and 3 wk after the 1st application. Means followed by the same letter(s) are not different than other means in the same column according to a Duncan's New Multiple Range Test (P=0.05) performed on arcsine square root transformed data. Non-transformed means are shown. Untreated control means were not included in the mean separation analyses.

Evaluation of herbicides applied to dormant rhubarb for three growing seasons, 2004, 2005 and 2006. Gina Koskela and Robert B. McReynolds. (North Willamette Research & Extension Center, Oregon State University, Aurora, OR 97002) Due to the diminishing effectiveness of the herbicides currently labeled for use in rhubarb, this trial was initiated to evaluate the efficacy and phytotoxicity of alternative herbicides. The experiments were conducted over a three year period on rhubarb established on May 30, 2003 with crown pieces at the North Willamette Research & Extension Center near Aurora, OR. Plot design was a randomized complete block with four replications. Treatments 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 8002 flat fan) boom delivering 40 gals water/A at 30 psi. Dichlobenil was applied by hand using a shaker can. An untreated weedy plot, the currently registered combination of pronamide + napropamide, and the newly registered metholachlor, were included for comparison. Treatments were applied on Jan. 22, 2004 when rhubarb plants were dormant, before leaves had emerged from the crown. The following year, on Jan. 6, 2005 the treatments were applied again to the same plots as in 2004. In 2006, using one of the two untreated control plots (weedy and weeded), the halosulfuron-methyl + sulfentrazone treatment combination were separated. What had previously been an untreated weedy plot, was treated with only sulfentrazone in 2006. And the plot that had been the combination treatment in 2004 and 2005, received only the halosulfuron-methyl treatment in 2006. Treatment applications in this third year were made Feb. 1, 2006. Weeds present in the plots included annual bluegrass, common groundsel, common chickweed, dandelion, white clover, common vetch, and deadnettle.

In 2004, phytotoxicity and herbicide efficacy evaluations were completed March 4 (47 days after treatment, DAT), March 18 (61 DAT), April 1 (75 DAT) and April 15 (89 DAT). In 2005, evaluations were completed only on April 6 (90 DAT) and April 20 (110 DAT). In 2006, evaluations were completed April 6 (64 DAT) and May 3 (91 DAT). The multiple ratings were combined into a mean phytotoxicity and weed control effectiveness for each year. The phytotoxicity evaluations rated the general appearance and vigor of each plant in a plot and specific injuries such as leaf burn. Weed control ratings evaluated the size and number of weeds in a plot (Table).

Yield data were collected on May 12, 2004 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 was completed for the mean weight/petiole, the mean number of petioles/plant and the mean weight of petioles/plant for each treatment. Yield data were collected April 27, 2005 in the same manner as in 2004 and was also analyzed to compare the effects of the herbicides on yield. Yield data were collected May 3, 2006 in the same manner as 2004 and 2005.

Though not significant, yield for the halosulfuron+sulfentrazone treatment was higher than the hand-weeded treatment and all other treatments for the years 2004 and 2005. A companion trial was established in a grower field on January 10, 2005 where halosulfuron and sulfentrazone were applied separately and compared to pronamide+napropamide (the grower standard) and a hand-weeded control. The results from that trial found no significant yield differences among treatments.

In 2006 there was an overall a yield reduction across all treatments including the untreated control. The oxyfluorfen, sulfentrazone and halosulfuron treatments resulted in the least yield reduction (5.9 6.6 and 9% respectively). While the untreated control, metolachlor and clomazone treatments resulted in the greatest yield reduction (38.0, 31.5 and 24.0% respectively). While the metolachlor treatments did not increase phytotoxicity, the yield data indicated a vigor reduction with the use of this product.

Table. Yield, phytotoxicity and efficacy data for herbicide effects on rhubarb, 2004, 2005 and 2006.

Treatments	Rate	Yield			Phytotoxicity[1]			Efficacy[2]		
		2004	2005	2006	2004	2005	2006	2004	2005	2006
	(lbs ai/A)	lb/plant			----------0-10----------			----------1-10----------		
Dimethenamid-P	0.75	6.3	12.1	11.0	0.3	0.0	0.4	8.1	8.6	7.3
Oxyfluorfen	2.00	5.9	11.3	10.6	2.1	3.7	1.5	9.1	9.0	8.6
Clomazone	1.50	7.7	14.4	10.9	2.1	3.9	2.7	8.7	9.2	8.2
Linuron	3.00	7.6	15.6	12.3	0.1	0.4	0.2	8.9	8.9	7.9
Metolachlor	2.00	4.3	13.9	9.5	1.4	1.0	0.2	8.7	8.4	8.1
Pronamide + napropamide	2.00 + 2.00	6.0	17.0	14.2	0.2	0.2	0.3	8.4	7.9	7.1
Prometryn	2.00	6.8	15.0	13.1	0.6	0.0	0.3	8.3	8.6	7.9
Pendamethalin	1.60	7.5	16.0	14.5	0.2	0.0	0.2	8.2	8.6	7.6
Halosulfuron-methyl+sulfentrazone	0.094 + 0.25	9.1	18.8	-----	0.6	0.1	----	8.2	9.3	----
Halosulfuron-methyl	0.094	----	----	14.1	----	----	0.0	----	----	9.0
Sulfentrazone	0.25	----	----	12.5	----	----	0.0	----	----	8.5
Dichlobenil	2.00	6.9	13.1	12.2	1.0	1.6	0.0	7.8	9.4	7.6
Hand-weeded		6.0	16.0	----	0.0	0.0	----	10.0	10.0	----
Untreated weedy control		7.6	17.2	10.6	0.0	0.0	0.0	0.0	0.0	0.0
LSD ($P \leq 0.05$)		NS	1.9	NS	0.5	0.7	0.3	1.0	1.1	0.5

[1]Phytotoxicity: 0=no injury; 10=all plants dead.

[2]Efficacy: 0=no control, plots weedy; 10= good control, no weeds.

Sequential application of herbicides for purple nutsedge control in turf. Kai Umeda and Gabriel Towers. (University of Arizona Cooperative Extension, Maricopa County, Phoenix, AZ 85040) A small plot experiment was conducted at the Biltmore Country Club in Phoenix, AZ in a rough turf area heavily infested with purple nutsedge. The five herbicide treatment plots were established measuring 5 ft by 40 ft and replicated three times in a randomized block design. At the first timing of application on 18 July 2006, each treatment was sprayed on the entire length of the 40 ft plot. At the second timing of application on 18 August at approximately 4 weeks after treatment of the first application, each treatment was sprayed on 15 ft of the front portion of the 40 ft that was previously sprayed. The third timing of application on 29 August at 6 weeks after treatment of the first application, each treatment was sprayed on another 15 ft of the once previously treated plot. Ten feet of the 40 ft plot remained as the once treated treatment replicate. All applications were made using a backpack CO_2 sprayer equipped with a hand-held boom. The boom consisted of three 8003 flat fan nozzles spaced 20 inches apart and pressurized to 30 psi. All sprays were applied in 30 gpa water and included a non-ionic surfactant, Latron CS-7 at 0.25% v/v. During the time of application on 18 July, the temperature was 86°F, clear sky, no winds, and the soil temperature at 2-inch depth was 80°F. The common bermudagrass turf mowed at 1 to 2-inch height was totally infested with purple nutsedge with approximately 30% of the area only consisting of nutsedge with no turf. The plot area was not mowed for 2 days prior to and 1 day following the initial application. The site was overhead sprinkler irrigated daily during the mornings and mowed weekly. The early sequential application, second timing at 4 weeks, was made on 18 August when the temperature was 80°F, with scattered clouds, a very slight breeze, and soil was moist at 72°F. The late sequential application, second timing at 6 weeks, was made on 29 August with air temperature at 78°F, clear sky, a very slight breeze, and soil was moist at 70°F. Sequential applications of all of the ALS-inhibiting herbicides offered acceptable to excellent levels of nutsedge control in turf. Single applications generally provided nutsedge control for 2 to 6 weeks.

Table. Timing of sequential applications of herbicides for nutsedge control in turf.

Treatment	Rate	Application timing[1]	CYPRO control[2] 8-Aug	18-Aug	29-Aug	12-Sep	19-Sep
	lb ai/A		%				
untreated check			0	0	0	0	0
Halosulfuron	0.062	single	85	65	43	20	17
Trifloxysulfuron	0.026	single	83	90	82	68	67
Sulfosulfuron	0.094	single	83	90	85	57	48
Imazaquin	0.5	single	75	77	77	70	50
Flazasulfuron	0.047	single	92	78	68	37	20
Halosulfuron	0.062	4 weeks			92	73	62
Trifloxysulfuron	0.026	4 weeks			95	83	85
Sulfosulfuron	0.094	4 weeks			95	93	98
Imazaquin	0.5	4 weeks			90	85	82
Flazasulfuron	0.047	4 weeks			95	82	87
Halosulfuron	0.062	6 weeks				85	78
Trifloxysulfuron	0.026	6 weeks				90	88
Sulfosulfuron	0.094	6 weeks				95	98
Imazaquin	0.5	6 weeks				88	88
Flazasulfuron	0.047	6 weeks				88	95
LSD (p=0.05)			7.7	12.5	21.0	30.1	30.3

[1]Application dates: 18 July, 18 (4 weeks) and 29 (6 weeks) August 2006.
[2]Rating dates: 08 August = 14 DAT-1; 18 August = 31 DAT-1; 29 August = 42 DAT-1 and 11 DAT-2; 12 September = 56 DAT-1, 25 DAT-2, 14 DAT-3; 19 September = 63 DAT-1, 32 DAT-2, and 21 DAT-3

Early spring season nutsedge control in overseeded turfgrass. Kai Umeda and Gabriel Towers. (University of Arizona Cooperative Extension, Maricopa County, Phoenix, AZ 85040) A small plot study was conducted at the Arizona Biltmore Country Club in Phoenix, AZ to evaluate the efficacy and safety of postemergence applied herbicides for nutsedge control in perennial ryegrass that was overseeded in dormant bermudagrass. Initial applications were made on 09 May 2006 when the air temperature was 76°F, clear sky, and a very slight breeze with soil temperature at 66°F at 2 inch depth. Purple nutsedge population was uniform and at 3 to 5 inch height in turf maintained at 2 inch height. Sequential applications for sulfentrazone treatments were made one month later on 09 June with air temperature at 76°F, clear, and no wind with soil temperature at 68°F. All sprays were made with a backpack CO_2 sprayer equipped with a hand-held boom with three flat-fan 8003 nozzles. Treatments were applied in 38 gpa water with a non-ionic surfactant Latron CS-7 added at 0.25% v/v and sprays pressurized to 30 psi. Each treatment plot measured 5 ft by 10 ft and was replicated three times in a randomized complete block design. Sulfentrazone treatments tended to exhibit a rate response with increasing rates exhibiting slightly more activity on nutsedge. At 1 month after applications, nutsedge recovered and did not exhibit any herbicide injury. Halosulfuron at 0.31 to 0.061 lb a.i./A provided acceptable nutsedge control at better than 83% for only 1 month. Both herbicides were safe on the perennial ryegrass and no injury was observed.

Table. Nutsedge control with early spring herbicide applications.[1]

		CYPRO control				
Treatment	Rate	17 May	02 Jun	09 Jun	23 Jun	18 Jul
	lb a.i./A			%		
Untreated check		0	0	0	0	0
Sulfentrazone	0.125	17	0	8	0	0
Sulfentrazone	0.25	43	0	17	0	0
Sulfentrazone	0.375	43	10	3	0	0
Sulfentrazone + sulfentrazone	0.125 + 0.125	18	3	3	13	0
Sulfentrazone + sulfentrazone	0.25 + 0.25	32	0	20	32	0
Sulfentrazone + sulfentrazone	0.375 + 0.375	35	3	35	53	0
Halosulfuron	0.031	13	90	83	27	0
Halosulfuron	0.047	18	88	83	10	0
Halosulfuron	0.061	20	90	88	42	0
LSD (p=0.05)		22.0	7.4	21.8	27.1	0

[1]Applications made on 09 May and 09 June, 2006

Weed control in glyphosate tolerant seedling alfalfa with glyphosate, pyraflufen ethyl, and other herbicides. Robyn C. Walton, Don W. Morishita, and Michael P. Quinn. (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 weed control in newly seeded glyphosate tolerant alfalfa with glyphosate, pyraflufen ethyl, imazamox, 2,4-DB, and sethoxydim. 'DKA41-18RR' was planted May 12, 2006, at a seeding rate of 18 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 (53.2% sand, 34.6% silt, and 12.2% clay) with a pH of 8.4, 0.9% organic matter, and CEC of 12.1-meq/100 g soil. Herbicides were applied June 7, 2006 with a CO_2-pressurized bicycle-wheel sprayer using 11001 flat fan nozzles calibrated to deliver 10 gpa at 19 psi. Environmental conditions at application were as follows: air temperature 84 F, soil temperature 75 F, relative humidity 43%, wind speed 3 mph, and 85% cloud cover. Application began at 1500 hours. Common lambsquarters (CHEAL), redroot pigweed (AMARE), and green foxtail (SETVI) were the major weed species present. Crop injury and weed control were evaluated visually 6, 14, and 70 days after treatment (DAT) on June 13, June 21, and August 16, respectively. Alfalfa was harvested July 17 and September 19 with a small-plot forage harvester. A grab sample was taken from each plot to determine clean forage yield and weed yield.

Crop injury 6 and 14 DAT ranged from 3 to 54% and 0 to 33%, June 13 and 21, respectively (Table 1). Glyphosate applied at 0.75 and 1.5 lb ae/A had the lowest injury averaging 2% for both evaluation dates. Pyraflufen ethyl at 0.00081, 0.00122, and 0.00163 lb ai/A + 2,4-DB + sethoxydim at 1.5 + 0.47 lb ai/A + COC at 2 pt/A had the highest injury ratings for both evaluation dates averaging 52% and 30% 6 and 14 DAT, respectively. By 70 DAT, crop injury averaged 5% for all herbicide treatments. Common lambsquarters control ranged from 61 to 100% for all herbicide treatments at the three evaluation dates. Glyphosate applied alone or in combination with other herbicides had the best overall common lambsquarters control averaging 99%. Pyraflufen ethyl + NIS at 0.00081 lb ai/A + 0.25% v/v had the poorest control. Redroot pigweed was controlled best by glyphosate applied alone or in combination with pyraflufen ethyl ($\geq$ 96%). All rates of pyraflufen ethyl + 2,4-DB + sethoxydim + COC had the overall poorest redroot pigweed control averaging 39%. Pyraflufen ethyl + NIS had the poorest green foxtail control ranging from 25 to 75 %. All other herbicide treatments had >80% green foxtail control except imazamox + COC + AMS at the first evaluation (65%). The first alfalfa cutting clean yield ranged from 0.6 to 1.4 ton/A (Table 2). Glyphosate + AMS at 1.5 lb ae/A + 2% v/v and pyraflufen ethyl + glyphosate + NIS at 0.00081 lb ai/A + 0.75 lb ae/A + 2% v/v had the highest yields at 1.5 and 1.4 ton/A, respectively. The untreated check had the highest first cutting weed yield at 2,940 lb/A. All pyraflufen ethyl + NIS rates had weed yields >1,000 lb/A and were higher than other herbicide treatments. The second alfalfa cutting clean yield ranged from 1.6 to 2.1 ton/A with no difference among treatments. Several herbicide treatments in the second cutting had weed yields higher than the untreated check. Pyraflufen ethyl + imazamox at 0.00122 + 0.047 lb ai/A + COC at 1% v/v yielded more than twice that of the untreated check (1,026 versus 506 lb/A). Poor alfalfa and high weed yield could be attributed to late and infrequent irrigations that occurred in the study site.

Table 1. Crop injury and weed control in glyphosate tolerant seedling alfalfa, near Kimberly, Idaho.[1]

Treatment[3]	Application rate[4]	Crop injury			Weed control[2] CHEAL			AMARE			SETVI		
		6/13	6/21	8/16	6/13	6/21	8/16	6/13	6/21	8/16	6/13	6/21	8/16
	lb ai/A	%											
Check	-	-	-	-	-	-	-	-	-	-	-	-	-
Glyphosate + AMS	0.75 + 2% v/v	4g	0f	0e	96abc	98abc	97a	96abc	99a	98a	97abc	100a	99a
Glyphosate + AMS	1.5 + 2% v/v	3g	0f	1de	98ab	99abc	99a	98ab	100a	98a	97abc	97a	97ab
Imazamox + COC + AMS	0.047 + 1% v/v + 2.5% v/v	6fg	16c	5b-e	71e	82f	95a	71h	99a	100a	65fg	91a	100a
2, 4-DB+ sethoxydim + COC	1.5 + 0.47 + 2 pt/A	33b	24b	5b-e	80d	93cde	100a	76gh	75e	65bc	82de	99a	98ab
Pyraflufen ethyl + NIS	0.00081 + 0.25% v/v	10ef	5e	8abc	83d	65g	69cd	83fg	83de	54cde	64fg	75bc	48c
Pyraflufen ethyl + NIS	0.00122 + 0.25% v/v	15de	8de	13a	91c	85ef	73bcd	86ef	80de	59cd	47g	41e	25c
Pyraflufen ethyl + NIS	0.00163 + 0.25% v/v	15de	5e	10ab	85d	83ef	61d	88def	93bc	62c	53g	54de	37c
Pyraflufen ethyl + NIS	0.00325 + 0.25% v/v	29b	11d	6bcd	98ab	97abc	88ab	98ab	95b	80b	55g	68cd	30c
Pyraflufen ethyl + glyphosate + AMS	0.00081 + 0.75 + 2% v/v	15de	0f	1de	100a	99ab	100a	100a	100ab	97a	99a	100a	97ab
Pyraflufen ethyl + glyphosate + AMS	0.00122 + 0.75 + 2% v/v	21c	4ef	1de	100a	99ab	100a	100a	100a	99a	99a	99a	97ab

Table 1. Continued.[1]

Treatment[3]	Application rate[4]	Crop injury			Weed control[2] CHEAL			AMARE			SETVI		
		6/13	6/21	8/16	6/13	6/21	8/16	6/13	6/21	8/16	6/13	6/21	8/16
	lb ai/A	%											
Pyraflufen ethyl + glyphosate + AMS	0.00163 + 0.75 + 2% v/v	29b	4ef	4cde	100a	99ab	95a	100a	100ab	97a	99ab	99a	99a
Pyraflufen ethyl + imazamox + COC	0.00081 + 0.047 + 1% v/v	18cd	6e	8abc	94bc	87def	69cd	94bcd	100a	100a	80ef	86ab	95ab
Pyraflufen ethyl + imazamox + COC	0.00122 + 0.047 + 1% v/v	28b	11d	5b-e	91a	85ef	85abc	97ab	100a	99a	82de	85ab	86b
Pyraflufen ethyl + imazamox + COC	0.00163 + 0.047 + 1% v/v	30b	11d	3cde	95abc	95bcd	92a	98ab	100a	100a	93bcd	91a	95ab
Pyraflufen ethyl + 2, 4-DB + sethoxydim + COC	0.00081 + 1.5 + 0.47 + 2 pt/A	51a	31a	6bcd	93bc	99abc	100a	93b-e	84de	41de	96abc	100a	100a
Pyraflufen ethyl + 2, 4-DB + sethoxydim + COC	0.00122 + 1.5 + 0.47 + 2 pt/A	51a	26b	5b-e	94bc	98abc	100a	95abc	86d	40e	90cde	99a	100a
Pyraflufen ethyl + 2, 4-DB + sethoxydim + COC	0.00163 + 1.5 + 0.47 + 2 pt/A	54a	33a	5b-e	93bc	100a	100a	90cde	86cd	35e	93bcd	100a	100a

[1]Weeds followed by the same letters are not significantly different (P=0.05).
[2]Weeds evaluated for control were common lambsquarters (CHEAL), redroot pigweed (AMARE), and green foxtail (SETVI).
[3]Glyphosate is Roundup WeatherMax. AMS is a 38% solution of ammonium sulfate. COC is crop oil concentrate. NIS is nonionic surfactant.
[4]Glyphosate rates are listed in pounds acid equivalent per acre.

Table 2. Crop and weed yields in newly planted glyphosate tolerant alfalfa, near Kimberly, Idaho.[1]

Treatment[2]	Application rate[3]	Alfalfa first cutting	Alfalfa second cutting	Weed mix[4] first cutting	Weed mix[4] second cutting
	lb ai/A	ton/A		lb/A	
Check	-	0.6cf	1.8a	2,940a	506a-e
Glyphosate + AMS	0.75 + 2% v/v	1.3ab	2.0a	69ghi	24g
Glyphosate + AMS	1.5 + 2% v/v	1.5a	1.9a	13i	213d-g
Imazamox + COC + AMS	0.047 + 1% v/v + 2.5% v/v	1.2abc	1.9a	122f-i	174d-g
2, 4-DB + sethoxydim + COC	1.5 + 0.47 + 2 pt/A	0.9c-f	1.9a	138f-i	295c-g
Pyraflufen ethyl + NIS	0.00081 + 0.25% v/v	1.0b-e	1.9a	1,018bc	300c-g
Pyraflufen ethyl + NIS	0.00122 + 0.25% v/v	0.7ef	1.7a	2,438a	558a-e
Pyraflufen ethyl + NIS	0.00163 + 0.25% v/v	1.1b-e	1.7a	1,199bc	963ab
Pyraflufen ethyl + NIS	0.00325 + 0.25% v/v	0.8def	1.7a	1,306b	932ab
Pyraflufen ethyl + glyphosate + AMS	0.00081 + 0.75 + 2% v/v	1.4a	1.9a	25i	214d-g
Pyraflufen ethyl + glyphosate + AMS	0.00122 + 0.75 + 2% v/v	1.3ab	1.8a	19i	124efg
Pyraflufen ethyl + glyphosate + AMS	0.00163 + 0.75 + 2% v/v	1.2abc	2.1a	42hi	43fg
Pyraflufen ethyl + imazamox + COC	0.00081 + 0.047 + 1% v/v	1.1a-d	1.7a	404def	632a-d
Pyraflufen ethyl + imazamox + COC	0.00122 + 0.047 + 1% v/v	1.0b-e	1.7a	642cd	1026a
Pyraflufen ethyl + imazamox + COC	0.00163 + 0.047 + 1% v/v	1.3ab	1.9a	216e-h	76fg
Pyraflufen ethyl + 2, 4-DB + sethoxydim + COC	0.00081 + 1.5 + 0.47 + 2 pt/A	1.1bcd	1.6a	299d-g	790abc
Pyraflufen ethyl + 2, 4-DB + sethoxydim + COC	0.00122 + 1.5 + 0.47 + 2 pt/A	1.0c-f	1.7a	483de	534a-e
Pyraflufen ethyl + 2, 4-DB + sethoxydim + COC	0.00163 + 1.5 + 0.47 + 2 pt/A	0.9c-f	1.7a	363def	364b-f

[1]Weeds followed by the same letters are not significantly different (P=0.05).
[2]Glyphosate is Roundup WeatherMax. AMS is a 38% solution of ammonium sulfate. COC is crop oil concentrate. NIS is nonionic surfactant.
[3]Glyphosate rates are listed in pounds acid equivalent per acre.
[4]Majority of weeds in weed mix were common lambsquarters, redroot pigweed, and green foxtail.

Yellow nutsedge control in roundup ready alfalfa. Mick Canevari, Donald 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 (Table 1). 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. Yellow nutsedge control was visually evaluated July 17, August 10, September 5 and September 18,2006 (Table 2).

Table 1. Application information.

	June 15, 2006	July 17, 2004	August 10, 2006
Timing	First cutting	Second cutting	Third cutting
Crop stage	7 to 12 inch	6 to 18 inch	3 to 8 inch
Yellow nutsedge stage	3 to 4 lf, 3 to 10 inch	3 to 5 lf, 6 to 8 inch	3 to 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

No treatment visibly injured the alfalfa (data not shown). On the final rating date September 18, 2006, all sequential glyphosate applications gave 98% yellow nutsedge control. A single glyphosate treatment after the second cutting gave 96% yellow nutsedge control. A single application of glyphosate 1.5 lb ai/A applied alone or with BB5 buffering agent after the first cutting gave 85 and 87% yellow nutsedge control, respectively. BB5 Natural buffering agent is an acid based adjuvant for reducing the Ph of the spray solution. It has been reported to increase the efficacy of glyphosate for controlling field bindweed.

Table 2. Yellow nutsedge control in glyphosate resistant alfalfa.

Treatment[1]	Rate	Application timing[2]	Yellow nutsedge control 7/17	8/10	9/5	9/18
	lb ai/A		%			
Glyphosate	1.0	1st, 2nd & 3rd	70	98	100	98
Glyphosate	1.5	1st	90	84	89	85
Glyphosate + glyphosate	1.5 1.0	1st 2nd & 3rd	80	97	100	98
Glyphosate + glyphosate	2.0 1.0	1st 2nd & 3rd	95	98	99	97
Glyphosate + BB5 Natural[3]	1.5	1st	93	88	88	87
Glyphosate	1.5	2nd	-	96	93	96
Untreated	-	-	0	0	0	0
LSD (05)			8.7	5.6	3.8	3.8

[1]Gylphosate Weathermax 5.5SL formulation.
[2]Herbicide treatment applied after 1st cutting 6/15/2006, 2nd cutting 7/17/2006 and 3rd cutting 8/10/2006.
[3]Added BB5 Natural buffering agent 0.22% V/V.

Prickly lettuce control in alfalfa seed production. Rick A. Boydston and Doug Walsh. (USDA-ARS and Washington State University, Prosser, WA 99350) A trial was initiated in the fall of 2005 to evaluate prickly lettuce control in alfalfa seed production with several herbicide treatments applied in the fall and spring to dormant alfalfa. The trial was conducted on a sprinkler irrigated alfalfa seed field near Touchet, WA. Fall treatments were applied November 21, 2005 and spring treatments on March 1, 2006. Prickly lettuce was 1 inch diameter with 1 to 2 leaves at the time of the fall herbicide applications and 1.5 to 3 inch diameter with 3 to 5 leaves at the time of the spring applications. Flumioxazin was applied at 0.125 and 0.25 lb ai/a, diuron at 1.5 lb ai/a, and norflurazon at 1.5 lb ai/a. All treatments included paraquat at 0.5 lb ai/a and nonionic surfactant at 0.25% (v/v) spray solution. Herbicides were applied with a backpack CO_2 sprayer delivering 25 gpa and treatments were replicated four times in a randomized complete block design. The entire field was burned on February 14, 2006, which is a common practice in alfalfa seed production in this region. The entire trial was also treated with pendimethalin at 1.7 lb ai/a on March 1, 2006. Emerged prickly lettuce seedlings were counted in February prior to field burning and prickly lettuce control was evaluated on a scale of 0 = no control to 100 = total control in December, April, and June and alfalfa injury was rated in April and June on a scale of 0 = no injury and 100 = dead. Alfalfa seed yield was determined from selected treatments on August 16, 2006 by hand harvesting plants from a 3.25 by 5 foot area in the center of each plot and extracting seed with a belt thrasher.

In mid December, the paraquat plus flumioxazin and paraquat plus norflurazon fall treatments were controlling prickly lettuce 97 to 99%, whereas the paraquat plus diuron treatment was controlling prickly lettuce 90% (data not shown). By February 7, 2006 all fall applied herbicide treatments had totally eliminated prickly lettuce (Table). Emerged prickly lettuce seedlings in nontreated plots were only slightly suppressed by the February field burning. Prickly lettuce control from all fall applied herbicide treatments was 99 to 100% in April and June (Table). Prickly lettuce control from spring applied diuron plus paraquat or flumioxazin plus paraquat was 98 to 99%, whereas norflurazon plus paraquat controlled prickly lettuce 94% (Table). Little or no alfalfa injury was noted in April and June from all herbicide treatments tested (Table). Alfalfa seed yield was not significantly different among the four treatments measured (Table). Norflurazon and diuron are currently labeled for use in alfalfa seed production. Flumioxazin controlled prickly lettuce well without significantly injuring alfalfa and is being considered for labeling in alfalfa seed production.

Table. Prickly lettuce control, alfalfa injury, and alfalfa seed yield following seven herbicide treatments near Touchet, WA in 2006[1].

Herbicide treatment	Rate	Herbicide application date	Prickly lettuce density Feb. 7, 2006[2]	Prickly lettuce control April 24, 2006	Prickly lettuce control June 21, 2006	Alfalfa injury April 24, 2006	Alfalfa seed yield Aug. 16, 2006
	lb ai/A		no./ft^2	%	%	%	lb/A
Flumioxazin + paraquat	0.125 + 0.5	Nov. 21	0 b	99 a	100 a	1.8 a	1269 a
Flumioxazin + paraquat	0.25 + 0.5	Nov. 21	0 b	100 a	100 a	2.0 a	1163 a
Diuron + paraquat	1.5 + 0.5	Nov. 21	0 b	99 a	100 a	0.5 a	1398 a
Norflurazon + paraquat	1.5 + 0.5	Nov. 21	0 b	100 a	99 a	3.0 a	--
Flumioxazin + paraquat	0.125 + 0.5	March 1	13 a	98 ab	99 a	3.8 a	1170 a
Diuron + paraquat	1.5 + 0.5	March 1	17 a	99 a	99 a	2.5 a	--
Norflurazon + paraquat	1.5 + 0.5	March 1	12 a	94 b	94 b	0 a	--
Nontreated weedy check			13 a	0	0	0	--

[1]The entire field was burned Feb. 14, 2006. All treatments received pendimethalin at 1.7lb ai/a on March 1, 2006.
[2]Means followed by the same letter within columns are not significantly different according to Fischer's Least Significant Difference test at the 5% level.

Effect of barley seed size and seeding rate on the competitiveness of malt barley with broadleaf weeds in an organic production system. Don W. Morishita, Robyn C. Walton, and Michael P. Quinn. (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 begin looking at non-chemical broadleaf weed management in malting barley. 'Moravian 37' was planted April 28, 2006 at four seeding rates of 750,000, 1,000,000, 1,250,000, and 1,500,000 seeds per acre with a cone planter. Barley seed was sized by passing grain through sieves and separated into the following four categories: small (<6/64 and >5.5/64), medium (<7/64 and >6/64), large (>7/64), and mixed sizes (>5.5/64). Experimental design was a four 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 1.5-meq/100 g soil. Wild oat in the study area was controlled by applying fenoxaprop at 0.0825 lb ai/A on May 17. Common lambsquarters, redroot pigweed, and kochia densities averaged 39, 31, and 1 plants/ft^2, respectively. However, when weed control was evaluated visually 82 days after planting (DAP) on July 19, common lambsquarters was the only weed present. Redroot pigweed and kochia apparently were out-competed by the barley and common lambsquarters and died off. Grain was harvested August 11 with a small-plot combine. Samples were taken from every plot to measure barley quality parameters.

Average stand counts of the two lowest seeding rates were not different from the two highest seeding rates. (Table 1). Also, the two highest seeding rate stand counts were not different. Common lambsquarters control averaged 50% in the 1.5 million seed/A seeding rate and was not different between the 1.0 or 1.25 million seed/A seeding rates P>0.1. Only the lowest seeding rate was lower than the two highest seeding rates. Barley yield was lowest with the mixed seed size compared to the small, medium, and large seed sizes. However, plump kernels in the mixed and large seed sizes were 2% higher than the medium sized seed. Color was highest with the medium sized seed. Considering all of the variables measured, barley seed size and seeding rate do not have a clear affect on barley yield and quality grown in competition with common lambsquarters.

Table 1. Stand count, common lambsquarters control, and barley height with effect of barley seed size, and seeding rate on the competitiveness of malt barley near Kimberly, Idaho.

	Grain		
	stand count	height	CHEAL
Seeding rate	5/25	7/13	7/19
	plants/A	inches	----%----
750,000 seed/A	626,175	30.0	38
1,000,000 seed/A	713,295	29.7	41
1,250,000 seed/A	849,420	29.2	51
1,500,000 seed/A	895,703	29.6	50
LSD (0.05)	90,946	ns	10[1]

[1]LSD value for common lambsquarters control calculated at P>0.1 probability level.

Table 2. Crop yield, plums, protein, and color with effect of barley seed size, and seeding rate on the competitiveness of malt barley near Kimberly, Idaho.

	Grain \			
Seed size	yield	plumps	protein	color
	bu/a	--------------%--------------		
Small (<6/64 and >5.5/64)	60	93	12	76
Medium (<7/64 and >6/64)	60	92	12	78
Large (>7/64)	61	94	12	76
Mixed sizes (>5.5/64)	51	94	12	75
LSD (0.05)	7[1]	1	ns	1

[1]LSD value for barley yield calculated at P>0.1 probability level.

Barley seed size, seeding rate, and pinoxaden rate effect on wild oat control in malting barley. Don W. Morishita, Robyn C. Walton, and Michael P. Quinn. (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 barley seed size, seeding rate, and herbicide rate on wild oat control and spring malt barley yield. 'Moravian 37' was planted April 28, 2006 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 1.5-meq/100 g soil. Pinoxaden was applied May 25, 2006 with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 24 psi. Environmental conditions at application were as follows: air temperature 69 F, soil temperature 68 F, relative humidity 39%, wind speed 8 mph, and 0% cloud cover. Application began at 1110. 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 16, 2006. Wild oat control was evaluated visually 55 days after treatment (DAT) on July 19. Grain was harvested August 10 with a small-plot combine. Stand counts taken in all of the plots showed that plant population increased in the medium and large seed plots compared to the small seed by about 21%. Among the seeding rate treatments, actual plant population was not different between the lowest and next lowest populations and between the highest and next highest populations. No injury was observed among any of the treatments in this study (data not shown). Barley plant height pooled across seed size and plant population was 1.1 inches taller in the untreated barley than the sprayed barley (data not shown). Wild oat control and barley yield significantly affected by seed size, seeding rate and pinoxaden rate interaction. No differences in plumps and thins, protein, or color were observed among the treatments.

Table 1. Seed and screening size description and desired plant population by seed size and actual plant population.

Seed size	Screening size	Actual plant population	Seeding rate	Actual plant population
	inches	plants/A	seed/A	plants/A
Small	(<6/64 and >5.5/64)	611,882	750,000	558,113
Medium	(<7/64 and >6/64)	760,939	1,000,000	638,880
Large	(>7/64)	727,588	1,250,000	840,345
			1,500,000	763,208
LSD (0.05)		73,118		84,430

Table 2. Wild oat control and barley yield with different seed size, seeding rate and herbicide application near Kimberly, Idaho.

Treatment[1]	Application rate	Wild oat control 7/19	Crop yield
	lb ai/A	---------%--------	bu/A
Small (<6/64 and >5.5/64)		8	39
750,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Small (<6/64 and >5.5/64)		89	87
750,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Medium (<7/64 and >6/64)		59	68
750,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Medium (<7/64 and >6/64)		56	62
750,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Large (>7/64)		29	54
750,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Large (>7/64)		95	95
750,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Small (<6/64 and >5.5/64)[2]		-	-
1,000,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Small (<6/64 and >5.5/64)		94	91
1,000,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Medium (<7/64 and >6/64)		40	63
1,000,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Medium (<7/64 and >6/64)		95	92
1,000,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Large (>7/64)		44	76
1,000,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Large (>7/64)		97	99
1,000,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		

Table 2. Continued.

Treatment[1]	Application rate	Wild oat control 7/19	Crop yield
	lb ai/A	---------%--------	bu/A
Small (<6/64 and >5.5/64)		23	59
1,250,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Small (<6/64 and >5.5/64)		94	87
1,250,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Medium (<7/64 and >6/64)		46	65
1,250,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Medium (<7/64 and >6/64)		96	97
1,250,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Large (>7/64)		43	69
1,250,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Large (>7/64)		99	96
1,250,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Small (<6/64 and >5.5/64)		41	64
1,500,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Small (<6/64 and >5.5/64)		95	103
1,500,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Medium (<7/64 and >6/64)		44	66
1,500,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Medium (<7/64 and >6/64)		100	91
1,500,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
Large (>7/64)		41	65
1,500,000 seed/A			
pinoxaden	0.0		
Adigor	0.0		
Large (>7/64)		97	105
1,500,000 seed/A			
pinoxaden	0.054		
Adigor	9.6 fl oz/a		
LSD (0.05)		24	23

[1]Adigore is a proprietary adjuvant.
[2]Data from this treatment were omitted due to treatment error.

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 31, 2006 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 31. Preemergence treatments were applied on May 31 and immediately incorporated with 0.75 in of sprinkler-applied water. Postemergence treatments were applied on June 29 when dry beans were in the 3rd to 4th trifoliate leaf stage and weeds were small. All postemergence treatments had a crop oil concentrate and Uran 32 added at 0.5 and 1.0 percent v/v. Black nightshade, prostrate and redroot pigweed and common lambsquarters infestations were heavy and Russian thistle infestations were 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 2459 to 2305 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] CHEAL	SOLNI	AMARE	AMABL	SASKR	Yield
	lb ai/A	—%—			%			lb/A
Flumioxazin	0.05	0	100	97	98	98	97	4226
Dimethenamid-p	0.56	0	100	86	90	90	28	2997
Flumioxazin + pendimethalin	0.05+0.8	0	100	96	97	97	99	4342
Dimethenamid-p + pendimethalin	0.56+0.8	0	100	92	92	94	35	3442
Flumioxazin/imazamox + bentazon	0.05/0.032+0.25	0	100	99	100	99	99	4111
Dimethenamid-p/imazamox + bentazon	0.56/0.032+0.25	0	100	99	99	99	93	4226
Dimethenamid-p + pendimethalin/imazamox + bentazon	0.56+0.8/ 0.032+0.25	0	100	99	98	99	95	3919
Flumioxazin + pendimethalin/imazamox + bentazon	0.05+0.8/ 0.032 + 0.25	0	100	99	99	97	99	4226
Weedy check		0	0	0	0	0	0	538
LSD (0.05)			1	3	3	2	4	569

[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.

Comparison of triallate and cycloate to postemergence herbicides for grass control in sugar beet. Robyn C. Walton, Don W. Morishita and Michael P. Quinn. (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 triallate, cycloate, and postemergence herbicides for grass control in 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 (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. '4490RZ' sugar beet was planted May 1, 2006 in 22-inch rows at a rate of 57,024 seed/A. Volunteer oat (AVESS), kochia (KCHSC), redroot pigweed (AMARE), common lambsquarters (CHEAL), green foxtail (SETVI), and barnyardgrass (ECHCG) were the major weed species present. Herbicides were broadcast-applied 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 15 and 26 days after the last herbicide treatment (DALT) on June 22, and July 3. The two center rows of each plot were harvested mechanically October 2.

Table1. Environmental conditions at application.

Application date	May 1	May 18	May 24	May 31	June 1	June 7
Application timing	PPI	cotyledon	2 leaf	4 leaf	4 leaf	6 leaf
Air temperature (F)	59	93	70	67	61	77
Soil temperature (F)	48	70	64	53	55	69
Relative humidity (%)	29	33	48	41	52	41
Wind velocity (mph)	5	1	2	9	4	4
Cloud cover (%)	40	13	15	10	5	85
Time of day	1030	1130	1030	1145	0855	1030
Weed species/ft^2						
barnyardgrass	-	-	0	0	<1	<1
foxtail, green	-	-	1	<1	<1	<1
kochia	-	-	2	3	2	2
lambsquarters, common	-	-	1	<1	<1	<1
oat, volunteer	-	-	15	15	20	18
pigweed, redroot	-	-	1	<1	<1	<1

Crop injury 26 DALT ranged from 4 to 10 % with no differences among herbicide treatments (Table 2). Volunteer oat control 15 DALT ranged from 39 to 95%. Herbicide treatments that contained triallate EC, quizalofop, clethodim, and cycloate had the best volunteer oat control. The standard herbicide treatment consisting of ethofumesate, desmedipham and phenmedipham (efs&dmp&pmp) + triflusulfuron + clopyralid applied sequentially at the cotyledon, 2, 4, and 6 leaf stages had the poorest volunteer oat control (39%). At 26 DALT, volunteer oat control for all herbicide treatments ranged from 17 to 87%. Triallate-EC had the highest volunteer oat control (87%) and the standard treatment had the lowest volunteer oat control (17%). All but one herbicide treatment had acceptable broadleaf weed control (>70%) at 15 and 26 DALT. The exception was cycloate at 1.5 lb ai/A followed by the standard treatment, which only controlled kochia 68%. Green foxtail and barnyardgrass control, 15 and 26 DALT, ranged from 94 to 100% with no differences among treatments. Sugar beet root yield ranged from 3 to 26 ton/A. Efs&dmp&pmp + triflusulfuron + clopyralid + quizalofop + COC was the highest yielding treatment (26 ton/A). Cycloate at 3 and 3.75 lb ai/A followed by the standard treatment had the next highest yield at 23 ton/A. Extractable sugar yield followed nearly the same order at root yield.

Table 2. Crop injury, weed control, root, and extractable sugar yield with preplant and postemergence herbicides near Kimberly, Idaho.[1]

Treatment[3]	Application rate	Application date	Crop injury 7/03	Weed control[2] AVESS 6/22	AVESS 7/03	KCHSC 6/22	KCHSC 7/03	AMARE 6/22	AMARE 7/03	CHEAL 6/22	SETVI 6/22	ECHCG 6/22	Root yield	Extractable yield
	lb ai/A		%										ton/A	lb/A
check	-	-	-	-	-	-	-	-	-	-	-	-	3c	716c
Triallate-EC /	1.5 /	5/1	10a	95a	88a	85a	65a	98a	100a	100a	94a	100a	18ab	4,800ab
Efs&dmp&pmp +	0.25 +	5/18												
triflusulfuron /	0.0156 /													
Efs&dmp&pmp +	0.33 +	5/24, 5/31,												
triflusulfuron +	0.0156 +	& 6/7												
clopyralid	0.094													
Triallate-G /	1.5 /	5/1	5a	58d	45c	88a	70a	100a	100a	100a	100a	100a	22ab	5671ab
Efs&dmp&pmp +	0.25 +	5/18												
triflusulfuron /	0.0156 /													
Efs&dmp&pmp +	0.33 +	5/24, 5/31												
triflusulfuron +	0.0156 +	& 6/7												
clopyralid	0.094													
Efs&dmp&pmp +	0.25 +	5/18	10a	89abc	61b	93a	83a	100a	100a	100a	100a	100a	26a	6,899a
triflusulfuron /	0.0156 /													
Efs&dmp&pmp +	0.33 +	5/24, 5/31												
triflusulfuron +	0.0156 +	& 6/7												
clopyralid /	0.094 /													
Quizalofop +	0.055 +	6/1												
COC	0.25													
Efs&dmp&pmp +	0.25 +	5/18	9a	91abc	80a	90a	74a	99a	100a	100a	100a	100a	21ab	5,373ab
triflusulfuron /	0.0156 /													
Efs&dmp&pmp +	0.33 +	5/24, 5/31												
triflusulfuron +	0.0156 +	& 6/7												
clopyralid /	0.094 /													
Clethodim +	0.094 +	6/1												
COC	0.25													
Cycloate /	1.5 /	5/1	10a	88bc	63b	89a	68a	100a	100a	99a	100a	100a	17ab	4,371ab
Efs&dmp&pmp +	0.33 +	5/24, 5/31												
triflusulfuron +	0.0156 +	& 6/7												
clopyralid	0.094													

Table2. Continued.[1]

Treatment[3]	Application rate	Application date	Crop injury 7/03	Weed control[2] AVESS 6/22	AVESS 7/03	KCHSC 6/22	KCHSC 7/03	AMARE 6/22	AMARE 7/03	CHEAL 6/22	SETVI 6/22	ECHCG 6/22	Root yield	Extractable yield
	lb ai/A		%										ton/A	lb/A
Cycloate / Efs&dmp&pmp + triflusulfuron + clopyralid	2.25 / 0.33 + 0.0156 + 0.094	5/1 5/24, 5/31 & 6/7	10a	88bc	64b	91a	84a	100a	100a	100a	100a	100a	21ab	5,441ab
Cycloate / Efs&dmp&pmp + triflusulfuron + clopyralid	3 / 0.33 + 0.0156 + 0.094	5/1 5/24, 5/31 & 6/7	10a	93ab	76a	90a	71a	100a	100a	100a	100a	100a	23ab	5,950ab
Cycloate / Efs&dmp&pmp + triflusulfuron + clopyralid	3.75 / 0.33 + 0.0156 + 0.094	5/1 5/24, 5/31 & 6/7	10a	85c	64b	92a	84a	100a	100a	100a	100a	100a	23ab	6,099ab
Efs&dmp&pmp + triflusulfuron / Efs&dmp&pmp + triflusulfuron / clopyralid	0.25 + 0.0156 / 0.33 + 0.0156 / 0.094	5/18 5/24, 5/31 & 6/7	4a	39e	18d	94a	74a	100a	100a	100a	100a	100a	13bc	3,322bc

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

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

[3]Efs&dmp&pmp is a 1:1:1 commercial formulation of ethofumesate, desmedipham, and phenmedipham. COC is crop oil concentrate. Triallate-EC is Far-Go EC. Triallate-G is Avadex Micro Activ granular formulation.

Volunteer potato timing of removal in sugar beet. Robyn C. Walton, Don W. Morishita, and Michael P. Quinn. (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 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 (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. '4490RZ' sugar beet was planted May 1, 2006 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 two sequential applications of efs&dmp&pmp + triflusulfuron at 0.33 + 0.0156 lb ai/A at the 2 and 4-leaf growth stage. Previous studies have shown this combination to have very little or not effect on potato growth. Herbicides were broadcast-applied with a small plot tractor 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 each plot were harvested mechanically October 3.

Table 1. Environmental conditions at application.

Application date	May 18	May 24	May 31
Application timing	cotyledon	2 leaf	4 leaf
Air temperature (F)	84	70	64
Soil temperature (F)	74	64	53
Relative humidity (%)	27	48	54
Wind velocity (mph)	1	2	8
Cloud cover (%)	80	15	10
Time of day	1530	1030	1030

No tubers developed or were harvested in the 'remove as needed at 4 inch rosette' treatment. Tubers harvested in the 'potatoes not removed' treatment, had the highest total tuber weight at 15,656 lb/A. Potatoes 'removed once at 4 inch rosette' and 'removed once at hooking' had the second highest total tuber weight at 12,355 and 11,080 lb/A, respectively. Tuber weights of the 'remove as need' treatments were significantly lower than each respective 'remove once' treatments. 'Remove once at 4 inch rosette', 'remove once at hooking', 'remove once at early tuber bulking', and 'not removed' had the highest tuber number harvested ranging from 46,086 to 36,280 tubers/A. The rest of the removal treatments and the 'no volunteer potato' treatment were not significantly different except for 'remove once at tuber initiation'. Sugar beet root and sucrose yield in the no volunteer potato treatment averaged 33 ton/A and 8,498 lb/A compared to 15 ton/A and 3,885 lb/A in the potato not removed treatment. This difference in yield is similar to results observed on volunteer potato density experiments. The yield data indicate that the optimum removal time for volunteer potato may be at tuber initiation. Sugar beet root and sucrose yield of remove once at tuber initiation and remove as needed at tuber initiation were equal. Removing 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.

Table 2. Volunteer potato tuber weight, tuber number, and sugar beet root and sucrose yield near Kimberly, Idaho.[1]

Treatment	Volunteer potato[2]										Root	Extractable
Treatment	<1 oz	1-4 oz	4-6 oz	>6 oz	Total	<1 oz	1-4 oz	4-6 oz	>6 oz	Total	yield	sugar
	lb/A					tuber number/A					tons/A	lb/A
No volunteer potato	0c	0d	0d	0c	0e	0c	0e	0c	0c	0c	33a	8,498a
Remove once at 4" rosette	327b	2,844a	1,638b	7,484ab	12,355b	9,806ab	18,304a	5,557b	12,420b	46,086a	18cd	4,477de
Remove as needed at 4" rosette	0c	0d	0d	0c	0e	0c	0e	0c	0c	0c	33a	8,553a
Remove once at hooking	163bc	2,811a	1,906b	6,112b	11,080b	5,557bc	16,016ab	6,537ab	11,767b	39,875a	22c	5,505cd
Remove as needed at hooking	0c	131d	108cd	0c	523de	5,230bc	1,308de	1,308c	0c	7,845bc	30ab	7,740ab
Remove once at tuber initiation	131bc	1,307bc	512c	1,504c	3,465cd	7,844bc	8,498bcd	1,634c	2,942c	20,918b	32a	7,860ab
Remove as needed at tuber initiation	131bc	654cd	0d	0c	785de	5,230bc	5,230cde	0c	0c	10,459bc	31a	8,241a
Remove once at early tuber bulking	621a	1,471bc	292c	1,863c	4,347c	17,977a	13,728ab	1,307c	3,269c	36,280a	27b	6,705bc
Remove once at mid tuber bulking	0c	588cd	0d	0c	588de	1,961bc	4,576de	0c	0c	6,537c	20c	4,919de
Not removed	131bc	2,157ab	3,387a	9,806a	15,656a	4,576bc	12,747abc	8,498a	16,342a	42,164a	15d	3,885e

[1]Means followed by the same letter are not significantly different (P=0.05).
[2]Volunteer potato was 'Russet Burbank'.

Volunteer potato interference in sugar beet (second year). Don W. Morishita, Robyn C. Walton, and Michael P. Quinn. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). The second year of a field experiment was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to determine the competitive effect of volunteer potato in 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 (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. '4490RZ' sugar beet was planted May 1, 2006 in 22-inch rows at a rate of 57,024 seed/A. To determine potato competition, whole potato tubers averaging 2 oz each were planted at seven densities in addition to a treatment with no potatoes. 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 two sequential applications of efs&dmp&pmp + triflusulfuron at 0.33 + 0.0156 lb ai/A at the 2 and 4-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 small plot tractor 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. The two center rows of each plot were harvested mechanically October 3.

Table 1. Environmental conditions at application.

Application date	May 18	May 24	May 31
Application timing	cotyledon	2 leaf	4 leaf
Air temperature (F)	84	70	64
Soil temperature (F)	74	64	53
Relative humidity (%)	27	48	54
Wind velocity (mph)	1	2	8
Cloud Cover (%)	80	15	10
Time of day	1500	1030	1030

Volunteer potato yield increased with increasing plant density for most of the tuber sizes measured (Table 2). At the highest volunteer potato plant density, total tuber yield was 20,499 lb/A compared to 21,153 lb/A in 2005, These tuber yields equated to 113,446 and 91,811 tubers/A in 2006 and 2005, respectively. An exponential regression was used to model the response of sugar beet root and extractable sugar yield to volunteer potato densities. Sugar beet root and extractable sugar yield models had R^2 values of -0.56 and -0.62, respectively. With no volunteer potato, sugar beet root and extractable sugar yield averaged 33 ton and 8,631 pounds per acre, respectively. At the lowest potato density (2,728 plants/A), sugar beet root yield was reduced 25% in 2005 and 21% in 2006 and at the highest density (16,335 plants/A), root yield was reduced 61% in 2005 and 58% in 2006.

Table 2. tuber weight and tuber number in volunteer potato density competition in sugar beet 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 potatoes	0c	0d	0c	0a	0d	0c	0d	0c	0a	0c	33a	8,631a
2,728 plants/A	190bc	927cd	1,260bc	1,795a	3,914c	4,426b	7,012cd	4,279bc	3,090a	30308b	26bc	6,968b
4,084 plants/A	143bc	1,480bc	1,159bc	2,639a	5,266bc	5,780b	10,519bcd	4,101bc	4,279a	33042b	28ab	7,344ab
5,445 plants/A	214bc	1,474bc	1,426bc	3,542a	6,624bc	6,477b	9,508bcd	4,992bc	6,656a	34765b	26bc	6,577bc
6,806 plants/A	241bc	2,059bc	1,792bc	5,366a	8,758bc	10,258ab	13,015bc	5,883bc	8,825a	49206b	28ab	7,334ab
8,168 plants/A	327ab	2,321bc	2,876b	3,432a	8,705bc	8,455b	14,055bc	9,152b	6,210a	45194b	21cd	5,392cd
10,890 plants/A	291bc	2,704b	2,621b	5,741a	11,039b	10,421ab	18,304b	7,904b	9,568a	53247b	20d	5,128cd
16,335 plants/A	624a	6,739a	6,052a	8,237a	20,499a	20,446a	46,799a	20,592a	13,728a	113446a	14e	4,192d

[1]Means followed by the same letter are not significantly different (P=0.05).
[2]Volunteer potato was 'Russet Burbank".

Ethofumesate carry over injury potential in irrigated spring wheat and barley. Don W. Morishita, Robyn C. Walton, and Michael P. Quinn. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). In 2006, the final year of a multi-year study to determine crop injury potential of small grain cereals to various ethofumesate rates and application timing made on sugar beet planted in 2005 was completed. Currently, the ethofumesate label restricts planting wheat or barley less than 12 months after applying ethofumesate for weed control in sugar beet. Consequently, growers are faced with either not using ethofumesate if they plan to grow wheat or barley the following year or plant a different crop. This study was initiated in April 2004 at the University of Idaho Research and Extension Center near Kimberly, Idaho. This report covers the results of the effects of ethofumesate on spring wheat and spring barley planted in 2006 following a sugar beet crop planted in 2005. Spring wheat ('Alpowa') and spring barley ('Moravian 37') were planted April 22, 2006 at 115 lb/A. Experimental design for each crop was a randomized complete block with four replications and individual plots were 4 by 30 ft. Soil type was a Portneuf silt loam (5.3% sand, 75.7% silt, and 18.9% clay) with a pH of 8.1, 1.95% organic matter, and CEC of 16.4-meq/100 g soil. Sugar beet herbicide treatments applied in 2005 were either broadcast or applied in an 11-inch band with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 10 or 15 gpa, respectively. Broadcast applications used 8001 flat fan nozzles and band applications used 8002 even fan nozzles. A maintenance herbicide application consisting of bromoxynil & MCPA + fluroxypyr at 0.5 + 0.125 lb ai/A was applied May 16, 2006 for broadleaf weed control. Fenoxaprop at 0.08 lb ai/A was applied May 17, 2006 for grass control. These herbicides were applied with a tractor sprayer equipped with 11001 flat fan nozzles calibrated to deliver 10 gpa. Environmental and application information from 2005 is given in Table 1. Crop injury was evaluated visually on May 23, June 12, and June 29, which was 347, 367, and 385 days after last sugar beet herbicide treatment (DALT) was applied, respectively. Barley and wheat was harvested separately on August 8 with a small-plot combine. Grain samples were collected from each plot to analyze for ethofumesate residue.

Table 1. Environmental conditions at application.

Application date	5/6/05	5/20/05	5/25/05	5/31/05	6/10/05
Application timing	pre	cotyledon	2 leaf	4 leaf	6 leaf
Air temperature (F)	63	68	56	62	68
Soil temperature (F)	52	61	55	48	54
Relative humidity (%)	43	57	46	59	30
Wind velocity (mph)	6	3	8	2	2
Cloud cover (%)	50	70	0	25	15
Time of day	1100	0930	1000	0730	1150

Crop injury ratings taken at three dates ranged from 0 to 5% with no difference among herbicide treatments (Table 2). These results are similar to the previous year's data. No difference in grain yield was observed among the treatments. Grain yield ranged from 91 to 97 bu/A in wheat and 116 to 129 bu/A in barley. Based on two years of data, it appears that ethofumesate does not carryover to affect wheat or barley planted the following year, regardless of whether ethofumesate was applied preemergence or postemergence. Laboratory analysis of the grain samples collected from the herbicide treatments found no ethofumesate or analyte residue (data not shown).

Table 2. Wheat and barley injury and grain yield following various ethofumesate applications, near Kimberly, Idaho.[1]

			Crop injury							
		Application	TRZAS			HORVS			Grain yield	
Treatment[3]	Rate	dates (2005)	5/23	6/12	6/29	5/23	6/12	6/29	TRZAS	HORVS
	lb ai/A		%						bu/A	
Check	-		-	-	-		-	-	91a	116a
Ethofumesate (broadcast)/	1.5/	5/06	1a	1a	0a	1a	3a	1a	96a	129a
efs&dmp&pmp (broadcast)	0.33	5/25, 5/31, 6/10								
ethofumesate (broadcast)/	1.25	5/25								
ethofumesate (broadcast)	0.25	6/10								
Ethofumesate (11-inch band)/	1.5/	5/06	3a	3a	1a	3a	1a	3a	92a	126a
efs&dmp&pmp (11-inch band)	0.33	5/25, 5/31, 6/10								
ethofumesate (11-inch band)/	1.25	5/25								
ethofumesate (11-inch band)	0.25	6/10								
Ethofumesate (broadcast)/	2.25/	5/06	3a	1a	0a	3a	0a	0a	97a	122a
efs&dmp&pmp (broadcast)	0.33	5/25, 5/31, 6/10								
ethofumesate (broadcast)/	1.25	5/25								
ethofumesate (broadcast)	0.25	6/10								
Ethofumesate (11-inch band)/	2.25/	5/06	1a	3a	1a	1a	3a	0a	92a	121a
efs&dmp&pmp (11-inch band)	0.33	5/25, 5/31, 6/10								
ethofumesate (11-inch band)/	1.25	5/25								
ethofumesate (11-inch band)	0.25	6/10								
Ethofumesate (broadcast)/	3.0/	5/06	3a	3a	0a	3a	1a	0a	92a	119a
efs&dmp&pmp (broadcast)	0.33	5/25, 5/31, 6/10								
ethofumesate (broadcast)/	1.25	5/25								
ethofumesate (broadcast)	0.25	6/10								
Ethofumesate (11-inch band)/	3.0/	5/06	1a	5a	0a	1a	4a	3a	94a	119a
efs&dmp&pmp (11-inch band)	0.33	5/25, 5/31, 6/10								
ethofumesate (11-inch band)/	1.25	5/25								
ethofumesate (11-inch band)	0.25	6/10								
Efs&dmp&pmp (broadcast)/	0.25/	5/4	0a	0a	0a	0a	1a	1a	93a	117a
efs&dmp&pmp (broadcast)	0.33/	5/25, 5/31, 6/10								
ethofumesate (broadcast)/	0.75/	5/25								
ethofumesate (broadcast)	1.375	5/31, 6/10								
Efs&dmp&pmp (broadcast)/	0.25/	5/4	1a	3a	0a	1a	3a	3a	93a	121a
efs&dmp&pmp (broadcast)/	0.33/	5/25, 5/31, 6/10								
ethofumesate (broadcast)/	0.75/	5/25								
ethofumesate (broadcast)	1.375	5/31, 6/10								
Efs&dmp&pmp (broadcast)/	0.25/	5/4	1a	0a	0a	1a	3a	1a	96a	117a
efs&dmp&pmp (broadcast)	0.33	5/25, 5/31, 6/10								

[1]Means followed by the same letter do not significantly differ (P=0.05).
[2]Crops evaluated for injury were spring wheat (TRZAS), and spring barley (HORVS).
[3]Efs&dmp&pmp is a commercial formulation of a 1:1:1 mixture of ethofumesate, desmedipham, and phenmedipham. Triflusulfuon + clopyralid at 0.0312 + 0.094 lb ai/A was added to all efs&dmp&pmp applications.

Downy brome control in established Kentucky bluegrass. Janice Reed, Donn Thill, and John Holman (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were conducted near Mt. Hope, WA to determine the effect of several pre-emergence and post-emergence herbicides on downy brome control in established Kentucky bluegrass. The experiments were conducted in 3-year-old stands of 'Kenblue' and 'Atlantis' bluegrass. 'Kenblue' is a tall, aggressive type of bluegrass and 'Atlantis' is a shorter, less aggressive type. Plots were 8 by 30 ft, arranged in a randomized complete block design with four replications and included an untreated check. Treatments were applied with a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Kentucky bluegrass injury and downy brome control were evaluated visually. Downy brome density was estimated visually as a percentage of ground cover in the untreated plots. Plots were not harvested. The study will be repeated at four locations during the 2006 to 2007 and 2007 to 2008 growing seasons to determine herbicide efficacy and bluegrass response in different varieties.

Table 1. Application and soil data.

Location	Fleming Road			Sands Road		
Bluegrass variety		'Kenblue'			'Atlantis'	
Application date	9/28/05	10/18/05	4/19/06	9/28/05	10/18/05	4/19/06
Application timing	Pre	Fall	Spring	Pre	Fall	Spring
Growth stage						
Downy brome	--	1 leaf	4 in, 1 tiller	--	1 leaf	3 in, 1 tiller
Bluegrass	2 to 4 inch	6 to 8 inch	8 to 10 inch	1 inch	2 to 4 inch	4 to 6 inch
Air temp (F)	72	64	59	72	67	66
Relative humidity (%)	36	61	56	36	52	55
Wind (mph, direction)	5, SW	2, NW	3, SE	5, SW	2, NW	2, SE
Cloud cover (%)	0	10	2	0	20	2
Soil moisture	low	medium	medium	low	medium	high
Soil temp at 2 in (F)	51	59	38	50	57	40
pH		4.5			5.4	
Organic matter (%)		4.5			4.5	
CEC (meq/100 g)		22			19	
Texture		silt loam			silt loam	

No Kentucky bluegrass injury was apparent at either site (data not shown). However, evidence of crop injury was difficult to see because grass stands were sparse and downy brome infestation was heavy. At both locations, flufenacet/metribuzin + metribuzin, oxyfluorfen + diuron, sulfosulfuron, and proproxycarbazone controlled downy brome 93 to 99%. At the Fleming Road site, flufenacet/metribuzin alone or combined with pendimethalin, metribuzin alone or combined with metolachlor, terbacil, dimethanamid, and oxyfluorfen controlled downy brome 89 to 100% (Table 2). Downy brome control with other pre-emergence and post-emergence herbicides tended to be lower at the Sands Road site. A shorter, less aggressive variety, higher post-harvest residue, and higher downy brome density at the Sands Road site likely contributed to lower herbicide efficacy.

Table 2. Downy brome control in Kentucky bluegrass with pre-emergence and post-emergence herbicides at two locations near Mt. Hope, WA in 2006.

Treatment[1]	Rate	Application[2] timing	Downy brome control[3, 4] Fleming Road	Sands Road
	lb ai/A		---------------%---------------	
Flufenacet/metribuzin	0.55	Pre	97 a	78 a-d
Flufenacet/metribuzin + metribuzin	0.55 + 0.24	Pre + fall	99 a	95 a
Flufenacet/metribuzin + pendimethalin	0.55 + 3	Pre + pre	99 a	78 a-d
Pendimethalin	3	Pre	35 def	3 j
Metolachlor	1.27	Pre	49 cd	13 ij
Metolachlor + metribuzin	1.27 + 0.24	Pre + fall	90 ab	33 ghi
Metolachlor + diuron	1.27 + 0.75	Pre + spring	60 c	60 c-f
Dimethanamid	1.5	Pre	91 ab	83 abc
Dithiopyr	0.5	Pre	80 b	20 hij
Terbacil	0.8	Fall	100 a	74 a-e
Oxyfluorfen	0.375	Fall	94 ab	85 ab
Oxyfluorfen + diuron	0.375 + 0.75	Fall	98 a	93 a
Sulfosulfuron	0.031	Fall	99 a	95 a
Proproxycarbazone	0.04	Fall	95 ab	95 a
Flucarbazone	1 + 0.027	Fall	44 de	65 b-f
Metribuzin	0.24	Fall	89 ab	10 ij
Metribuzin	0.38	Fall	92 ab	43 fgh
Primisulfuron	0.0356	Spring	43 de	57 d-g
Primisulfuron + diuron	0.0234 + 0.56	Spring + spring	26 f	52 efg
Diuron	1	Spring	30 ef	20 hij
Average downy brome density (% stand)			40	70

[1] Non-ionic surfactant (R-11) was applied at 0.5% v/v with sulfosulfuron, proproxycarbazone, and flucarbazone, and at 0.25% v/v with diuron. Primisulfuron alone was applied with crop oil concentrate (Moract) at 2.5% v/v.

[2] Pre= pre-emergence to downy brome. Fall application was to 1 leaf downy brome. Spring application was to 1 tiller downy brome.

[3] Downy brome control expressed as percent of untreated check. Rated on May 24, 2006.

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

Weed control with metam-sodium during establishment of Kentucky bluegrass. L.H. Bennett, S.M. Frost and D.A. Ball (OSU-Columbia Basin Agricultural Research Center, Pendleton, OR 97801). A study was conducted to evaluate winter annual grass weed and broadleaf weed control with using metam-sodium (Vapam®) during the seedling establishment period of Kentucky bluegrass (KBG) grown for seed. The experimental area was located at the Hermiston Agricultural Research and Extension Center, Hermiston, OR. Downy brome and rattail fescue were broadcast seeded in the plot area on August 8, 2005 and incorporated with a spike-tooth harrow, and lightly irrigated to imbibe seed. Metam-sodium treatments were applied preplant on August 12, 2005. Treatments 3 and 6 used a chemigation simulator which applied 0.4 acre inches of water in two passes over the plots. Treatments 4 and 7 were applied at 0.6 acre inches of water with 3 passes of the chemigator over the plots. Treatments 5 and 8 were applied uniformly to the soil surface and incorporated with a roto-tiller + roller packer at 1 to 2 inch depth. Treatments included two rates of metam-sodium (15 and 30 gal/A) with each type of application method (i.e. roto-till or chemigation). The entire plot area was then irrigated to promote weed seed germination and to prevent metam-sodium volatility loss. The chemigation simulator was calibrated to apply water at 60 psi through flood-type nozzles. Plots were 6.7 ft by 30 ft, in an RCB arrangement, with 4 replications. Soil at the site was an Atkins fine sandy loam (71.6% sand, 18.9% silt, 9.5% clay, 1.1% organic matter, 6.8 pH, and CEC of 9.2 meq/100 g). Kentucky bluegrass (var 'Baron') was seeded on August 30, 2005 at 5 lb/A on 11 in. row spacing. Weed counts were made September 26, 2005 (Table 2). Plots were hand-weeded and weeding time recorded for each treatment on October 10, 2005 (Table 2). Visual control of downy brome was rated on 5/17/06. Plots were swathed with a small plot swather on June 15, 2006 and harvested with a small plot combine on June 30, 2006. Yield results are shown in Table 2.

Table 1. Conditions at time of herbicide applications.

	Aug 12, 2005
Crop and Weed application timing	Preplant
Air temp (°F)	58
Relative humidity (%)	80
Wind velocity (mph)	1
Soil temp 1 inch (F)	56

Metam-sodium treatments reduced early season weed density, with the 30 gal/A metam-sodium rate providing a somewhat higher level of weed control than the 15 gal/A metam-sodium rate. Increasing the chemigation water rate from 0.4 to 0.6 acre-inch slightly improved weed control for the 15 gal metam-sodium rate, but not for the 30 gal metam-sodium rate. Roto-till application of metam-sodium provided comparable grass weed control to chemigation application, but was ineffective at controlling broadleaf weeds including henbit, lambsquarters, common mallow, and various mustard species (Table 2). The roto-till treatment alone controlled downy brome better than metam-sodium at 15 gal + 0.4 ac in (75% versus 46%, respectively) when rated on 5/17/06. Hand-weeding times were significantly reduced by most metam-sodium treatments, which could lead to overall weed control savings, depending on expected weed density in grass seed fields. Seed yields were highest from the 30 gal/A rate of Vapam roto-till treatment which was significantly better than the untreated, no roto-till control, but not significantly better than any of the other treatments.

Table 2. Weed control with metam-sodium in Kentucky bluegrass grown for seed. Hermiston, OR. .

Treatment	Metam-sodium rate	Water rate	Downy brome 9/26/05	Rattail fescue 9/26/05	Broadleaf weeds 9/26/05	Hand weeding time 10/10/05	Downy brome control 5/17/06	KBG yield 6/30/06
	Prod/A	Acre-inches	-----------Plants / 0.5 m^2---------			Man hours/plot	----%-----	lb/A
Untreated	--	--	64	113	180	1.23	0	776
UTC - rototill	--	--	23	45	179	1.03	75	925
Metam-sodium + H_2O	15 gal	0.4	29	27	25	0.72	46	1025
Metam-sodium + H_2O	15 gal	0.6	30	28	14	0.61	59	1030
Metam-sodium + rototill	15 gal	--	23	22	147	0.85	83	1078
Metam-sodium + H_2O	30 gal	0.4	15	20	9	0.46	67	919
Metam-sodium + H_2O	30 gal	0.6	16	20	8	0.44	74	1010
Metam-sodium + rototill	30 gal	--	10	11	42	0.61	85	1159
LSD (.05)			19	35	56	0.35	17	316

Red clover establishment with winter wheat for small broomrape management. Ryan D. Lins, Jed B. Colquhoun, and Carol A. Mallory-Smith. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002) False-host plant species stimulate parasitic plant seed germination with death prior to host plant attachment. False-hosts differ from host plants in that false-host species release exudates that only promote parasitic seed germination but not attachment. Wheat has been identified as an effective false-host for small broomrape. The small broomrape soil seedbank could be reduced in infested red clover fields by incorporating wheat into red clover seed production. In 2003, two field experiments were established at the Hyslop Research Farm near Corvallis, OR to compare eight different methods of red clover establishment within a wheat stand. 'Kenland' medium red clover, 'Cayuse' oat and 'Foote' soft white winter wheat were planted to compare wheat yield and red clover establishment among interseeding systems. Experimental design was a randomized complete block with ten treatments, four replications, and a plot size of 8 by 40 ft. Treatments included red clover monocropped in 12 inch rows, wheat monocropped in 6 inch rows (conventional wheat system), red clover broadcast-seeded into 12 inch oat rows and 6 inch wheat rows at time of planting, and red clover spring-broadcast (February, March, April) into fall-planted 6 and 12 inch wheat rows. The oat treatment was included as a common red clover establishment system that is presently used. The 6 inch wheat row width was chosen for the fall red clover interseeding treatment to maximize wheat yield and the release of small broomrape germination exudates. At both sites, oat, wheat, and fall interseeded red clover were planted on October 14, 2003. Second year red clover establishment was determined by placing a transect through the middle of each plot and calculating percent red clover ground cover on March 25, 2005. Wheat yield and red clover establishment are presented in the table below.

Table. Wheat yield in 2004 and red clover ground cover in 2005 for Site 1 and 2 at the Hyslop Research Farm near Corvallis, OR.

	Wheat yield		Red clover ground cover	
Cropping system	Site 1	Site 2	Site 1	Site 2
	-----(lb/acre)----		------(%)------	
Red clover monocrop	-	-	98	100
Wheat monocrop	5931	6122	-	-
Red clover-oat intercrop	-	-	99	100
Fall red clover-wheat intercrop	5483	5800	13	77
Feb red clover-wheat (6 inch)	5379	5844	2	14
March red clover-wheat (6 inch)	5494	5505	0	0
April red clover-wheat (6 inch)	5663	6237	0	0
Feb red clover-wheat (12 inch)	4871	5653	43	39
March red clover-wheat (12 inch)	5445	5630	9	33
April red clover-wheat (12 inch)	5560	5581	0	0
LSD (0.05)	NS	NS	19	20
Contrasts[1]				
Spring intercrop row width	NS	NS	***	***
Wheat mono vs. Intercrop wheat	NS	NS	-	-
Fall vs. spring intercrop	NS	NS	-	-

[1] Contrasts significant at the P = 0.001 level are indicated with ***. Non-significant comparisons are indicated with NS.

At both sites, red clover stand establishment was 98% or greater for the red clover monocrop and the red clover-oat intercrop. Only the fall red clover-wheat intercropped at Site 2 produced enough red clover ground cover for a typical grower to consider stand retention (>70%). Spring interseeded treatments did not result in sufficient red clover ground cover regardless of row spacing or seeding date. Spring interseeding was not agronomically viable for red clover establishment. Further adaptation of fall intercropping will be necessary for a viable integrated small broomrape management system.

Broadleaf weed control in roundup ready field corn with 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 16, 2006 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. Pioneer 35N45RR) and annual broadleaf weeds to 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. Field corn was planted with flexi-planters equipped with disk openers on May 16. Postemergence treatments were applied on June 6 when corn was in the 4th leaf stage and weeds were small. Black nightshade, prostrate and redroot pigweed, and common lambsquarters infestations were heavy and Russian thistle infestations were light throughout the experimental area. Crop injury was evaluated on June 9 and weed control on July 6.

Acetochlor + atrazine at 3.3 and glyphosate at 0.75 lb ai/A gave poor control of redroot pigweed. Prostrate pigweed control were good to excellent with all treatments except glyphosate at 0.75 and 1.5 lbs ai/A and the weedy check. Glyphosate at 0.75 lb ai/A gave poor control of common lambsquarters. Rimsulfuron plus atrazine plus glyphosate at 0.015 plus 0.8 plus 0.75, nicosulfuron plus rimsulfuron (packaged mix) plus mesotrione plus atrazine at 0.035 plus 0.06 plus 0.8 and nicosulfuron plus rimsulfuron (packaged mix) plus dicamba at 0.035 plus 0.06 lb ai/A gave excellent control of black nightshade. Glyphosate at 0.75 lb ai/A gave poor control of Russian thistle.

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

Treatments[1]	Rate	Crop injury[2]	Weed control[2] AMARE	AMABL	CHEAL	SOLNI	SASKR
	lb ai/A				%		
Rimsulfuron + atrazine + glyphosate	0.015+0.8+0.75	0	99	99	99	99	98
Acetochlor + atrazine	3.3	0	65	93	85	87	90
Glyphosate + rimsulfuron	0.75+0.015	0	94	93	80	88	69
Nicosulfuron + rimsulfuron (pm) + mesotrione + atrazine[3]	0.035+0.06+0.8	0	99	100	98	99	94
Nicosulfuron + rimsulfuron (pm) + dicamba[3]	0.035+0.06	0	95	99	99	99	100
Glyphosate	0.75	0	70	80	54	85	46
Glyphosate	1.5	0	83	82	83	84	92
Weedy check		0	0	0	0	0	0
LSD (0.05)			4	3	5	3	5

1. pm equal packaged.
2. Rated on a scale from 0 to 100 with 0 being no control or crop injury and 100 being dead plants.
3. Treatments applied with a COC and ammonium sulfate at 1.0% v/v and 2.0 lbs/A. All other treatments were applied with ammonium sulfate at 2.0 lbs/A.

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 16, 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 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. Preemergence treatments were applied on May 17 and immediately incorporated with 0.75 in of sprinkler-applied water. Postemergence treatments were applied on June 9 when corn was in the 4th leaf stage and weeds were small. Treatments with diflufenzopyr plus dicamba had a nonionic surfactant and Uran 32 added at 0.25 and 0.5 percent v/v. Black nightshade, prostrate and redroot pigweed, and common lambsquarters infestations were heavy and Russian thistle infestations were light throughout the experimental area. Treatments were evaluated on July 6.

Dimethenamid-p and s-metolachlor alone at 0.75 and 1.25 lb ai/A, respectively, gave poor control of Russian thistle. However, when dimethenamid-p and s-metolachlor at 0.75 and 1.25 lb ai/A were combined with diflufenzopyr plus dicamba at 0.25 lb ai/A, Russian thistle control increased approximately 48 percent. Common lambsquarters, redroot and prostrate pigweed and black nightshade control was 90% or greater with all herbicide treatments as compared to the weedy check.

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

Treatments[1]	Rate	Crop[2] injury	Weed control[2] CHEAL	SOLNI	AMARE	AMABL	SASKR
	lb ai/A	---%---			---%---		
Dimethenamid-p + atrazine (pm)	0.85	0	96	92	90	92	90
Dimethenamid-p + atrazine (pm)	1.9	0	99	95	96	97	99
S-metolachlor + atrazine (pm)	0.83	0	97	94	92	95	91
S-metolachlor + atrazine (pm)	1.65	0	99	97	97	98	98
Dimethenamid-p	0.75	0	96	94	91	94	51
S-metolachlor	1.25	0	98	92	91	92	51
Dimethenamid-p/diflufenzopyr + dicamba (pm)	0.75/0.25	0	98	98	99	99	99
S-metolachlor/diflufenzopyr + dicamba (pm)	1.25/0.25	0	99	98	99	98	99
Weedy check			0	0	0	0	0
LSD (0.05)			2	2	3	2	3

[1] pm equal packaged mix, 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.

Cultural tactics that reduce common sunflower seedling emergence in following years. Randy L. Anderson. (USDA-ARS, Brookings SD 57006). Weed management is expensive for producers in the western Corn Belt. Costs are high because the corn-soybean rotation favors population growth of weed species that are crop mimics. One prominent weed is common sunflower, which emerges in May and early June, then flowers in late August.

Producers in this region are interested in diversifying the corn-soybean rotation with cool-season crops such as winter wheat to improve weed management. In the semiarid Great Plains, producers following rotations comprised of two cool-season crops, such as winter wheat and dry pea, followed by two warm-season crops, such as corn and proso millet, have reduced input costs 50% for weed management compared to less diverse rotations. This trend reflects lower weed community density due to the diversity of crop life cycles and planting dates. We wondered if this approach would help manage weeds in the western Corn Belt.

To explore this possibility, we conducted a study to quantify seedling emergence of common sunflower during a four-year interval. Cultural tactics related to tillage management and crop sequencing were imposed on a site heavily infested with common sunflower. This report summarizes seedling emergence of common sunflower in the third and fourth years after imposition of cultural treatments.

Cultural Treatments

Five cultural treatments were established in 2001 (see Table below). Our goal was to examine tactics that may affect the number of common sunflower seedlings emerging in following years. The first two treatments compared impact of tillage management; conventional tillage (CT) consisted of chisel plowing, cultivating, and disking whereas no-till (NT) relied on glyphosate to control weeds before planting soybean. We also evaluated three crop sequences that included cool-season crops such as rye as a cover crop (terminated at soybean planting), canola and winter wheat. The crop sequence for the first two years is shown in the Table.

All crops were planted with a disk drill and a row spacing of 7.5 inches. Plot size was 10 feet by 60 feet. In the center 20 feet of each plot, any common sunflower plants establishing in the plots were removed by hand to prevent seed being added to this subplot for 4 years.

Table. Treatments related to wild sunflower seedling emergence.[1]

Tillage	Sequence
CT	soybean-soybean
NT	soybean-soybean
NT	[rye–CC]-soybean-[rye-CC]-soybean
NT	winter wheat-soybean
NT	canola-winter wheat

[1] Abbreviations: CT, conventional tillage; NT, no-tillage; CC, cover crop.

In the third and fourth years, soybean was planted in all plots. During these years, emergence of common sunflower seedlings in the 10 by 20-foot subplot was recorded weekly, then removed by hand. The study was repeated at a different site during 2002 to 2005.

Seedling Emergence of Common Sunflower

Our data represent common sunflower seedlings averaged across years and sites. With conventional tillage, 84 common sunflower seedlings emerged in the 20-m^2 area during the third and fourth years (see Figure below). In contrast, seedling density declined to 45 in the NT system. Adding a cereal crop, either rye as a cover crop or winter wheat, to the no-till system reduced wild sunflower emergence to 29 seedlings. After two years of cool-season crops, canola and winter wheat, seedling emergence was only 12, a 7-fold difference when compared with 84 seedlings observed in the tilled system.

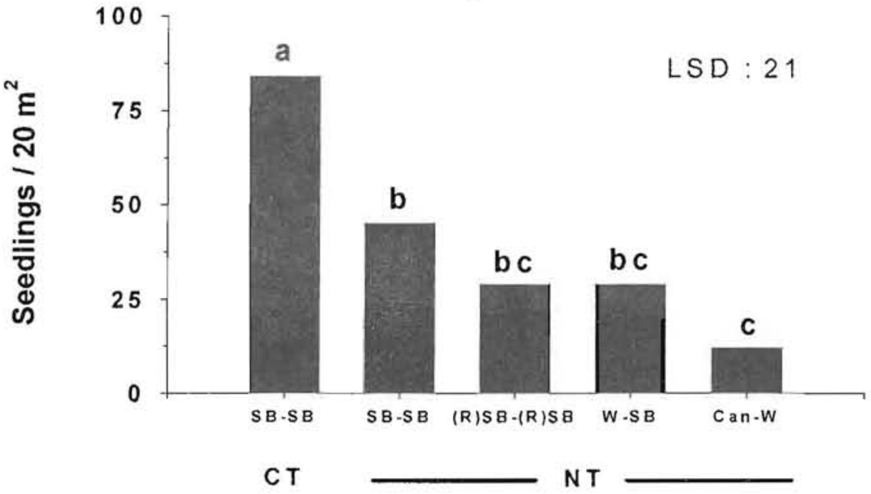

Figure. Seedling emergence of common sunflower in years 3 and 4, after establishing treatments in years 1 and 2. Study was repeated across time, with data averaged across years and studies. Bars with the same letter are not significantly different as determined by Fisher's Protected LSD (0.05). Abbreviations: SB, soybean; (R)SB, rye as a cover crop followed by soybean; W, winter wheat; Can, canola; CT, conventional tillage; NT, no-tillage.

Tillage prolonged survival of common sunflower seed, thus increasing seedling density in following years compared with the no-till treatment. However, we were surprised with the low emergence in the treatment that included canola and winter wheat. In the first two years of the study, we noted that common sunflower seedlings seldom emerged in winter wheat or canola, thus we were concerned that common sunflower seeds may persist in this treatment and increase seedling density in later years. Yet, our data showed the opposite effect. Apparently, winter wheat and canola develop a microclimate in soil that favors predation, decay and death of common sunflower seeds in the seedbank, leading to fewer seedlings in following years. We speculate that one factor may be the soil microbial community is more active with winter wheat because its rooting system is fibrous and close to the soil surface, contrasting with the taproot structure of soybean.

Implications for Weed Management

One benefit of adding cool-season crops such as winter wheat to corn and soybean is the opportunity to prevent warm-season weeds such as common sunflower from producing seeds during the winter wheat growing season. Our study suggests a second benefit; cool-season crops also may reduce seed survival in soil. With a no-till rotation that included canola and winter wheat, common sunflower seedling density was 86% lower compared with a soybean-soybean sequence established with tillage.

To test this concept further, we established a new study to examine crop sequencing effect on the weed community present in this region.

<u>*Brassica rapa* control in spring pea.</u> Joan Campbell and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, Idaho 83844-2339) An experiment was established near Moscow, Idaho in spring pea to determine *Brassica rapa* L. control with linuron and diuron. *B. rapa* was seeded to obtain a uniform population of about 8 plants/ft^2 on April 28, 2006, and 'Cruiser' spring pea was seeded April 29, 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 4.8, 2.6%, 4 cmol/kg, and loam, respectively. The experimental design was a randomized complete block with four replications and 8 by 30 ft experimental units. Crop injury and weed control were observed throughout the season and pea seed was harvested at maturity.

Table 1. Growth stage and edaphic conditions at herbicide application time.

	April 29, 2006	May 30, 2006
Pea growth stage	pre-emergence	2 to 4 node, 3 to 5 inch tall
Brassica rapa growth stage	pre-emergence	2 leaves
Relative humidity (%)	45	57
Wind velocity (mph)	2 northeast	3 south
Air temperature (F)	72	68
Soil temperature (F)	65	70

B. rapa control was 90% or greater with metribuzin+bentazon+COC throughout the growing season (Table 2). *B. rapa* control also was good with diuron at 1.6 and 2.0 lb ai/a and linuron at 0.75 and 1.0 lb ai/a. Linuron at 0.5 lb ai/a and metribuzin applied pre-emergence or postemergence were unsatisfactory for *B. rapa* control. Crop response between 0 and 5% was observed in some metribuzin postemergence treated plots however, pea seed yield did not differ among treatments.

Table 2. *B. rapa* control and spring pea seed yield.

Treatment	Rate	Herbicide application timing	*B. rapa* control June 11	July 1	July 8	Pea seed yield
	lb ai/a		%			lb/a
Linuron	0.5	pre	65	65	49	1316
Linuron	0.75	pre	86	83	74	1346
Linuron	1.0	pre	86	91	87	1408
Diuron	1.2	pre	83	81	78	1321
Diuron	1.6	pre	90	90	89	1470
Diuron	2.0	pre	90	96	85	1353
Metribuzin	0.375	pre	51	29	31	1486
Metribuzin	0.25	post	78	78	70	1194
Metribuzin + bentazon + COC[1]	0.25 + 0.5 + 2[1]	pre + post + post	90	98	97	1213
Untreated check			-	-	-	1397
LSD (0.05)			10	15	23	NS

[1] COC (Moract crop oil concentrate) was applied at 2 pint/acre.

Weed control in direct-seeded field pea. Gregory J. Endres and Blaine G. Schatz. (Carrington Research Extension Center, North Dakota State University, Carrington, ND 58421) Weed control and field pea response to selected soil- and POST-applied herbicides were evaluated in a randomized complete-block design with three replicates. The experiment was conducted on a Heimdahl loam soil with 6.9 pH and 3.3% organic matter at the NDSU Carrington Research Extension Center. Herbicide treatments were applied with a CO_2 pressurized hand-held plot sprayer at 17 gal/A. Fall treatments were applied November 3, 2005 at 35 psi through 80015 flat-fan nozzles with 36 F, 81% RH, 100% cloudy sky, and 11 mph wind. The trial area was treated on April 21, 2006 with a burn-down application of glyphosate at 0.57 lb ae/A plus liquid ammonium sulfate at 0.5% v/v. Spring herbicide treatments were applied at 30 psi through 8002 flat-fan nozzles. Spring preplant (PP) treatments were applied on April 21 with 63 F, 48% RH, 30% clear sky, and 13 mph wind. Rainfall totaled 0.62 inches 7 d following PP application. On April 27, inoculated 'Admiral' field pea was seeded into standing wheat stubble in 7-inch rows at a rate of 300,000 pure live seeds/A. PRE treatments were applied on April 27 with 58 F, 61% RH, 100% cloudy sky, and 3 mph wind. Rainfall totaled 0.8 inches 3 d following PRE application. The early POST (EPOST) treatment was applied on May 23 with 80 F, 42% RH, 15% clear sky, and 9 mph wind to 3-inch tall field pea, 2- to 3-leaf foxtail (green and yellow), and 0.5-inch tall common lambsquarters and pigweed (prostrate and redroot). POST treatments were applied on June 5 with 80 F, 44% RH, 65% clear sky, and 2 mph wind to 8- to 9-inch tall field pea, 5-leaf foxtail, 1- to 4-inch tall common lambsquarters, and 1- to 3-inch tall pigweed. Average plant density in untreated plots was measured on June 2: field pea = 9 plants/ft^2, grass weeds = 28 plants/ft^2, and broadleaf weeds = 2 plants/ft^2. The trial was harvested with a plot combine on July 24.

PP sulfentrazone + imazethapyr provided 98 to 99% control of foxtail and broadleaf weeds on June 2 (Table 1). Fall- or spring-applied (PP and PRE) sulfentrazone at 0.14 lb/A provided 95 to 99% control of broadleaf weeds; however, foxtail control was as low as 68%. Spring-applied pendimethalin provided 93 to 99% broadleaf weed control compared to 84 to 89% control with fall application. Linuron at 1 lb/A and KIH 485 provided 90 to 95% control of broadleaf weeds. Sequentially-applied bentazon at 0.5 lb/A + sethoxydim at 0.1 lb/A provided 97% control of pigweed spp. compared to 84% control with the single application of bentazon at 1.0 lb/A + sethoxydim at 0.2 lb/A on July 3 (Table 2). Also, bentazon at 0.5 lb/A + sethoxydim at 0.1 lb/A + imazamox at 0.016 lb/a provided similar foxtail and common lambsquarters control, and improved pigweed control compared to bentazon at 1.0 lb/A + sethoxydim at 0.2 lb/A. The tank mixture of imazamox at 0.03 lb/A with bentazon + sethoxydim caused crop chlorosis and 17% height reduction when visually evaluated 14 d after application (data not shown), delayed crop maturity and reduced seed yield compared to yield of the untreated check. Crop injury or delay in maturity did not occur with other treatments in the trial. Pea seed yield exceeded 50 bu/A with PP sulfentrazone + imazethapyr followed by sethoxydim, and PRE pendimethalin followed by bentazon + sethoxydim.

Table 1. Weed control with soil-applied herbicides in direct-seeded field pea, Carrington, 2006.

Treatment[1]	Application timing[2]	Rate	June 2 Foxtail spp.[3]	Common lambsquarters	Pigweed spp.[3]
		lb ai/A	------% control		------
Untreated	x	x	0	0	0
Sulfentrazone	Fall	0.141	77	95	99
Sulfentrazone/Sulfentrazone	Fall/PRE	0.07/0.07	68	98	98
Pendimethalin	Fall	1.5	85	84	89
Sulfentrazone	PRE	0.141	68	99	99
Sulfentrazone+imazethapyr	PP	0.105+0.016	98	99	99
Pendimethalin	PRE	1.5	88	98	99
Sulfentrazone+pendimethalin	PRE	0.07+0.75	90	96	99
Pendimethalin	PP	1.5	91	98	93
Ethalfluralin	PP	0.75	86	76	96
Sulfentrazone	PP	0.141	73	99	98
Pendimethalin	PP	1.5	93	95	99
Linuron	PRE	0.5	57	86	85
Linuron	PRE	1	73	95	95
Diuron	PRE	1.88	68	76	96
KIH 485	PRE	0.15	68	90	91
C.V. (%)			11	9	6
LSD (0.05)			13	14	9

[1]Pendimethalin=ProwlH_20, BASF. The trial was treated on April 21 with a PRE burn-down application of glyphosate at 0.57 lb ae/A plus liquid ammonium sulfate at 0.5% v/v.

[2]Fall=November 3, 2005; PP=April 21, 2006; PRE=April 27.

[3]Foxtail spp.=yellow and green; Pigweed spp.=redroot and prostrate.

Table 2. Weed control and crop response with soil- and POST-applied herbicides in direct-seeded field pea, Carrington, 2006.

			July 3			Field pea		
Treatment[1]	Application timing[2]	Rate	Foxtail spp.[3]	Common lambs-quarters	Pigweed spp.[3]	Plant maturity[4]	Seed yield	Test weight
		lb ai/A	--------------% control		---------------	Jday	bu/A	lb/bu
Untreated	x	x	0	0	0	193	38.5	63.8
Sulfentrazone/bentazon+ sethoxydim+MSO+UAN	Fall/POST	0.14/0.5+ 0.1+1%+2pt	77	98	99	193	47.8	64.1
Sulfentrazone/sulfentrazone/ Bentazon+sethoxydim+MSO+UAN	Fall/PRE/ POST	0.07/0.07/ 0.5+0.1+1%+2pt	84	99	99	193	44.2	64.0
Pendimethalin/bentazon+ sethoxydim+MSO+UAN	Fall/POST	1.5/0.5+ 0.1+1%+2pt	90	93	91	193	49.4	63.3
Sulfentrazone/bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.14/0.5+ 0.1+1%+2pt	88	99	99	193	48.0	64.3
Sulfentrazone+imazethapyr/ sethoxydim+MSO	PP/POST	0.105+0.016/ 0.1+1%	96	99	99	194	53.9	64.1
Pendimethalin/bentazon+sethoxydim +MSO+UAN	PRE/POST	1.5/0.5+0.1 +1%+2pt	98	98	98	193	52.0	63.9
Sulfentrazone+pendimethalin/ bentazon+sethoxydim+MSO+UAN	PRE/POST	0.07+0.75/ 0.5+0.1+1%+2pt	97	99	99	194	49.9	64.0
Pendimethalin/bentazon+sethoxydim +imazamox+MSO+UAN	PP/POST	1.5/0.2+0.04 +0.031+1%+2pt	98	99	99	204	22.5	52.7
Ethalfluralin/bentazon+sethoxydim +imazamox+MSO+UAN	PP/POST	0.75/1+0.2 +0.016+1%+2pt	90	99	99	195	45.8	63.7
Sulfentrazone/bentazon+sethoxydim +imazamox+MSO+UAN	PP/POST	0.14/1+0.2 +0.016+1%+2pt	92	99	99	194	40.3	63.9
Pendimethalin/bentazon+sethoxydim +imazamox+MSO+UAN	PP/POST	1.5/1.0+0.2 +0.016+1%+2pt	96	99	99	196	47.3	64.3
Linuron	PRE	0.5	40	79	88	193	43.0	64.0
Linuron	PRE	1	53	82	95	193	44.9	63.6
Diuron	PRE	1.88	57	48	83	193	46.7	64.1
KIH 485	PRE	0.15	57	68	82	193	49.8	64.3
Bentazon+sethoxydim+MSO+UAN	POST	1+0.2+1%+2pt	81	91	84	193	48.5	64.6
Bentazon+sethoxydim+MSO+UAN/ bentazon+sethoxydim+MSO+UAN	EPOST/ POST	0.5+0.1+1%+2pt/ 0.5+0.1+1%+2pt	76	96	97	194	49.8	64.0
Bentazon+sethoxydim+imazamox+ MSO+UAN	POST	1+0.2+0.016+ 1%+2pt	74	93	99	193	42.2	64.1
Bentazon+sethoxydim+imazamox+ MSO+UAN	POST	0.5+0.1+0.016+ 1%+2pt	78	98	99	196	36.6	64.2
C.V. (%)			8	13	8	1	9	6
LSD (0.05)			10	19	12	2	6.8	NS

[1]MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; Pendimethalin=ProwlH_2O, BASF; UAN=urea ammonium nitrate. The trial was treated on April 21 with a PRE burn-down application of glyphosate at 0.57 lb ae/A plus ammonium sulfate at 0.5% v/v.

[2]Fall=November 3, 2005; PP=April 21, 2006; PRE=April 27; EPOST=May 23; POST=June 5.

[3]Foxtail spp.=yellow and green; Pigweed spp.=redroot and prostrate.

[4]Plant maturity from planting date (Julian d 117).

Fluroxypyr plus clopyralid comparison to other postemergence herbicides in spring wheat. Don W. Morishita, Robyn C. Walton, and Michael P. Quinn. (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 weed control with a fluroxypyr and clopyralid premixed formulation when applied to spring wheat. 'Klassic' was planted April 28, 2006 at 115 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 (5.3% sand, 75.7% silt, and 18.9% clay) with a pH of 8.1, 1.95% organic matter, and CEC of 16.4-meq/100 g soil. Herbicides were applied May 19, 2006 with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 21 psi. Environmental conditions at application were as follows: air temperature 80 F, soil temperature 65 F, relative humidity 36%, wind speed 3 mph, and 15% cloud cover. Kochia (KCHSC), common lambsquarters (CHEAL), and redroot pigweed (AMARE) densities averaged 24, 8, and 2 plants/ft^2, respectively. Application began at 1145 hours. Crop injury only was evaluated 11 days after treatment (DAT) on May 30 and crop injury and weed control were evaluated visually 24 and 45 DAT on June 12 and July 3, respectively. Grain was harvested August 9 with a small-plot combine.

Crop injury ratings over three evaluation dates ranged from 0 to 11% with no difference among treatments on any date. Redroot pigweed control was ≥90% 24 DAT with all herbicide treatments. Most treatments continued to control redroot pigweed ≥87%, with the exception of fluroxypyr & bromoxynil and fluroxypyr + bromoxynil & MCPA at 45 DAT. Similarly kochia control ranged from 88 to 97% with all herbicide treatments 24 DAT. By 45 DAT kochia control with fluroxypyr & clopyralid + thifensulfuron at 0.187 lb ae/A + 0.014 lb ai/A, and fluroxypyr & bromoxynil had declined to <80%. Like the other two weeds, common lambsquarters control was better on the first evaluation date and declined to <80% with fluroxypyr & clopyralid and fluroxypyr & bromoxynil. Weed control with the fluroxypyr & bromoxynil combination declined 10% or more from the first to second evaluation date with all three weed species. All herbicide treatments yielded better than the untreated check and there was no yield difference among herbicide treatments. Grain yield among herbicide treatments ranged from 59 to 67 bu/A.

Table. Crop injury, weed control, and grain yield with broadleaf herbicides near Kimberly, Idaho.[1]

					Weed control[2]						
	Application	Crop injury			AMARE		KCHSC		CHEAL		Grain
Treatment[3]	rate	5/30	6/12	7/3	6/12	7/3	6/12	7/3	6/12	7/3	yield
	lb ai/A	%									bu/A
Check	-	-	-	-	-	-	-	-	-	-	33b
Fluroxypyr & clopyralid	0.187 lb ae/A	0a	5a	1a	92ef	87ab	94a	80a	88b	78cd	67a
Fluroxypyr & clopyralid + MCPA LVE	0.187 lb ae/A + 0.375 lb ae/A	0a	9a	0a	98bc	90a	94a	87a	96a	93ab	62a
Fluroxypyr & clopyralid + thifensulfuron + NIS	0.187 lb ae/A + 0.014 + 0.25 % v/v	4a	10a	3a	100a	96a	92a	79a	96a	95a	59a
Fluroxypyr & clopyralid + thifensulfuron & tribenuron TM + NIS	0.187 lb ae/A + 0.025+ 0.25 % v/v	4a	10a	3a	100a	97a	91a	80a	99a	94a	60a
Fluroxypyr & bromoxynil	0.312 lb ae/A	1a	8a	0a	90f	70c	95a	78a	86b	76d	61a
Fluroxypyr & bromoxynil + MCPA LVE	0.312 lb ae/A + 0.25 lb ae/A	3a	10a	3a	96cde	86ab	97a	84a	97a	88abc	59a
Fluroxypyr & bromoxynil + thifensulfuron & tribenuron BS + NIS	0.312 lb ae/A + 0.025 + 0.25 % v/v	3a	11a	0a	99ab	93a	95a	85a	98a	89ab	63a
Fluroxypyr & bromoxynil + thifensulfuron + NIS	0.312 lb ae/A + 0.014 + 0.25 % v/v	3a	9a	3a	100a	95a	95a	80a	93ab	83bcd	61a
Fluroxypyr + bromoxynil & MCPA	0.0625 + 0.5	1a	9a	0a	93def	78bc	95a	81a	95a	85a-d	63a
Fluroxypyr + 2,4-D LVE	0.094 + 0.375 lb ae/A	4a	10a	3a	97bcd	93a	95a	91a	93ab	93ab	63a

[1]Means followed by the same letter are not significantly different (P=0.05).
[2]Weeds evaluated for control were redroot pigweed (AMARE), kochia (KCHSC), and common lambsquarters (CHEAL).
[3]NIS is nonionic surfactant. Thifensulfuron & tribenuron TM is a 4:1 mixture of thifensulfuron and tribenuron in a 50% soluble granule formulation. Thifensulfuron & tribenuron BS is a 2:1 mixture of thifensulfuron and tribenuron in a 50% soluble granular formulation. Bromoxynil & MCPA is a 1:1 commercially formulated pre-mixture sold as Bronate Advanced. Fluroxypyr & clopyralid is a 1:1 commercially formulated pre-mixture sold as Widematch.

Comparison of pendimethalin and postemergence herbicides for weed control in spring wheat. Robyn C. Walton, Don W. Morishita, and Michael P. Quinn. (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 pendimethalin to several postemergence herbicides for weed control in spring wheat. 'Klassic' was planted April 22, 2006 at 115 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 (5.3% sand, 75.7% silt, and 18.9% clay) with a pH of 8.1, 1.95% organic matter, and CEC of 16.4-meq/100 g soil. Herbicides were broadcast-applied with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 10 gpa using 11001 flat fan nozzles. Additional environmental and application information is given in Table 1. Kochia (KCHSC), common lambsquarters (CHEAL), and redroot pigweed (AMARE) were the major weed species present. Crop injury and weed control were evaluated visually 18 and 34 days after last treatment (DALT), on June 12 and 28, respectively. Grain was harvested August 8 with a small-plot combine.

Table 1. Environmental conditions at application.

Application date	April 26	May 19	May 25
Application timing	pre	3 tillers	full tiller
Air temperature (F)	69	85	61
Soil temperature (F)	60	73	60
Relative humidity (%)	23	23	48
Wind velocity (mph)	6	6	6
Cloud cover (%)	10	50	1
Time of day	1445	1400	0930
Weed species/ft^2			
kochia	-	-	2
lambsquarters, common	-	-	5
pigweed, redroot	-	-	4

Crop injury ranged from 3 to 11% 18 DALT, on June 12. At 34 DALT, crop injury was ≤5% with no difference among herbicide treatments for either evaluation date (Table 2). Bromoxynil & MCPA-2 + fluroxypyr and pendimethalin + bromoxynil & MCPA-2 + fluroxypyr had the best overall kochia control for both evaluation dates averaging 100%. Pendimethalin applied alone pre-emergence had the poorest kochia control (53 and 41%) at 18 and 34 DALT. For all other treatments, kochia control averaged 87% at 18 DALT, but dropped to an average of 64% control 34 DALT. Common lambsquarters control was >90% for all herbicide treatments 18 and 34 DALT, with no difference among treatments. Redroot pigweed control ranged from 92 to 100% 34 DALT, except for pendimethalin applied alone pre-emergence, which averaged 73% and was lower than all other herbicide treatments. There was no difference in redroot pigweed control among treatments at the second (34 DALT) evaluation with control averaging 95%. Grain yield of herbicide treatments ranged from 46 to 69 bu/A and were all higher than the untreated check at 42 bu/A. Bromoxynil & MCPA + fluroxypyr and mesosulfuron & propoxycarbazone + bromoxynil & MCPA-1 + Destiny HC were among the highest yielding treatments at 69 and 68 bu/A, but were not significantly different from most of the other herbicide treatments.

Table 2. Crop injury, broadleaf weed control, and wheat yield in spring wheat near Kimberly, Idaho.[1]

Treatment[3]	Application rate	Application date	Crop injury 6/12	Crop injury 6/28	Weed control[2] KCHSC 6/12	KCHSC 6/28	CHEAL 6/12	CHEAL 6/28	AMARE 6/12	AMARE 6/28	Grain yield
	lb ai/A		%								bu/A
Check	-	-	-	-	-	-	-	-	-	-	42c
2, 4-D LVE-2 + AG06011	1.0 lb ae/A + 0.039	5/25	6a	5a	88b	63bc	96a	97a	96abc	94a	61ab
2, 4-D LVE-2 + bromoxynil & MCPA-1 + Interlock	1.0 lb ae/A + 0.5 + 0.0313	5/25	5a	3a	87b	65b	100a	99a	9bc	99a	59ab
2, 4-D LVE-2	1.0 lb ae/A	5/25	8a	5a	85b	63bc	99a	99a	92c	97a	59ab
2,4-D LVE-1	1.0 lb ae/A	5/25	4a	1a	80b	56c	97a	100a	96abc	91a	66a
Mesosulfuron & propoxycarbezone + bromoxynil & MCPA-1 + Destiny HC	0.0143 + 0.5 + 1.5 % v/v	5/25	6a	3a	87b	66b	99a	100a	100ab	99a	63a
Mesosulfuron & propoxycarbezone + bromoxynil & MCPA-1 + Destiny HC	0.0143 + 0.5 + 1.0 % v/v	5/25	9a	4a	90b	66b	99a	98a	100a	99a	59ab
Mesosulfuron & propoxycarbezone + bromoxynil & MCPA-1 + Destiny HC	0.0143 + 0.5 + 0.75 % v/v	5/25	9a	3a	90b	63bc	98a	93a	100ab	100a	68a
Mesosulfuron & propoxycarbezone + bromoxynil & MCPA-1 + Destiny HC + Interlock	0.0143 + 0.5 + 0.75 % v/v + 0.0313	5/25	6a	1a	90b	66b	99a	99a	99abc	98a	64a
Pendimethalin	0.95	4/26	3a	0a	53c	41d	96a	96a	73d	95a	46ab
Bromoxynil & MCPA-2 + fluroxypyr	0.5 + 0.094	5/19	6a	3a	100a	100a	99a	92a	94bc	92a	69a
Pendimethalin + bromoxynil & MCPA-2 + fluroxypyr	0.95 + 0.5 + 0.094	5/19	11a	3a	100a	100a	100a	100a	96abc	97a	66a

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

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

[3]2, 4-D LVE-1 is a commercial formulation of a 2, 4-D low volatile ester. 2, 4-D LVE-2 is an experimental formulation of a 2, 4-D low volatile ester. AG06011 is a proprietary deposition aid. Bromoxynil & MCPA-1 is a 1:1 commercially formulated pre-mixture sold as Bison. Bromoxynil & MCPA-2 is a 1:1 commercially formulated pre-mixture sold as Bronate Advanced. Mesosulfuron & propoxycarbezone is a 4:1 mixture of a commercially formulated pre-mixture sold as Rimfire. Interlock is a deposition and drift reducing agent. Destiny HC is a high surfactant methylated soy seed oil concentrate.

Broadleaf weed control in irrigated spring wheat with pyraflufen ethyl. Robyn C. Walton, Don W. Morishita, and Michael P. Quinn. (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 broadleaf weed control when pyraflufen ethyl was applied to spring wheat. 'Klassic' was planted April 22, 2006, at 115 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 (5.3% sand, 75.7% silt, and 18.9% clay) with a pH of 8.1, 1.95% organic matter, and CEC of 16.4-meq/100 g soil. Herbicides were applied May 16, 2006 with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 19 psi. Environmental conditions at application were as follows: air temperature 78 F, soil temperature 68 F, relative humidity 28%, wind speed 6 mph, and 70% cloud cover. Kochia (KCHSC), common lambsquarters (CHEAL), and redroot pigweed (AMARE) densities averaged 31, 12, and 1 plants/ft^2, respectively. Applications began at 1130 hours. Crop injury and weed control was evaluated visually 14 and 28 days after treatment (DAT), on May 30 and June 13. Grain was harvested August 9 with a small-plot combine.

Crop injury was $\leq$4% for the first evaluation (14 DAT) with no differences among treatments (Table). Crop injury at the second evaluation (28 DAT) ranged from 1 to 11%. Pyraflufen ethyl + NIS, pyraflufen ethyl + fluroxypyr + NIS, and pyraflufen ethyl + thifensulfuron & tribenuron + NIS had the least amount of injury (1%). Kochia control at the 14 and 28 DAT evaluations ranged from 36 to 98% and 31 to 98 %. For both evaluations, pyraflufen ethyl at 0.00081 lb ai/a + NIS had the lowest kochia control averaging 34 %. Bromoxynil & MCPA + fluroxypyr had the highest kochia control (98%), for both evaluations. Common lambsquarters control ranged from 86 to 100% 14 DAT, with no differences between treatments. At the 28 DAT evaluation, common lambsquarters control ranged from 89 to 97%. Redroot pigweed control averaged 94% with the exception of pyraflufen ethyl at 0.00081 lb ai/A + NIS, pyraflufen ethyl at 0.00081 lb ai/A + fluroxypyr at 0.094 lb ai/A + NIS, and pyraflufen ethyl at 0.00122 lb ai/A + NIS (78, 79, and 83%) statistically had the poorest control, but still showed very acceptable results. Grain yield of herbicide treatments ranged from 30 to 72 bu/A and were higher than the untreated check, which yielded 22 bu/A. Pyraflufen ethyl + bromoxynil & MCPA + thifensulfuron & tribenuron + NIS, pyraflufen ethyl + bromoxynil & MCPA + fluroxypyr + NIS, and bromoxynil & MCPA + fluroxypyr were among the highest yielding treatments averaging 71 bu/A.

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

				Weed control[2]					
	Application	Crop injury		KCHSC		CHEAL		AMARE	Grain
Treatment[3]	rate	5/30	6/13	5/30	6/13	5/30	6/13	6/13	yield
	lb ai/A	%							bu/A
Check	-	-	-	-	-	-	-	-	22i
Pyraflufen ethyl + NIS	0.00081 + 0.25 % v/v	0a	1d	36f	31f	92a	90bc	78b	30hi
Pyraflufen ethyl + bromoxynil & MCPA + NIS	0.00081 + 0.5 + 0.25 % v/v	1a	6bc	89abc	85abc	100a	93abc	93a	58a-f
Pyraflufen ethyl + thifensulfuron & tribenuron + NIS	0.00081 + 0.014 + 0.25 % v/v	1a	4cd	53ef	51e	99a	98a	94a	47a-g
Pyraflufen ethyl + 2,4-D LVE + NIS	0.00081 + 0.5 lb ae/A + 0.25 % v/v	3a	11a	90ab	90ab	99a	95ab	93a	63a-d
Pyraflufen ethyl + MCPA LVE + NIS	0.00081 + 0.5 lb ae/A + 0.25 % v/v	3a	6bc	65cde	73bcd	93a	89c	93a	43e-h
Pyraflufen ethyl + fluroxypyr + NIS	0.00081 + 0.094 + 0.25 % v/v	0a	1d	93ab	96a	89a	89c	79b	64abc
Pyraflufen ethyl + bromoxynil & MCPA + fluroxypyr + NIS	0.00081 + 0.5 + 0.094 + 0.25 % v/v	1a	4cd	96a	96a	100a	97a	95a	69ab
Pyraflufen ethyl + bromoxynil & MCPA + thifensulfuron & tribenuron + NIS	0.00081 + 0.5 + 0.014 + 0.25 % v/v	3a	8abc	89abc	93a	100a	96a	96a	72a
Pyraflufen ethyl + NIS	0.00122 + 0.25 % v/v	1a	4cd	54ef	54de	95a	95ab	83b	39gh

Table. Continued.[1]

Treatment[3]	Application rate	Crop injury 5/30	Crop injury 6/13	Weed control[2] KCHSC 5/30	KCHSC 6/13	CHEAL 5/30	CHEAL 6/13	AMARE 6/13	Grain yield
	lb ai/A	%							bu/A
Pyraflufen ethyl + bromoxynil & MCPA + fluroxypyr + NIS	0.00122 + 0.5 + 0.094 + 0.25 % v/v	0a	9ab	96a	95a	98a	96a	95a	70ab
Pyraflufen ethyl + bromoxynil & MCPA + thifensulfuron & tribenuron + NIS	0.00122 + 0.5 + 0.014 + 0.25 % v/v	4a	9ab	95ab	92a	99a	97a	96a	63a-d
Pyraflufen ethyl + 2,4-D LVE + NIS	0.00122 + 0.5 lb ae/A + 0.25 % v/v	3a	8abc	85a-d	89abc	96a	96a	94a	67abc
Pyraflufen ethyl + MCPA LVE + NIS	0.00122 + 0.5 lb ae/A + 0.25 % v/v	3a	8abc	80a-d	84abc	100a	97a	95a	54b-g
Pyraflufen ethyl + bromoxynil & MCPA + NIS	0.00122 + 0.5 + 0.25 % v/v	3a	9ab	93ab	93a	100a	94abc	93a	62a-d
Pyraflufen ethyl + thifensulfuron & tribenuron + NIS	0.00122 + 0.014 + 0.25 % v/v	1a	1d	64de	70cde	95a	96a	93a	52c-g
Bromoxynil & MCPA + fluroxypyr	0.5 + 0.094	0a	8abc	98a	98a	99a	96a	93a	70ab
Thifensulfuron & tribenuron + bromoxynil & MCPA	0.014 + 0.5	0a	10ab	94ab	93a	100a	98a	94a	68abc
2,4-D LVE	0.5 lb ae/A	0a	10ab	81a-d	90ab	96a	94abc	94a	59ae
MCPA LVE	0.5lb ae/A	0a	4cd	71b-e	71bcd	86a	90bc	96a	42fgh

[1]Means followed by the same letter are not significantly different (P=0.05).
[2]Weeds evaluated for control were kochia (KCHSC), common lambsquarters (CHEAL), and redroot pigweed (AMARE).
[3]NIS is a nonionic surfactant. Bromoxynil & MCPA is a 1:1 commercially formulated pre-mixture sold as Bronate Advanced. Thifensulfuron & tribenuron is a 2:1 commercially formulated pre-mixture of thifensulfuron and tribenuron in a 75% extrudable paste formulation sold as Harmony Extra XP.

Comparison of difenzoquat combinations to other herbicides for wild oat control in spring wheat. Don W. Morishita, Robyn C. Walton, and Michael P. Quinn. (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 difenzoquat alone and in combination with imazamethabenz, tralkoxydim, and fenoxaprop to current postemergence wild oat herbicides. 'Alpowa' was planted April 28, 2006 at 115 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 23 with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 21 psi. Environmental conditions at application were as follows: air temperature 65 F, soil temperature 61 F, relative humidity 29%, wind speed 9 mph, and 20% cloud cover Wild oat (AVEFA), and common lambsquarters (CHEAL) densities averaged 21 and 22 plants/ft^2, respectively. Application began at 1100 hours. Crop injury was evaluated visually 21 days after treatment (DAT) on June 13. Crop injury and weed control were evaluated visually 35 and 62 DAT on June 27 and July 24. Grain was harvested August 14 with a small-plot combine.

Crop injury 21 DAT ranged from 0 to 5% and was not different among treatments. At 35 DAT, crop injury appeared to increase and ranged from 3 to 15%. Difenzoquat in combination with fenoxaprop or tralkoxydim and tralkoxydim alone had the lowest crop injury level. By 62 DAT, little or no crop injury was evident and no difference among herbicide treatments was observed. Wild oat control at 35 DAT for all treatments except difenzoquat + tralkoxydim + Supercharge controlled wild oat 93% or better. Wild oat control at 62 DAT was ≥84% with fenoxaprop alone or in combination with fluroxypyr + thifensulfuron & tribenuron and fluroxypyr + thifensulfuron. Wild oat control was poorest (23%) with difenzoquat + tralkoxydim. Common lambsquarters control was best at both evaluation dates where a broadleaf herbicide such as fluroxypyr, thifensulfuron, tribenuron, or MCPA was included in the tank mixture. Grain yield followed a similar pattern as common lambsquarters control. The three highest yielding treatments included fenoxaprop plus a broadleaf herbicide combination and ranged from 61 to 67 bu/A.

Table. Crop injury, weed control and grain yield with fenoxaprop, difenzoquat combinations, and experimental herbicide for wild oat control in spring wheat near Kimberly, Idaho.[1]

					Weed control[2]				
	Application	Crop injury			AVEFA		CHEAL		Grain
Treatment[3]	rate	6/13	6/27	7/24	6/27	7/24	6/27	7/24	yield
	lb ai/A								bu/A
Check	-	-	-	-	-	-	-	-	23e
Fenoxaprop	0.0825	0a	9a-d	4a	99a	86ab	8bc	26c	47cd
Fenoxaprop + fluroxypyr + thifensulfuron & tribenuron TM	0.0825 + 0.094 + 0.025	0a	10a-d	1a	99a	89a	97a	100a	65a
Fenoxaprop + fluroxypyr + thifensulfuron	0.0825 + 0.094 + 0.014	1a	14ab	6a	99a	84abc	97a	98a	61ab
Fenoxaprop + fluroxypyr + MCPA LVE	0.0825 + 0.094 + 0.347	0a	10a-d	0a	97ab	74cd	100a	100a	67a
Difenzoquat + NIS	1.0 + 0.25 % v/v	3a	13abc	3a	99a	60ef	6bc	5d	41d
Difenzoquat + fenoxaprop + NIS	0.5 + 0.041 + 0.25 % v/v	1a	3d	0a	93b	50f	0c	3d	39d
Difenzoquat + tralkoxydim + Supercharge	0.5 + 0.1 + 0.5 % v/v	0a	5cd	0a	62c	23g	19bc	24c	40d
Difenzoquat + imazamethabenz + NIS	0.5 + 0.234 + 0.25 % v/v	5a	15a	3a	96ab	55f	25b	28c	42cd
Tralkoxydim + Supercharge	0.2 + 0.5 % v/v	0a	6bcd	1a	93b	69de	21bc	31c	52bc

[1]Means followed by the same letter are not significantly different (P=0.05).
[2]Weeds evaluated for weed control were wild oat (AVEFA) and common lambsquarters (CHEAL).
[3]NIS is nonionic surfactant. Thifensulfuron & tribenuron TM is a 4:1 mixture of thifensulfuron and tribenuron in a 50% soluble granular formulation. Supercharge is a proprietary adjuvant.

Comparing wild oat control in spring wheat with pinoxaden, clodinafop, and fenoxaprop. Robyn C. Walton, Don W. Morishita and Michael P. Quinn. (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 wild oat control in spring wheat with pinoxaden, clodinafop, and fenoxaprop applied alone and in combination with broadleaf herbicides. 'Alpowa' was planted April 28, 2006 at 115 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 May 23, 2006 with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 21 psi. Environmental conditions at application were as follows: air temperature 65 F, soil temperature 61 F, relative humidity 29%, wind speed 9 mph, and 20% cloud cover. Application began at 1000 hours. Wild oat (AVEFA), common lambsquarters (CHEAL), redroot pigweed (AMARE), and green foxtail (SETVI) densities averaged 2, 12, 7, and <1 plants/ft^2, respectively. Crop injury was evaluated visually 21 days after treatment (DAT) on June 13. Crop injury and weed control was evaluated visually 36, 48, and 62 (DAT) on June 28, July 10, and July 24. Grain was harvested August 14 with a small-plot combine.

Crop injury ranged from 0 to 10% for all four evaluations (21, 36, 48, and 62 DAT) with no differences among herbicide treatments (Table). Wild oat control ranged from 0 to 100% at 36, 48, and 62 DAT. Pinoxaden applied alone or in combination with broadleaf herbicides controlled wild oat 99%. Clodinafop + bromoxynil & MCPA + DSV and Clodinafop + fluroxypyr & clopyralid + MCPA-LVE + DSV had the poorest overall wild oat control averaging only 9%. Clodinafop + DSV without a broadleaf herbicide partner controlled wild oat 75 to 89% over the three evaluation dates. It is not known why wild oat control was so low with the clodinafop plus broadleaf herbicide combinations. Common lambsquarters control 36 DAT averaged 98% control for all treatments that included a broadleaf herbicide tank-mixture. Where only a wild oat herbicide was applied, common lambsquarters control was reduced to an average of 34% and remained about the same averaging 37% 48 and 62 DAT. Common lambsquarters control averaged ≥99% 48 and 62 DAT with the broadleaf herbicide tank-mixtures. Similar to common lambsquarters, redroot pigweed control 36 DAT ranged from 23 to 95% for all herbicide treatments. Again, where only a wild oat herbicide was applied, control was reduced. However, by 62 DAT, redroot pigweed control for all herbicide treatments had increased to an acceptable range of 76 to 100%. This is most likely due to poor redroot pigweed competitiveness. Green foxtail is typically not a problem in small grain cereals, but in this study control ranged from 79 to 100% 62 DAT. Treatments that included pinoxaden or fenoxaprop controlled green foxtail ≥95%. Grain yield for herbicide treatments ranged from 28 to 64 bu/A. All herbicide treatments had higher yields than the untreated check (25 bu/A) except clodinafop + fluroxypyr & clopyralid + MCPA-LVE + DSV which yielded 28 bu/A The low yield is attributed to poor wild oat control in that treatment. Pinoxaden in combination with bromoxynil & MCPA or fluroxypyr & clopyralid + MCPA were among the highest yielding treatments at 64 and 62 bu/A, respectively.

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

Treatment[3]	Application rate	Crop injury				Weed control[2] AVEFA			CHEAL			AMARE			SETVI	Grain yield
		6/13	6/28	7/10	7/24	6/28	7/10	7/24	6/28	7/10	7/24	6/28	7/10	7/24	7/24	
	lb ai/A	%														bu/A
Check	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25d
Pinoxaden + Adigor	0.054 + 9.6 fl oz/A	0a	6a	3a	1a	100a	100a	100a	21c	29c	26b	51b	69d	76c	100a	51bc
Pinoxaden + Adigor + bromoxynil & MCPA	0.054 + 9.6 fl oz/A + 0.5 lb ae/A	0a	9a	5a	3a	99a	99ab	97a	99a	99a	99a	84a	89b	82bc	95ab	64a
Pinoxaden + Adigor + fluroxypyr & clopyralid + MCPA-LVE	0.054 + 9.6 fl oz/A + 0.187 lb ae/A + 0.348 lb ae/A	0a	9a	4a	1a	100a	100a	96a	96a	100a	99a	88a	87bc	90ab	95ab	62ab
Fenoxaprop	0.05	0a	9a	5a	0a	96a	86bc	77b	40b	31c	38b	23c	80bcd	80bc	100a	44c
Fenoxaprop + bromoxynil & MCPA	0.05 + 0.5 lb ae/A	0a	6a	5a	1a	62b	42d	55b	97a	98a	99a	93a	88bc	91ab	97a	54abc
Fenoxaprop + fluroxypyr & clopyralid + MCPA-LVE	0.05 + 0.187 lb ae/A + 0.348 lb ae/A	0a	10a	4a	0a	68b	43d	53b	98a	100a	100a	86a	90b	89abc	96a	49c
Clodinafop + DSV	0.05 + 10.1 fl oz/A	0a	8a	5a	1a	89ab	80c	75b	40b	51b	47b	31bc	75cd	81bc	88bc	48c
Clodinafop + DSV + bromoxynil & MCPA	0.05 + 10.1 fl oz/A + 0.5 lb ae/A	0a	3a	5a	0a	17c	12e	12c	98a	100a	100a	94a	99a	100a	86cd	44c
Clodinafop + DSV + fluroxypyr & clopyralid + MCPA-LVE	0.05 + 10.1 fl oz/A + 0.187 lb ae/A + 0.348 lb ae/A	0a	4a	6a	0a	13c	0f	1d	99a	100a	100a	95a	100a	96ab	79d	28d

[1]Means followed by the same letter are not significantly different (P=0.05).
[2]Weeds evaluated for were wild oat (AVEFA), common lambsquarters (CHEAL), redroot pigweed (AMARE), and green foxtail (SETVI).
[3]Adigor is a proprietary adjuvant. Bromoxynil & MCPA is a 1:1 commercially formulated pre-mixture sold as Bronate Advanced. Fluroxypyr & clopyralid is a 1:1 commercially formulated pre-mixture sold as Widematch. DSV is a proprietary adjuvant.

Tolerance of imidazolinone-resistant winter and spring wheat to imazamox plus MCPA ester combinations. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established near Genesee, ID in imidazolinone-resistant winter and spring wheat to evaluate wheat response to imazamox plus MCPA ester combinations. 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). The winter wheat study was oversprayed with bromoxynil/MCPA at 0.75 lb ai/A to control broadleaf weeds. Wheat injury was evaluated visually. Wheat seed was harvested from the winter and spring wheat studies with a small plot combine on August 8 and 21, 2006, respectively .

Table 1. Application and soil data.

	Winter wheat study	Spring wheat study
Wheat variety	ID 587	Gunner
Wheat planting date	October 11, 2005	April 27, 2006
Application date	April 25, 2006	May 25, 2006
Wheat growth stage	3 tiller	1 tiller
Air temperature (F)	58	60
Relative humidity (%)	59	69
Wind (mph, direction)	2, SW	2, NW
Cloud cover (%)	70	80
Soil moisture	moist	moist
Soil temperature at 2 in (F)	47	60
Soil		
pH	5.2	5.2
OM (%)	3.7	3.4
CEC (meq/100g)	25	24
Texture	silt loam	silt loam

In the winter wheat study, imazamox plus MCPA ester combined with bromoxynil injured wheat 4% on May 11, 2006 (Table 2). By May 31, winter wheat injury was not visible in the imazamox plus MCPA ester plus bromoxynil treatment. The imazamox plus MCPA ester combination at the two highest rates injured winter wheat 14 to 28%. Winter wheat seed yield ranged from 93 to 110 bu/A and did not differ among treatments. Winter wheat seed test weight was lowest for the highest rate of imazamox plus MCPA ester (60.5 lb/bu) and did not differ from the bromoxynil treatment and all imazamox plus MCPA ester combinations, except the lowest rate.

In the spring wheat study, imazamox plus MCPA ester combined with dicamba injured spring wheat 4% on May 31, 2006 (Table 3). By June 22, all treatments injured spring wheat 4 to 17% but did not differ among treatments. Spring wheat seed yield was highest for imazamox alone treatment and did not differ from the untreated check. Spring wheat seed test weight ranged from 58.6 to 60.3 lb/bu and did not differ among treatments.

Table 2. Winter wheat response with imazamox and MCPA ester combinations near Genesee, Idaho in 2006.

Treatment[1]	Rate	Wheat injury		Wheat	
		May 11	May 31	Yield	Test weight
	lb ai/A	---------------%---------------		bu/A	lb/bu
Imazamox	0.039	0	0	101	61.9
MCPA ester	0.29	0	0	110	61.8
Imazamox +	0.039				
MCPA ester	0.29	0	0	98	62.4
Imazamox +	0.047				
MCPA ester	0.347	0	0	100	61.2
Imazamox +	0.078				
MCPA ester	0.58	0	14	96	61.2
Imazamox +	0.094				
MCPA ester	0.694	0	28	94	60.5
Imazamox +	0.039				
MCPA ester +	0.29				
bromoxynil	0.5	4	0	93	61.2
Imazamox +	0.039				
MCPA ester +	0.29				
fluroxypyr	0.125	0	0	107	61.3
Untreated check	--	--	--	103	62.0
LSD (0.05)		2	3	NS	0.7

[1]All treatments were applied with a non-ionic surfactant (R-11) at 0.25% v/v and urea ammonium nitrate (URAN) at 2.5% v/v.

Table 3. Spring wheat response with imazamox and MCPA ester combinations near Genesee, Idaho in 2006.

Treatment[1]	Rate	Wheat injury		Wheat	
		May 31	June 22	Yield	Test weight
	lb ai/A	---------------%---------------		bu/A	lb/bu
Imazamox	0.062	0	6	70	59.2
Imazamox +	0.062				
MCPA ester	0.46	0	5	62	58.9
Imazamox +	0.062				
MCPA ester +	0.46				
fluroxypyr	0.094	0	14	58	59.5
Imazamox +	0.062				
MCPA ester +	0.46				
fluroxypyr	0.188	0	4	60	59.1
Imazamox +	0.062				
MCPA ester +	0.46				
bromoxynil	0.25	0	10	58	59.8
Imazamox +	0.062				
MCPA ester +	0.46				
bromoxynil	0.5	0	8	59	59.3
Imazamox +	0.062				
MCPA ester +	0.46				
dicamba	0.063	4	4	60	58.6
Imazamox +	0.062				
MCPA ester +	0.46				
dicamba	0.125	4	9	56	59.7
Imazamox +	0.062				
MCPA ester +	0.46				
2,4-D amine	0.125	0	10	54	60.3
Imazamox +	0.062				
MCPA ester +	0.46				
2,4-D amine	0.25	0	17	51	59.9
Untreated check	--	--	--	68	59.4
LSD (0.05)		1	NS	7	NS

[1]All treatments were applied with a non-ionic surfactant (R-11) at 0.25% v/v and urea ammonium nitrate (URAN) at 2.5% v/v.

Downy brome 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 near Lewiston, Idaho in 'ID 587' imidazolinone-tolerant winter wheat to evaluate downy brome control and wheat response with metribuzin or flufenacet/metribuzin combinations and imazamox alone or plus MCPA ester combinations. All 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). In all experiments, wheat injury and downy brome control were evaluated visually during the growing season, and wheat seed was harvested on August 18, 2006.

Table 1. Application and soil data.

Study	Metribuzin or flufenacet/metribuzin		Imazamox
Application date	November 2, 2005	April 10, 2006	April 17, 2006
Growth stage			
Wheat	preemergence	4 to 5 lf	4 to 5 lf
Downy brome (BROTE)	preemergence	2 to 3 lf	2 to 3 lf
Air temperature (F)	53	52	55
Relative humidity (%)	70	54	54
Wind (mph, direction)	3, NW	3, SE	1, SE
Cloud cover (%)	100	40	40
Soil moisture	moist	moist	moist
Soil temperature at 2 in (F)	50	45	45
pH		5.6	
OM (%)		3.9	
CEC (meq/100g)		22	
Texture		silt loam	

In the metribuzin or flufenacet/metribuzin combination study, no treatment visually injured winter wheat (data not shown). Downy brome control was best with flufenacet/metribuzin combined with propoxycarbazone/mesosulfuron (87%) but did not differ from preemergence applied metribuzin combined with propoxycarbazone plus metribuzin applied at the 2 to 3 leaf growth stage (60%) (Table 2). Wheat seed yield did not differ among treatments, but tended to be lowest in the untreated check (27 bu/A). Wheat seed test weight ranged from 53.6 to 56.5 lb/bu and did not differ among treatments.

In the imazamox alone or plus MCPA ester study, no treatment injured wheat (data not shown). All treatments controlled downy brome 51 to 66%, except pendimethalin or thifensulfuron/tribenuron alone (Table 3). Wheat seed yield was lowest for the untreated check and pendimethalin or thifensulfuron/tribenuron alone, but did not differ from imazamox plus MCPA ester alone and thifensulfuron/tribenuron combinations, except with imazamox alone. Wheat seed test weight was highest for the untreated check but did not differ from pendimethalin alone, imazamox plus MCPA ester alone, or thifensulfuron/tribenuron alone or combined with imazamox plus MCPA ester.

Table 2. Downy brome control and wheat response with metribuzin and flufenacet/metribuzin near Lewiston, Idaho in 2006.

Treatment[1]	Rate	Application timing[2]	Downy brome control[3]	Wheat	
				Yield	Test weight
	lb ai/A		%	bu/A	lb/bu
Flufenacet/metribuzin	0.425	preemergence	40	42	55.8
Flufenacet/metribuzin +	0.425	preemergence			
propoxycarbazone +	0.04	2 to 3 leaf			
metribuzin +	0.188				
NIS	0.25% v/v		50	41	53.6
Flufenacet/metribuzin +	0.425	preemergence			
propoxycarbazone/mesosulfuron +	0.044	2 to 3 leaf			
UAN +	2 qt/A				
NIS	0.5% v/v		87	44	54.3
Metribuzin +	0.28	preemergence			
propoxycarbazone +	0.04	2 to 3 leaf			
metribuzin +	0.188				
NIS	0.25% v/v		60	40	55.1
Metribuzin +	0.28	preemergence			
propoxycarbazone/mesosulfuron +	0.044	2 to 3 leaf			
metribuzin +	0.188				
NIS	0.5% v/v		59	38	54.6
Propoxycarbazone +	0.04				
metribuzin +	0.188				
NIS	0.25% v/v	2 to 3 leaf	43	39	56.5
Propoxycarbazone/mesosulfuron +	0.044				
UAN +	2 qt/A				
NIS	0.5% v/v	2 to 3 leaf	56	42	55.3
Untreated check	--		--	27	56.3
LSD (0.05)			27	NS	NS
Density (plants/ft^2)			15		

[1]NIS is 90% nonionic surfactant (R-11) and UAN is urea ammonium nitrate (URAN).
[2]Application timing based on downy brome growth stage.
[3]June 20, 2006 evaluation.

Table 3. Downy brome control and wheat response with imazamox plus MCPA ester combinations near Lewiston, Idaho in 2006.

Treatment[1]	Rate	Downy brome control[2]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Imazamox	0.031	55	43	54.3
Imazamox + MCPA ester	0.031 + 0.23	62	36	55.8
Imazamox +	0.031			
UAN	30% v/v	64	47	54.6
Imazamox + MCPA ester +	0.031 + 0.23			
UAN	30% v/v	60	41	54.4
Imazamox +	0.031			
AMS	15 lb ai/100 gal	56	44	54.3
Imazamox + MCPA ester +	0.031 + 0.23			
AMS	15 lb ai/100 gal	66	42	55.0
Pendimethalin	0.76	12	28	56.7
Imazamox +	0.031			
pendimethalin	0.76	54	43	53.4
Imazamox + MCPA ester +	0.031 + 0.23			
pendimethalin	0.76	65	46	54.3
Thifensulfuron/tribenuron	0.0188	15	28	56.8
Thifensulfuron/tribenuron +	0.0188			
imazamox	0.031	62	44	54.2
Thifensulfuron/tribenuron +	0.0188			
imazamox + MCPA ester	0.031 + 0.23	60	37	55.9
Thifensulfuron/tribenuron +	0.0188			
imazamox +	0.031			
UAN	30% v/v	51	37	53.9
Thifensulfuron/tribenuron +	0.0188			
imazamox + MCPA ester +	0.031 + 0.23			
UAN	30% v/v	51	36	55.1
Propoxycarbazone	0.04	54	45	54.6
Untreated check	--	--	30	57.3
LSD (0.05)		19	10	2.1
Density (plants/ft^2)		15		

[1]Non ionic surfactant (R-11) was applied at 0.25% v/v with all treatments except pendimethalin alone. Urea ammonium nitrate (URAN) was applied at 2.5% v/v with all imazamox treatments, except with UAN at 30% v/v or AMS. MCPA ester rate is in lb ae/A.

[2]June 20, 2006 evaluation.

Rattail fescue and *Bromus* species 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 in imidazolinone-tolerant winter wheat to evaluate wheat response, rattail fescue and *Bromus* species control and with 1) grass herbicides combined with metribuzin; 2) imazamox plus MCPA ester combinations; and 3) flufenacet/metribuzin and pendimethalin combinations. 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). To control broadleaf weeds, studies were oversprayed with thifensulfuron/tribenuron at 0.0156 lb ai/A and bromoxynil/MCPA at 0.5 lb ai/A at the grass herbicide study on May 10; and prosulfuron at 0.0178 lb ai/A and MCPA amine at 0.35 lb ai/A at the flufenacet/metribuzin and pendimethalin combination study on May 25, 2006. Weed control was evaluated visually. Wheat seed was harvested with a small plot combine in the imazamox combination study on August 18, 2006. Wheat seed was not harvested in the flufenacet/metribuzin and pendimethalin combination study due to non-uniform winter wheat stand and in the grass herbicide study due to poor rattail fescue control.

Table 1. Application and soil data.

	Grass herbicides study	Imazamox study		Flufenacet/metribuzin and pendimethalin study	
Location	Grangeville, Idaho	Lewiston, Idaho		Lewiston, Idaho	
Application date	4/21/06	11/2/05	4/12/06	11/2/05	4/12/06
Winter wheat variety	OR CF101	ID 587		ID 587	
Growth stage					
Winter wheat	2 tiller	preemergence	3 to 4 lf	preemergence	3 to 4 lf
Rattail fescue (VLPMY)	1 tiller	preemergence	4 to 5 leaf	preemergence	4 to 5 leaf
Downy brome (BROTE)	1 tiller	preemergence	2 to 4 leaf	preemergence	2 to 4 leaf
Field brome (BROAV)	1 tiller	--	--	--	--
Air temperature (F)	61	52	61	52	61
Relative humidity (%)	57	70	60	70	60
Wind (mph, direction)	5, NE	1, NW	1, NE	1, NW	1, NE
Cloud cover (%)	90	100	100	100	100
Soil moisture	wet	moist	wet	moist	wet
Soil temperature at 2 in (F)	49	50	50	50	50
pH	5.0	5.4			
OM (%)	6.2	3.3			
CEC (meq/100g)	34	24			
Texture	silt loam	silt loam			

In the grass herbicides combined with metribuzin study, no treatment visually injured wheat (data not shown). Imazamox treatments and propoxycarbazone plus metribuzin controlled downy brome best (93 to 97%) but did not differ from propoxycarbazone/mesosulfuron treatments and sulfosulfuron or propoxycarbazone alone (77 to 87%) (Table 2). All treatments controlled field brome 88 to 98%, except flufenacet/metribuzin, metribuzin alone or combined with flufenacet/metribuzin. Rattail fescue control did not differ among treatments, but tended to be higher with flucarbazone alone or sulfosulfuron plus metribuzin (70 and 73%).

In the imazamox combination study, no treatment visually injured wheat (data not shown). All treatments controlled downy brome 99% except flufenacet/metribuzin, and pendimethalin or thifensulfuron/tribenuron alone (Table 3). Rattail fescue control did not differ among treatments, but tended to be higher with pendimethalin combinations (70 and 71%). Wheat seed yield did not differ among treatments or from the untreated check and ranged from 31 to 46 bu/A. Wheat seed test weight was greater for imazamox plus AMS and the untreated check (59.3 and 59.4 lb/bu) than flufenacet/metribuzin and imazamox plus thifensulfuron/tribenuron alone or combined with UAN at 30% v/v with and without MCPA ester. (57.4 to 58.0 lb/bu).

In the flufenacet/metribuzin and pendimethalin combination study, no treatment visually injured wheat (data not shown). Flufenacet/metribuzin plus sulfosulfuron controlled rattail fescue best at 91% but did not differ from sulfosulfuron alone or flufenacet/metribuzin combined with mesosulfuron or propoxycarbazone/mesosulfuron (76%) (Table 4).

Table 2. Bromus species and rattail fescue control with grass herbicides combined with metribuzin near Grangeville, ID in 2006.

Treatment[1]	Rate	Weed control BROTE[2]	Weed control BROAV[3]	Weed control VLPMY[3,4]
	lb ai/A	%		
Metribuzin	0.25	47	49	20
Flufenacet/metribuzin	0.425	42	62	30
Flufenacet/metribuzin +	0.425			
metribuzin	0.1875	39	26	52
Sulfosulfuron +	0.031			
NIS +	0.5% v/v			
UAN	5% v/v	77	90	39
Sulfosulfuron +	0.031			
NIS +	0.5% v/v			
UAN +	5% v/v			
metribuzin	0.1875	47	94	73
Propoxycarbazone +	0.04			
NIS	0.5% v/v	87	96	33
Propoxycarbazone +	0.04			
NIS +	0.5% v/v			
metribuzin	0.1875	93	96	58
Propoxycarbazone/mesosulfuron +	0.0246			
NIS	0.5% v/v	82	98	40
Propoxycarbazone/mesosulfuron +	0.0246			
NIS +	0.5% v/v			
metribuzin	0.1875	81	98	47
Flucarbazone +	0.027			
NIS +	0.25% v/v			
UAN	5% v/v	62	98	70
Flucarbazone +	0.027			
NIS +	0.25% v/v			
UAN +	5% v/v			
metribuzin	0.1875	51	98	55
Imazamox +	0.04			
NIS +	0.25% v/v			
UAN	2.5% v/v	96	93	53
Imazamox +	0.04			
NIS +	0.25% v/v			
UAN +	2.5% v/v			
flufenacet/metribuzin	0.425	97	88	52
LSD (0.05)		31	19	NS
Density (plants/ft^2)		5	3	15

[1]NIS is a non-ionic surfactant (R-11). UAN is urea ammonium nitrate (URAN).
[2]May 25, 2006 evaluation date.
[3]June 21, 2006 evaluation date.
[4]Three replications analyzed due to a low population of rattail fescue in fourth replicate.

Table 3. Downy brome and rattail fescue control and wheat response with imazamox plus MCPA ester combinations near Lewiston, Idaho in 2006.

Treatment[1]	Rate	Application timing[2]	Weed control BROTE[3]	Weed control VLPMY[4]	Wheat Yield	Wheat Test weight
	lb ai/A		----------%----------		bu/A	lb/bu
Imazamox	0.039	2 to 4 leaf	99	66	42	58.9
Imazamox + MCPA ester	0.039 + 0.29	2 to 4 leaf	99	66	36	58.3
Imazamox +	0.039					
UAN	30% v/v	2 to 4 leaf	99	58	41	58.6
Imazamox + MCPA ester +	0.039 + 0.29					
UAN	30% v/v	2 to 4 leaf	99	66	43	58.6
Imazamox +	0.039					
AMS	15 lb ai/100 gal	2 to 4 leaf	99	51	42	59.3
Imazamox + MCPA ester +	0.039 + 0.29					
AMS	15 lb ai/100 gal	2 to 4 leaf	99	54	46	58.7
Pendimethalin	0.76	2 to 4 leaf	45	42	38	59.1
Imazamox +	0.039					
pendimethalin	0.76	2 to 4 leaf	99	71	41	59.0
Imazamox + MCPA ester +	0.039 + 0.29					
pendimethalin	0.76	2 to 4 leaf	99	70	46	58.8
Thifensulfuron/tribenuron	0.0188	2 to 4 leaf	20	38	41	58.9
Thifensulfuron/tribenuron +	0.0188					
imazamox	0.039	2 to 4 leaf	99	52	31	57.7
Thifensulfuron/tribenuron +	0.0188					
imazamox + MCPA ester	0.039 + 0.29	2 to 4 leaf	99	65	42	58.3
Thifensulfuron/tribenuron +	0.0188					
imazamox +	0.039					
UAN	30% v/v	2 to 4 leaf	99	55	37	57.4
Thifensulfuron/tribenuron +	0.0188					
imazamox + MCPA ester +	0.039 + 0.29					
UAN	30% v/v	2 to 4 leaf	99	60	33	58.0
Flufenacet/metribuzin	0.425	preemergence	20	51	35	58.0
Untreated check	--	--	--	--	39	59.4
LSD (0.05)			17	NS	NS	1.2
Density (plants/ft^2)			5	10		

[1]Non ionic surfactant (R-11) was applied at 0.25% v/v with all treatments except pendimethalin alone. Urea ammonium nitrate (URAN) was applied at 2.5% v/v with all imazamox treatments, except with UAN at 30% v/v or AMS. MCPA ester rate is in lb ae/A.
[2]Application timing based on winter wheat growth stage.
[3]May 19, 2006 evaluation.
[4]June 20, 2006 evaluation.

Table 4. Rattail fescue control with metribuzin/flufenacet and pendimethalin combinations near Lewiston, ID in 2006.

Treatment[1]	Rate	Application timing[2]	Rattail fescue control[3]
	lb ai/A		%
Flufenacet/metribuzin	0.425	preemergence	48
Pendimethalin	0.75	preemergence	35
Flufenacet/metribuzin +	0.425		
pendimethalin	0.1875	preemergence	66
Sulfosulfuron +	0.031		
NIS +	0.5% v/v		
UAN	5% v/v	4 to 5 leaf	76
Mesosulfuron +	0.0134		
NIS +	0.5% v/v		
UAN	5% v/v	4 to 5 leaf	42
Propoxycarbazone +	0.04		
NIS +	0.5% v/v		
UAN	5% v/v	4 to 5 leaf	38
Propoxycarbazone/mesosulfuron +	0.0246		
NIS +	0.5% v/v		
UAN	5% v/v	4 to 5 leaf	30
Flufenacet/metribuzin	0.425	preemergence	
sulfosulfuron +	0.031	4 to 5 leaf	
NIS +	0.5% v/v		
UAN +	5% v/v		91
Flufenacet/metribuzin	0.425	preemergence	
mesosulfuron +	0.0134	4 to 5 leaf	
NIS +	0.5% v/v		
UAN	5% v/v		76
Flufenacet/metribuzin	0.425	preemergence	
propoxycarbazone +	0.04	4 to 5 leaf	
NIS +	0.5% v/v		
UAN	5% v/v		62
Flufenacet/metribuzin	0.425	preemergence	
propoxycarbazone/mesosulfuron +	0.0246	4 to 5 leaf	
NIS +	0.5% v/v		
UAN	5% v/v		76
Pendimethalin	0.75	preemergence	
sulfosulfuron +	0.031	4 to 5 leaf	
NIS +	0.5% v/v		
UAN +	5% v/v		65
Pendimethalin	0.75	preemergence	
mesosulfuron +	0.0134	4 to 5 leaf	
NIS +	0.5% v/v		
UAN	5% v/v		48
Pendimethalin	0.75	preemergence	
propoxycarbazone +	0.04	4 to 5 leaf	
NIS +	0.5% v/v		
UAN	5% v/v		40
Pendimethalin	0.75	preemergence	
propoxycarbazone/mesosulfuron +	0.0246	4 to 5 leaf	
NIS +	0.5% v/v		
UAN	5% v/v		41
LSD (0.05)			22
Density (plants/ft^2)			18

[1]NIS is a non-ionic surfactant (R-11). UAN is urea ammonium nitrate (URAN).
[2]Application timing based on rattail fescue growth stage.
[3]June 20, 2006 evaluation date.

Rattail fescue and Italian ryegrass control in winter wheat with pendimethalin combinations. 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 and Pullman, WA to evaluate rattail fescue and Italian ryegrass control, respectively, in winter wheat with pendimethalin combinations. 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 Pullman site was oversprayed with thifensulfuron/tribenuron at 0.0188 lb ai/A on May 9, 2006 to control broadleaf weeds. Weed control was evaluated visually. Winter wheat seed at the Pullman and Lewiston sites was harvested with a small plot combine on August 7 and 18, 2006, respectively.

Table 1. Application and soil data.

Location	Lewiston, Idaho			Pullman, Washington	
Winter wheat variety	ID 587			Madsen/Malcolm blend	
Winter wheat planting date	October 27, 2005			October 7, 2005	
Application date	11/2/05	3/30/06	4/12/06	4/27/06	5/9/06
Growth stage					
Winter wheat	preemergence	2 to 3 leaf	3 to 5 leaf	3 tiller	3 tiller
Rattail fescue	preemergence	2 to 3 leaf	4 to 5 leaf	--	--
Italian ryegrass	--	--	--	2 tiller	3 tiller
Air temperature (F)	52	61	55	60	54
Relative humidity (%)	70	44	70	52	50
Wind (mph, direction)	1, NW	3, NW	3, NW	3, W	1, W
Cloud cover (%)	100	80	90	30	10
Soil moisture	moist	dry	wet	moist	dry
Soil temperature at 2 in (F)	50	44	47	50	48
Soil					
pH	5.4			5.4	
OM (%)	3.3			3.2	
CEC (meq/100g)	24			19	
Texture	silt loam			silt loam	

At the Lewiston site, no treatment visually injured winter wheat (data not shown). Flufenacet/metribuzin treatments and sulfosulfuron treatments applied at the 2 to 3 leaf stage controlled rattail fescue better (68 to 71%) than pendimethalin alone, propoxycarbazone treatments applied at the 2 to 3 leaf stage and mesosulfuron treatments applied at the 3 to 5 leaf stage (26 to 40%) (Table 2). The addition of pendimethalin with any treatment did not improve weed control. Wheat seed yield and test weight ranged from 24 to 41 bu/A and 54.8 to 56.7 lb/bu, respectively, and did not differ among treatments.

At the Pullman site, no treatment visually injured winter wheat (data not shown). Italian ryegrass was controlled 78 to 87% with mesosulfuron treatments (Table 3). The addition of pendimethalin with any treatment did not improve weed control. No other treatment controlled Italian ryegrass. Wheat seed yield and test weight ranged from 103 to 115 bu/A and 60.2 to 61.9 lb/bu, respectively, and did not differ among treatments.

Table 2. Rattail fescue control and winter wheat response with pendimethalin combinations near Lewiston, ID in 2006.

Treatment[1]	Rate	Application Timing[2]	Rattail fescue control[3]	Winter wheat Yield	Winter wheat Test weight
	lb ai/A		%	bu/A	lb/bu
Pendimethalin	1.25	preemergence	30	24	55.7
Flufenacet/metribuzin	0.425	preemergence	69	35	55.8
Flufenacet/metribuzin + pendimethalin	0.425 1.25	preemergence	68	32	54.8
Sulfosulfuron	0.031	2 to 3 leaf	71	36	56.2
Sulfosulfuron + pendimethalin	0.031 1.25	2 to 3 leaf	69	41	55.1
Propoxycarbazone	0.04	2 to 3 leaf	26	35	55.6
Propoxycarbazone + pendimethalin	0.04 1.25	2 to 3 leaf	40	30	55.6
Mesosulfuron	0.013	2 to 3 leaf	44	30	56.7
Mesosulfuron + pendimethalin	0.013 1.25	2 to 3 leaf	47	39	56.5
Sulfosulfuron	0.031	3 to 5 leaf	50	34	55.5
Sulfosulfuron + pendimethalin	0.031 1.25	3 to 5 leaf	49	32	56.7
Propoxycarbazone	0.04	3 to 5 leaf	46	29	56.0
Propoxycarbazone + pendimethalin	0.04 1.25	3 t o5 leaf	48	35	55.9
Mesosulfuron	0.013	3 to 5 leaf	38	25	56.0
Mesosulfuron + pendimethalin	0.013 1.25	3 to 5 leaf	28	32	55.6
Untreated check	--	--	--	34	56.0
LSD (0.05)			28	NS	NS
Density (plants/ft²)			20		

[1]A non-ionic surfactant (R-11) was applied at 0.25%v/v with propoxycarbazone and 0.5%v/v with sulfosulfuron and mesosulfuron. Urea ammonium nitrate (URAN) at 2 qt/A was applied with mesosulfuron.
[2]Application timing is based on rattail fescue growth stage.
[3]June 20, 2006 evaluation date.

Table 3. Italian ryegrass control and winter wheat response with pendimethalin combinations near Pullman, WA in 2006.

Treatment[1]	Rate	Application Timing[2]	Italian ryegrass control[3]	Winter wheat Yield	Winter wheat Test weight
	lb ai/A		%	bu/A	lb/bu
Sulfosulfuron	0.031	2 tiller	17	111	61.8
Sulfosulfuron +	0.031				
pendimethalin	1.25	2 tiller	18	108	61.7
Propoxycarbazone	0.04	2 tiller	3	108	60.9
Propoxycarbazone +	0.04				
pendimethalin	1.25	2 tiller	7	108	61.2
Mesosulfuron	0.013	2 tiller	87	113	61.9
Mesosulfuron +	0.013				
pendimethalin	1.25	2 tiller	85	115	60.9
Sulfosulfuron	0.031	3 tiller	18	108	60.2
Sulfosulfuron +	0.031				
pendimethalin	1.25	3 tiller	18	108	61.5
Propoxycarbazone	0.04	3 tiller	22	108	60.5
Propoxycarbazone +	0.04				
pendimethalin	1.25	3 tiller	23	103	60.5
Mesosulfuron	0.013	3 tiller	78	104	60.7
Mesosulfuron +	0.013				
pendimethalin	1.25	3 tiller	83	113	61.0
Untreated check	--	--	--	110	61.9
LSD (0.05)			16	NS	NS
Density (plants/ft^2)			10		

[1]A non-ionic surfactant (R-11) was applied at 0.25%v/v with propoxycarbazone and 0.5%v/v with sulfosulfuron and mesosulfuron. Urea ammonium nitrate (URAN) at 2 qt/A was applied with mesosulfuron.
[2]Application timing is based on Italian ryegrass growth stage.
[3]June 29, 2006 evaluation date.

Wild oat 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 in winter wheat to evaluate wild oat control with 1) flucarbazone combinations 2) pinoxaden combined with broadleaf herbicides, and 3) grass herbicides combined with a one to one or a one to four ratio of thifensulfuron to tribenuron. 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 flucarbazone study was oversprayed with bromoxynil/MCPA at 0.5 lb ai/A on May 16, 2006 to control broadleaf weeds. Wheat injury and wild oat control were evaluated visually during the growing season. Wheat seed was harvested with a small plot combine at the flucarbazone study on August 8 and the pinoxaden and thifensulfuron and tribenuron studies on August 10, 2006.

Table 1. Application and soil data.

	Flucarbazone study		Pinoxaden study		Thifensulfuron and tribenuron study
Location	Genesee, Idaho		Moscow, Idaho		Moscow, Idaho
Winter wheat variety	Hiller		ID 587		ID 587
Application date	5/5/06	5/15/06	5/5/06	5/15/06	5/3/06
Growth stage					
Winter wheat	3 tiller	jointing	3 tiller	6 tiller	3 tiller
Wild oat	2 leaf	3 leaf	2 leaf	4 leaf	2 leaf
Air temperature (F)	54	82	71	72	64
Relative humidity (%)	63	44	32	55	36
Wind (mph, direction)	3, E	2, E	2, E	3, E	3, E
Cloud cover (%)	0	0	0	10	40
Soil moisture	moist	dry	dry	dry	dry
Soil temperature at 2 in (F)	48	62	60	70	58
pH	5.5		5.2		
OM (%)	4.6		3.5		
CEC (meq/100g)	28		20		
Texture	silt loam		silt loam		

In the flucarbazone study, flucarbazone combined with URAN at 50% v/v injured wheat 8 and 10% (Table 2). Difenzoquat and all flucarbazone treatments controlled wild oat 94 to 97%. Wild oat control was 89% with mesosulfuron. Wheat seed yield and test weight did not differ among treatments and ranged from 90 to 96 bu/A and 57.7 to 58.8 lb/bu, respectively.

In the pinoxaden study, no treatment visually injured winter wheat (data not shown). All pinoxaden treatments and fenoxaprop controlled wild oat 91 to 97% (Table 3). Wild oat control did not decrease when pinoxaden was combined with broadleaf herbicides (91 to 97%) or increase with UAN (97%) compared to pinoxaden alone (96%). Clodinafop, difenzoquat, and tralkoxydim treatments suppressed wild oat 46 to 74%. Wheat seed yield tended to be reduced by the addition of most broadleaf herbicides compared to pinoxaden alone. Wheat seed yield of fenoxaprop, clodinafop, difenzoquat and tralkoxydim treatments was less than pinoxaden alone. Wheat seed test weight was less for pinoxaden plus thifensulfuron and MCPA ester, clodinafop, difenzoquat, and tralkoxydim treatments than pinoxaden alone.

In the thifensulfuron and tribenuron study, no treatment injured winter wheat (data not shown). The addition of thifensulfuron and tribenuron at the one to one ratio reduced wild oat control 22% compared to clodinafop alone at the high rate (Table 4). Wheat seed yield and test weight were not affected by the addition of thifensulfuron and tribenuron compared to all grass herbicides alone at all rate.

Table 2. Wild oat control and wheat response in winter wheat with flucarbazone combined with various adjuvants near Genesee, Idaho in 2006.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	Wild oat control[4]	Wheat Yield	Wheat Test weight
	lb ai/A		%	%	bu/A	lb/bu
Flucarbazone +	0.027					
R-11	0.25 % v/v	2 leaf	0	97	91	58.5
Flucarbazone +	0.027					
R-11 +	0.25 %v/v					
Bronc	15 lb ai/100 gal	2 leaf	0	97	91	58.2
Flucarbazone +	0.027					
R-11 +	0.25% v/v					
URAN	50% v/v	2 leaf	8	97	95	57.7
Flucarbazone +	0.027					
Super Spread MSO +	1.5 pt/A					
URAN	50% v/v	2 leaf	10	97	96	58.6
Flucarbazone +	0.027					
Super Spread MSO +	1.5 pt/A					
Bronc	15 lb ai/100 gal	2 leaf	0	94	93	58.4
Flucarbazone +	0.018					
Super Spread MSO +	1.5 pt/A					
Bronc	15 lb ai/100 gal	2 leaf	0	97	94	58.3
Flucarbazone +	0.027					
R-11 +	0.25% v/v					
metribuzin	0.14	2 leaf	0	97	95	58.2
Flucarbazone +	0.027					
R-11 +	0.25% v/v					
metribuzin	0.19	2 leaf	0	97	91	58.3
Flucarbazone +	0.027					
R-11 +	0.25% v/v					
Bronc Max	0.5% v/v	2 leaf	0	97	92	58.8
Flucarbazone +	0.027					
Renegade	1.75 pt/A	2 leaf	0	97	93	58.2
Flucarbazone +	0.018					
Renegade +	1.75 pt/A					
In-Place	2 oz/A	2 leaf	1	97	92	58.2
Mesosulfuron +	0.0089					
R-11 +	0.5% v/v					
URAN	2 qt/A	2 leaf	0	89	96	58.1
Difenzoquat	1	3 leaf	0	97	90	58.5
Untreated check	--	--	--	--	93	58.0
LSD (0.05)			2	4	NS	NS
Density (plants/ft^2)				4		

[1]R-11 is 90% nonionic surfactant (NIS); Bronc is ammonium sulfate; URAN is urea ammonium nitrate; Super Spread MSO is nonionic surfactant + modified vegetable oil; Bronc Max is ammonium sulfate + citric acid; Renegade is a modified vegetable oil/NIS/NH_4/buffer; and In-Place is a deposition aid.

[2]Application timing based on wild oat growth stage.

[3]May 11, 2006 evaluation.

[4]July 10, 2006 evaluation.

Table 3. Wild oat control and winter wheat response with pinoxaden combinations near Moscow, Idaho in 2006.

Treatment[1]	Rate	Application timing[2]	Wild oat control[3]	Wheat Yield	Wheat Test weight
	lb ai/A		%	bu/A	lb/bu
Pinoxaden	0.054	2 leaf	96	76	61.3
Pinoxaden +	0.054				
UAN	50% v/v	2 leaf	97	72	61.0
Pinoxaden +	0.054				
Bronate Advanced	0.75	2 leaf	96	67	61.3
Pinoxaden +	0.054				
MCPA ester	0.348	2 leaf	97	72	61.6
Pinoxaden +	0.054				
MCPA amine	0.347	2 leaf	94	63	61.1
Pinoxaden +	0.054				
fluroxypyr	0.125	2 leaf	97	68	61.4
Pinoxaden +	0.054				
thifensulfuron	0.023	2 leaf	97	72	61.3
Pinoxaden +	0.054				
thifensulfuron +	0.023				
Bronate Advanced	0.75	2 leaf	95	63	61.3
Pinoxaden +	0.054				
thifensulfuron +	0.023				
Bronate Advanced +	0.75				
UAN	50% v/v	2 leaf	96	60	61.1
Pinoxaden +	0.054				
thifensulfuron +	0.023				
MCPA ester	0.348	2 leaf	96	62	60.8
Pinoxaden +	0.054				
thifensulfuron +	0.023				
MCPA amine	0.347	2 leaf	91	68	61.3
Pinoxaden +	0.054				
thifensulfuron +	0.023				
fluroxypyr	0.125	2 leaf	96	70	61.3
Pinoxaden +	0.054				
prosulfuron	0.018	2 leaf	94	66	61.4
Pinoxaden +	0.054				
prosulfuron +	0.018				
Bronate Advanced	0.75	2 leaf	96	62	61.0
Pinoxaden +	0.054				
prosulfuron +	0.018				
Bronate Advanced +	0.75				
UAN	50% v/v	2 leaf	95	63	61.0
Pinoxaden +	0.054				
prosulfuron +	0.018				
MCPA ester	0.348	2 leaf	96	68	61.1
Pinoxaden +	0.054				
prosulfuron +	0.018				
MCPA amine	0.347	2 leaf	92	66	61.2
Pinoxaden +	0.054				
prosulfuron +	0.018				
fluroxypyr	0.125	2 leaf	94	67	61.2
Pinoxaden +	0.054				
WecoMax	0.56	2 leaf	96	62	61.2
Clodinafop +	0.05				
WecoMax	0.56	2 leaf	46	54	60.0
Tralkoxydim +	0.25				
WecoMax	0.56	2 leaf	74	60	60.8
Fenoxaprop	0.083	2 leaf	94	61	61.4
Difenzoquat	1	3 leaf	58	53	59.6
Untreated check	--	--	--	48	58.5
LSD (0.05)			5	8	0.5
Density (plants/ft^2)			40		

[1]An adjuvant (Adigor) was applied with all pinoxaden treatments at 0.6 pt/A. A non-ionic surfactant/crop oil concentrate (Supercharge) at 0.5% v/v and ammonium sulfate (Bronc) at 15 lb ai/100 gal was applied with tralkoxydim. Bronate Advanced and WecoMax are premix formulations of bromoxynil/MCPA.
[2]Application timing based on wild oat growth stage.
[3]June 28, 2006 evaluation.

Table 4. Wild oat control and wheat response with grass herbicides combined with thifensulfuron and tribenuron near Moscow, Idaho in 2006.

Treatment[1]	Rate	Wild oat control[2]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Mesosulfuron + bromoxynil/MCPA	0.0089 + 0.5	72	75	61.3
Mesosulfuron + bromoxynil/MCPA +	0.0089 + 0.5			
thifensulfuron +	0.02			
tribenuron	0.005	78	69	61.1
Mesosulfuron + bromoxynil/MCPA +	0.0089 + 0.5			
thifensulfuron +	0.0125			
tribenuron	0.0125	81	76	61.6
Mesosulfuron + bromoxynil/MCPA	0.0134 + 0.5	82	73	61.6
Mesosulfuron + bromoxynil/MCPA +	0.0134 + 0.5			
thifensulfuron +	0.02			
tribenuron	0.005	82	72	61.6
Mesosulfuron + bromoxynil/MCPA +	0.00.134 + 0.5			
thifensulfuron +	0.0125			
tribenuron	0.0125	85	70	61.8
Flucarbazone + bromoxynil/MCPA	0.018 + 0.5	50	71	60.8
Flucarbazone + bromoxynil/MCPA +	0.018 +0.5			
thifensulfuron +	0.02			
tribenuron +	0.005			
2,4-D ester	0.24	54	66	61.0
Flucarbazone + bromoxynil/MCPA +	0.018 + 0.5			
thifensulfuron +	0.0125			
tribenuron +	0.0125			
2,4-D ester	0.24	55	62	61.0
Flucarbazone + bromoxynil/MCPA	0.026 + 0.5	56	69	61.3
Flucarbazone + bromoxynil/MCPA +	0.026 + 0.5			
thifensulfuron +	0.02			
tribenuron +	0.005			
2,4-D ester	0.24	59	71	60.9
Flucarbazone + bromoxynil/MCPA +	0.026 + 0.5			
thifensulfuron +	0.0125			
tribenuron +	0.0125			
2,4-D ester	0.24	64	61	61.4
Clodinafop + bromoxynil/MCPA	0.05 + 0.5	34	70	61.1
Clodinafop + bromoxynil/MCPA +	0.05 +0.5			
thifensulfuron +	0.02			
tribenuron	0.005	28	68	61.2
Clodinafop + bromoxynil/MCPA +	0.05 + 0.5			
thifensulfuron +	0.0125			
tribenuron	0.0125	30	60	61.2
Clodinafop + bromoxynil/MCPA	0.062 +0.5	78	79	61.4
Clodinafop + bromoxynil/MCPA +	0.062 + 0.5			
thifensulfuron +	0.02			
tribenuron	0.005	70	73	61.6
Clodinafop + bromoxynil/MCPA +	0.062 + 0.5			
thifensulfuron +	0.0125			
tribenuron	0.0125	60	73	61.4
Pinoxaden +bromoxynil/MCPA	0.054 +0.5	95	76	61.2
Pinoxaden + bromoxynil/MCPA +	0.054 + 0.5			
thifensulfuron +	0.02			
tribenuron	0.005	95	82	61.6
Pinoxaden + bromoxynil/MCPA +	0.054 +0.5			
thifensulfuron +	0.0125			
tribenuron	0.0125	96	82	61.7
Untreated check	--	--	54	60.1
LSD (0.05)		16	12	0.6
Density (plants/ft²)		30		

[1]Thifensulfuron and tribenuron were 50% formulations. A non-ionic surfactant (R-11) was applied with all treatments at 0.25% v/v except mesosulfuron which was applied at 0.5% v/v. Urea ammonium nitrate (URAN) was applied at 5% v/v with mesosulfuron treatments. An adjuvant (Adigor) was applied at 0.6 pt/A with pinoxaden treatments.

[2]June 28, 2006 evaluation.

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 'Mel' imidazolinone-tolerant winter wheat planted on October 8, 2005 near Moscow, Idaho to evaluate ACCase-resistant Italian ryegrass and wheat response with flufenacet/metribuzin combined with mesosulfuron, and pinoxaden combined with broadleaf herbicides. 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). To control broadleaf weeds, the flufenacet/metribuzin study was oversprayed with thifensulfuron/tribenuron at 0.0156 lb ai/A on May 16, 2006. Wheat response and Italian ryegrass control was evaluated visually. Wheat seed was harvested with a small plot combine on August 9, 2006.

Table 1. Application and soil data.

	Flufenacet/metribuzin study		Pinoxaden study
Application date	10/13/05	4/27/06	5/5/06
Wheat growth stage	preemergence	2 tiller	2 tiller
Italian ryegrass growth stage	preemergence	1 tiller	1 to 2 tiller
Air temperature (F)	57	67	77
Relative humidity (%)	100	36	21
Wind (mph, direction)	0	3, N	2, N
Cloud cover (%)	100	40	50
Soil moisture	moist	moist	dry
Soil temperature at 2 in (F)	52	60	65
pH		5.0	
OM (%)		3.5	
CEC (meq/100g)		18	
Texture		silt loam	

In the flufenacet/metribuzin study, no treatment injured winter wheat (data not shown). Italian ryegrass control was best with mesosulfuron combined with the highest rate of flufenacet/metribuzin (95%) but did not differ from any flufenacet/metribuzin plus mesosulfuron combination (Table 2). Wheat seed yield was greatest for flufenacet/metribuzin at the highest and lowest rate plus mesosulfuron but did not differ from the two highest rates of flufenacet/metribuzin alone or any flufenacet/metribuzin plus mesosulfuron combination. Wheat test weight did not differ among treatments and ranged from 61.5 to 63.0 lb/bu.

In the pinoxaden study, no treatment injured winter wheat (data not shown). Mesosulfuron treatments controlled Italian ryegrass 85 to 88% (Table 3). Italian ryegrass control did not decrease when pinoxaden was combined with broadleaf herbicides (44 to 60%) compared to pinoxaden alone (58%). Clodinafop did not control Italian ryegrass. Wheat seed yield was higher for the mesosulfuron treatments compared to the untreated check, clodinafop, pinoxaden alone or combined with bromoxynil/MCPA with or without thifensulfuron or thifensulfuron/tribenuron, and MCPA ester plus tribenuron or thifensulfuron/tribenuron. Wheat seed test weight did not differ among treatments (61.1 to 63.3 lb/bu), but tended to be lower in the untreated check (58.0 lb/bu).

Table 2. Italian ryegrass control and winter wheat response with flufenacet/metribuzin and mesosulfuron combinations near Moscow, ID in 2006.

Treatment[1]	Rate	Application timing[2]	Italian ryegrass control[3,4]	Wheat Yield[4]	Wheat Test weight[4]
	lb ai/A		%	bu/A	lb/bu
Flufenacet/metribuzin	0.17	preemergence	30	56	62.1
Flufenacet/metribuzin	0.255	preemergence	53	67	61.9
Flufenacet/metribuzin	0.34	preemergence	58	72	61.9
Flufenacet/metribuzin	0.425	preemergence	73	70	61.6
Mesosulfuron	0.0134	1 tiller	58	52	63.0
Flufenacet/metribuzin +	0.17	preemergence			
mesosulfuron	0.0134	1 tiller	84	78	61.9
Flufenacet/metribuzin +	0.255	preemergence			
mesosulfuron	0.0134	1 tiller	83	68	62.8
Flufenacet/metribuzin +	0.34	preemergence			
mesosulfuron	0.0134	1 tiller	85	77	62.0
Flufenacet/metribuzin +	0.425	preemergence			
mesosulfuron	0.0134	1 tiller	95	78	62.2
Untreated check	--	--	--	27	61.5
LSD (0.05)			19	10	NS
Density (plants/ft^2)			30		

[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 27, 2006 evaluation.
[4]Only 3 replications included in analysis due to poor wheat stand.

Table 3. Italian ryegrass control and winter wheat response with pinoxaden combinations near Moscow, ID in 2006.

Treatment[1]	Rate	Italian ryegrass control[2]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Pinoxaden	0.054	58	28	61.5
Pinoxaden +	0.054			
bromoxynil/MCPA	0.5	51	30	61.3
Pinoxaden +	0.054			
dicamba +	0.062			
MCPA ester	0.232	55	41	61.9
Pinoxaden +	0.054			
prosulfuron +	0.018			
bromoxynil/MCPA	0.5	52	42	62.1
Pinoxaden +	0.054			
prosulfuron +	0.018			
MCPA ester	0.348	54	40	62.2
Pinoxaden +	0.054			
tribenuron +	0.016			
MCPA ester	0.348	48	29	61.1
Pinoxaden +	0.054			
thifensulfuron +	0.019			
bromoxynil/MCPA	0.5	49	36	61.2
Pinoxaden +	0.054			
thifensulfuron/tribenuron +	0.019			
bromoxynil/MCPA	0.5	44	35	62.2
Pinoxaden +	0.054			
thifensulfuron/tribenuron +	0.019			
MCPA ester	0.348	54	31	61.6
Pinoxaden +	0.054			
thifensulfuron/tribenuron +	0.019			
clopyralid/fluroxypyr	0.187	51	38	62.0
Pinoxaden +	0.054			
thifensulfuron/tribenuron +	0.019			
fluroxypyr	0.125	45	41	61.8
Pinoxaden +	0.054			
fluroxypyr +	0.125			
bromoxynil/MCPA	0.5	54	44	62.0
Pinoxaden +	0.054			
fluroxypyr +	0.125			
thifensulfuron	0.019	48	49	62.1
Pinoxaden +	0.054			
fluroxypyr/MCPA ester	0.665	60	41	62.0
Pinoxaden +	0.054			
clopyralid/fluroxypyr +	0.187			
thifensulfuron	0.019	58	51	62.7
Pinoxaden +	0.054			
clopyralid/fluroxypyr +	0.187			
MCPA ester	0.348	50	44	62.2
Pinoxaden +	0.054			
2,4-D ester	0.357	54	49	62.2
Mesosulfuron	0.013	85	55	63.3
Mesosulfuron +	0.013			
bromoxynil/MCPA	0.5	88	55	63.0
Clodinafop	0.063	0	31	61.2
Untreated check	--	--	15	58.0
LSD (0.05)		14	18	NS
Density (plants/ft^2)		40		

[1]An adjuvant (Adigor) was applied with all pinoxaden treatments at 0.6 pt/A. A non-ionic surfactant (R-11) at 0.5% v/v and ammonium sulfate (Bronc) at 3 lb ai/A was applied with mesosulfuron.
[2]June 27, 2006 evaluation.

Italian ryegrass control in winter wheat with flufenacet/metribuzin combinations. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established near Pullman, WA and Moscow, ID in winter wheat to evaluate Italian ryegrass (LOLMU) control and wheat response with flufenacet/metribuzin alone or combined with other grass herbicides. 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). To control broadleaf weeds, studies were oversprayed with thifensulfuron/tribenuron at 0.0188 lb ai/A at the Pullman site on May 9, 2006 and 0.0156 lb ai/A at the Moscow site on May 16, 2006. Italian ryegrass control was evaluated visually. Wheat seed was harvested with a small plot combine at the Moscow and Pullman studies on August 7 and 9, 2006, respectively.

Table 1. Application and soil data.

Location	Moscow, Idaho		Pullman, Washington	
Winter wheat variety	Mel		Madsen/Malcolm blend	
Application date	10/13/05	4/27/06	10/13/05	4/27/06
Wheat growth stage	preemergence	2 tiller	preemergence	3 tiller
Italian ryegrass growth stage	preemergence	1 tiller	preemergence	2 tiller
Air temperature (F)	57	67	57	62
Relative humidity (%)	70	40	100	56
Wind (mph, direction)	0	2, W	0	3, W
Cloud cover (%)	100	60	100	50
Soil moisture	dry	moist	moist	dry
Soil temperature at 2 in (F)	52	60	50	52
pH	5.0		5.4	
OM (%)	3.5		3.2	
CEC (meq/100g)	18		19	
Texture	silt loam		silt loam	

At both sites, no treatment visually injured wheat (data not shown). At the Moscow site, flufenacet/metribuzin plus triasulfuron or mesosulfuron and triasulfuron combined with pinoxaden controlled Italian ryegrass the best (89 to 90%) but did not differ from flufenacet/metribuzin plus flucarbazone or triasulfuron alone (84 and 85%) (Table 2). Mesosulfuron, flufenacet/metribuzin alone or combined with pinoxaden suppressed Italian ryegrass 66 to 73%. Wheat seed yield was highest with triasulfuron alone or combined with pinoxaden and flufenacet/metribuzin plus flucarbazone (87 to 89 bu/A) but did not differ from flufenacet/metribuzin combined with triasulfuron or mesosulfuron (81 and 82 bu/A). Test weight ranged from 62.3 to 63.6 lb/bu and did not differ among treatments. At the Pullman site, Italian ryegrass control was best with flufenacet/metribuzin plus mesosulfuron (90%) but did not differ from mesosulfuron alone or triasulfuron plus pinoxaden (81 to 85%). Wheat seed yield and test weight did not differ among treatments or from the untreated check and ranged from 103 to 134 bu/A and 60.9 to 62.0 lb/bu.

Table 2. Italian ryegrass control and wheat yield and test weight with flufenacet/metribuzin combinations near Moscow, ID and Pullman, WA in 2006.

			Moscow			Pullman		
				Wheat			Wheat	
Treatment[1]	Rate	Application timing[2]	LOLMU control[3]	Yield	Test weight	LOLMU control[4]	Yield	Test weight
	lb ai/A		%	bu/A	lb/bu	%	bu/A	lb/bu
Flufenacet/metribuzin	0.425	preemergence	72	69	62.4	59	103	61.6
Triasulfuron	0.026	preemergence	85	88	63.6	45	127	61.5
Flufenacet/metribuzin + triasulfuron	0.425 0.026	preemergence	90	81	63.2	61	118	61.2
Pinoxaden	0.054	postemergence	40	54	63.2	68	117	61.9
Flufenacet/metribuzin+ pinoxaden	0.425 0.054	preemergence postemergence	66	73	62.3	72	128	61.3
Triasulfuron+ pinoxaden	0.026 0.054	preemergence postemergence	89	87	63.4	81	134	61.9
Mesosulfuron	0.013	postemergence	73	71	63.6	85	124	62.0
Flufenacet/metribuzin + mesosulfuron	0.425 0.013	preemergence postemergence	90	82	62.6	90	128	61.3
Flucarbazone	0.027	postemergence	27	49	63.0	55	121	60.9
Flufenacet/metribuzin + flucarbazone	0.425 0.027	preemergence postemergence	84	89	63.0	66	125	61.6
Clodinafop	0.062	postemergence	0	50	62.4	30	115	61.7
Untreated check	--	--	--	37	62.4	--	114	61.5
LSD (0.05)			16	13	NS	13	NS	NS
Density (plants/ft^2)			30			5		

[1]An adjuvant (Adigor) at 0.6 pt/A was applied with pinoxaden treatments. A non-ionic surfactant (R-11) at 0.25 and 0.5%v/v was applied with flucarbazone and mesosulfuron treatments, respectively. Urea ammonium nitrate (URAN) was applied with mesosulfuron and flucarbazone treatments at 2 qt/A.

[2]Application timing based on Italian ryegrass growth stage. Postemergence = 1 tiller for Moscow and 2 tiller for Pullman.

[3]June 26, 2006 evaluation date.

[4]June 29, 2006 evaluation date.

Single-gene imidazolinone-tolerant wheat response to imazamox and imazamox&MCPA. Patrick W. Geier and Phillip W. Stahlman. (Kansas State University Agricultural Research Center, Hays, KS 67601-9228) Objective of the study was to determine the tolerance of winter wheat containing a single gene for imidazolinone tolerance to high rates of imazamox or imazamox&MCPA. The experiment was conducted under weed-free conditions. Treatments were applied on November 1, 2005 when wheat had two to three leaves, or on November 7, 2005 when wheat had two to three tillers. All herbicide treatments included nonionic surfactant at 0.25% v/v and urea 28% ammonium nitrate at 2.5% v/v. The study was conducted near Hays, KS on a Roxbury silt loam soil with 2.7% organic matter and pH 7.8. 'KS03HW6-1' imidazolinone-tolerant wheat was seeded 1.8 inch deep at 72 lb/A on October 4, 2005. Treatments were arranged in a factorial design of herbicide treatment by application timing with four replications. Plots were 10 by 32 ft. Herbicides were broadcast-applied using a tractor-mounted, compressed-air sprayer equipped with TT110015 nozzles delivering 12.2 gpa at 30 psi and 3.0 mph. Yields were determined using a small plot combine on June 15, 2006.

All herbicide treatments caused 50 to 88% stunting of wheat at 72 days after the later applications, and stunting generally increased as herbicide rate increased. Though some recovery was apparent at 119 days after the later applications, stunting remained greater than 50% with imazamox alone at the two higher rates and either application timing, imazamox&MCPA at 0.093&0.75 lb/A at either application timing, and imazamox&MCPA at 0.062&0.5 lb/A applied at the later date. Similarly, wheat leaf necrosis was most severe, up to 93%, with imazamox or imazamox&MCPA at the higher rates and the later application timings. Leaf necrosis was visible at 119 days after the later applications, and ranged from 11 to 93%. At maturity, wheat receiving imazamox alone at 0.14 lb/A was 3 to 6 inches shorter than wheat receiving imazamox alone at 0.0625 lb/A, and yields were 10 to 15 bu/A less. Likewise, wheat was generally shorter with the highest rates of imazamox&MCPA applied late, and yields were 8.2 to 15.5 bu/A less than wheat receiving imazamox&MCPA at 0.047&0.375 lb/A.

Table. Single-gene imidazolinone-tolerant wheat response to imazamox alone or with MCPA, near Hays, KS in 2006.

Treatment[1]	Rate	Application timing	Stunting[2] 72 days	Stunting[2] 119 days	Necrosis[2] 72 days	Necrosis[2] 119 days	Mature height	Yield
	lb ai/A		%		%		inches	bu/A
Imazamox&MCPA	0.047&0.375	Early fall	55	18	25	14	31	27.1
Imazamox&MCPA	0.047&0.375	Fall	83	38	85	46	30	26.3
Imazamox&MCPA	0.062&0.5	Early fall	50	33	50	33	31	26.7
Imazamox&MCPA	0.062&0.5	Fall	83	74	90	78	28	20.9
Imazamox&MCPA	0.093&0.75	Early fall	88	75	90	83	30	18.6
Imazamox&MCPA	0.093&0.75	Fall	88	86	90	93	25	11.6
Imazamox	0.0625	Early fall	53	18	28	11	31	27.9
Imazamox	0.0625	Fall	53	28	48	15	31	27.7
Imazamox	0.094	Early fall	80	53	83	48	30	24.6
Imazamox	0.094	Fall	83	59	90	58	30	23.5
Imazamox	0.14	Early fall	88	79	90	84	27	17.0
Imazamox	0.14	Fall	85	83	90	89	25	12.9
LSD (0.05)			6	14	5	13	1	3.1

[1] All herbicide treatments included nonionic surfactant (Activator 90) at 0.25% v/v and 28% urea ammonium nitrate at 2.5% v/v.

[2] Stunting and necrosis ratings at 72 and 119 days after the late fall applications.

Two-gene imidazolinone-tolerant wheat response to imazamox and imazamox&MCPA. Patrick W. Geier and Phillip W. Stahlman. (Kansas State University Agricultural Research Center, Hays, KS 67601-9228) Objective of the study was to determine the tolerance of winter wheat containing two genes for herbicide tolerance to imazamox and imazamox&MCPA. The experiment was conducted under weed-free conditions. Treatments were applied on November 23, 2005 when wheat had two to three leaves, or on March 6, 2006 when wheat had two to three tillers. All herbicide treatments included nonionic surfactant at 0.25% v/v and 28% urea ammonium nitrate at 2.5% v/v. The study was conducted near Hays, KS on a Roxbury silt loam soil with 2.7% organic matter and pH 7.8. 'P112-282' imidazolinone-tolerant wheat was seeded 1.0 inch deep at 68 lb/A on October 28, 2005. Treatments were arranged in a factorial design of herbicide treatment by application timing with four replications. Plots were 8 by 25 ft. Herbicides were broadcast-applied using a backpack sprayer equipped with TT110015 nozzles delivering 13.1 gpa at 34 psi and 3.0 mph. Yields were determined using a small plot combine on June 15, 2006.

Wheat chlorosis was 10 to 18% at 35 days after spring application when imazamox was applied at 0.0625 or 0.14 lb/A in the spring and when the premix of imazamox&MCPA was applied in spring at 0.062&0.5 or 0.093&0.75 lb/A. The highest rates of imazamox and imazamox&MCPA applied in the spring caused 8 to 10% wheat stunting on the same date; whereas fall-applied imazamox at 0.14 lb/A caused 9% stunting. By seasons' end, mature wheat height did not differ between herbicide treatments, but spring-treated wheat was one inch taller than fall-treated wheat. Yields ranged from 43.4 to 48.7 bu/A and did not differ between treatments or application timings.

Table. Two-gene imidazolinone-tolerant wheat response to imazamox and imazamox&MCPA, near Hays, KS, 2006.

Treatment[1]	Rate	Application timing	Stunting[2]	Chlorosis[2]	Yield
	lb ai/A		%	%	bu/A
Imazamox&MCPA	0.047&0.375	Fall	0	0	45.4
Imazamox&MCPA	0.047&0.375	Spring	1	6	48.2
Imazamox&MCPA	0.062&0.5	Fall	0	0	44.7
Imazamox&MCPA	0.062&0.5	Spring	0	10	45.7
Imazamox&MCPA	0.093&0.75	Fall	9	0	44.9
Imazamox&MCPA	0.093&0.75	Spring	10	16	43.4
Imazamox	0.0625	Fall	1	0	46.9
Imazamox	0.0625	Spring	0	10	46.5
Imazamox	0.094	Fall	0	0	44.8
Imazamox	0.094	Spring	4	8	48.7
Imazamox	0.14	Fall	0	0	45.9
Imazamox	0.14	Spring	8	18	47.1
LSD (0.05)			3	3	NS

[1] All herbicide treatments included nonionic surfactant (Activator 90) at 0.25% v/v and 28% urea ammonium nitrate at 2.5% v/v.

[2] Stunting and chlorosis ratings at 35 days after spring applications.

Imidazolinone-tolerant wheat response to imazamox plus tank mixtures. Patrick W. Geier and Phillip W. Stahlman. (Kansas State University Agricultural Research Center, Hays, KS 67601-9228) Objective of the study was to determine the tolerance of imidazolinone–tolerant winter wheat to 2X rates of imazamox plus MCPA, with or without other herbicides. All treatments were applied postemergence on March 14, 2006, and included nonionic surfactant at 0.25% v/v and 28% urea ammonium nitrate at 2.5% v/v. The study was conducted on a Roxbury silt loam soil with 3.4% organic matter and pH 7.8 at the Kansas State University Agricultural Research Center near Hays, KS. 'KS03HW6-1' imidazolinone-tolerant wheat was seeded 1.5 inches deep at 53 lb/A on September 23, 2005. Treatments were arranged in a randomized complete block with four replications and plots were 10 by 32 ft. Herbicides were broadcast-applied using a tractor-mounted, compressed-air sprayer equipped with TT110015 nozzles delivering 12.2 gpa at 30 psi and 3.0 mph. Wheat yields were determined on June 16, 2006 using a small plot combine.

Imazamox plus MCPA and dicamba caused 14 to 19% wheat chlorosis at 23 days after treatment, whereas no other treatment caused more than 6% chlorosis. Imazamox plus MCPA, at any rate or with bromoxynil or dicamba, caused the greatest tiller epinasty (13 to 21%), stunting (11 to 28%), and mature height reduction (3 to 4 inches) in wheat. In general, the addition of fluroxypyr to imazamox plus MCPA lessened wheat injury; bromoxynil and dicamba did not. Grain yields ranged from 33.7 to 43.6 bu/A, but did not differ between treated and nontreated wheat.

Table. Wheat response to imazamox, alone and in combinations, applied spring-postemergence near Hays, KS in 2006.

Treatment[1]	Rate	Chlorosis 23 DAT	Tiller epinasty 48 DAT	Stunting 48 DAT	Stunting 85 DAT	Mature height	Yield
	lb ai/A	%	%	%	%	inches	bu/A
Imazamox	0.08	0	0	0	0	31	41.5
MCPA	0.58	0	0	0	0	31	43.6
Imazamox+MCPA	0.08+0.58	3	16	20	10	28	36.9
Imazamox+MCPA	0.09+0.69	1	21	28	20	27	33.7
Imazamox+MCPA+fluroxypyr	0.08+0.58+0.19	3	4	9	0	29	35.9
Imazamox+MCPA+bromoxynil	0.08+0.58+0.50	6	13	16	10	28	39.4
Imazamox+MCPA+fluroxypyr	0.08+0.58+0.38	3	0	5	3	29	39.3
Imazamox+MCPA+dicamba	0.08+0.58+0.09	14	13	11	6	28	35.7
Imazamox+MCPA+dicamba	0.08+0.58+0.19	19	21	20	15	28	34.2
Untreated control	-----	0	0	0	0	30	34.7
LSD (0.05)		4	5	8	5	2	NS

[1] All herbicide treatments included nonionic surfactant (Activator 90) at 0.25% v/v and 28% urea ammonium nitrate at 2.5% v/v.

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) Studies were established near Potlatch and Grangeville, Idaho to evaluate injury and yield of five 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 five winter wheat varieties (ID 587, 99-419, 99-435, 00-475-2DH, and 02-859), subplots were two application times (early and pre-joint) 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, studies were oversprayed with thifensulfuron/tribenuron at 0.0188 lb ai/A at Potlatch on May 16 and chlorsulfuron at 0.0156 lb ai/A at Grangeville on May 18, 2006. In both experiments, wheat injury was evaluated visually. Wheat seed was harvested on July 31, 2006 at Grangeville. Wheat seed was not harvested at Potlatch due to a non-uniform wheat stand.

Table 1. Application and soil data.

	Potlatch		Grangeville	
Planting date	October 20, 2005		October 22, 2005	
Application date	4/25/06	5/9/06	4/21/06	5/11/06
Wheat growth stage	1 tiller	3 tiller	3 tiller	5 tiller
Air temperature (F)	50	60	57	60
Relative humidity (%)	69	50	62	49
Wind (mph, direction)	2, SW	3, W	4, E	0
Cloud cover (%)	75	10	80	5
Soil moisture	wet	dry	moist	dry
Soil temperature at 2 in (F)	50	54	52	54
pH	4.9		4.6	
OM (%)	3.2		5.9	
CEC (meq/100g)	19		33	
Texture	silt loam		silty clay loam	

At Potlatch, wheat injury was greater with imazamox at 0.094 lb ai/A (18%) than imazamox at 0.047 lb ai/A (6%) [LSD (0.05) = 4].

At Grangeville, wheat injury was greater with imazamox at 0.094 lb ai/A (11%) than imazamox at 0.047 lb ai/A (4%) [LSD (0.05) = 2] and greater at the 5 tiller (14%) than the 3 tiller application time (2%) [LSD (0.05) = 2]. Wheat injury was higher for 99-419 (13%) and lower for 99-435 (2%) than all other treatments (7 to 8% for 02-859, ID 587, and 00-475-2DH) [LSD (0.05) = 3]. At both application times, wheat injury increased with increasing imazamox rate (Table 2). With all varieties, except 99-435, wheat injury increased with imazamox rate and later application time (Table 3 and 4). Wheat seed yield was higher for the untreated check (60 bu/A) than both imazamox rates (51 and 53 bu/A) [LSD (0.05) =6]. With varieties, wheat seed yield was greater for 00-475-2DH (58 bu/A) than 02-859 and ID 587 (50 and 48 bu/A) but did not differ from 99-435 and 99-419 (54 bu/A) [LSD (0.05) = 6]. Test weight was greatest for 00-475-2DH and 99-419 (61.2 and 60.6 lb/bu) followed by 99-435 and ID 587 (59.2 and 58.8 lb/bu) [LSD (0.05) =1.0]. Variety 02-859 test weight was the lowest (57.0 lb/bu).

Table 2. Wheat injury near Grangeville averaged over variety in 2006.

Application time	Imazamox rate[1]	Wheat injury[2]
	lb ai/A	%
3 tiller	0.047	1
	0.094	7
5 tiller	0.047	3
	0.094	20
LSD (0.05)		3

[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 21, 2006 evaluation.

Table 3. Wheat injury near Grangeville averaged over imazamox application time in 2006.

Wheat variety	Imazamox rate[1]	Wheat injury[2]
	lb ai/A	%
99-419	0.047	9
	0.094	18
99-435	0.047	2
	0.094	3
00-475-2DH	0.047	3
	0.094	14
02-859	0.047	2
	0.094	12
ID 875	0.047	4
	0.094	11
LSD (0.05)		4

[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 21, 2006 evaluation.

Table 4. Wheat injury near Grangeville averaged over imazamox rate in 2006.

Wheat variety	Application time	Wheat injury[1]
		%
99-419	3 tiller	1
	5 tiller	25
99-435	3 tiller	1
	5 tiller	4
00-475-2DH	3 tiller	1
	5 tiller	16
02-859	3 tiller	4
	5 tiller	10
ID 587	3 tiller	1
	5 tiller	14
LSD (0.05)		4

[1]June 21, 2006 evaluation.

Tillage affects imazamox persistence in soil. Jonquil R. Rood and Donald C. Thill. (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 Sandra M. Frost (Columbia Basin Agricultural Research Center, Oregon State University, Pendleton, OR 97801). Studies were established near Genesee, ID (high precipitation area), Davenport, WA (intermediate precipitation with cool climate) and Pendleton, OR (intermediate precipitation area with warm climate) 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 and 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). Sites were oversprayed with fluroxypyr at 0.12 lb ai/A and bromoxynil/MCPA at 0.5 lb ai/A for broadleaf control on May 5 at Genesee and April 27 at Davenport. Wheat injury and weed control were evaluated visually. Wheat seed was harvested with a small plot combine at Genesee on August 15, Davenport on August 9, and Pendleton on July 26, 2006. During fall 2006 following wheat harvest, plots were prepared using the appropriate tillage practice. Conventional plots were moldboard plowed in the fall and will be field cultivated in the spring. Minimum tillage plots were chisel plowed in the fall and will be field cultivated in the spring. Direct seeds will not be tilled prior to seeding. In the spring 2007 '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. Studies are being repeated during the 2006-2008 growing seasons.

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	

Wheat injury for the fall applied imazamox was not evident until the spring at all three sites (Tables 2-4). At all locations, imazamox at 0.140 lb ai/A applied in the fall stunted and thinned the wheat stand the greatest (50 to 54%). Wheat injury from spring applied imazamox was greatest at the Pendleton site (3 to 44%) and the least at the Genesee site (1%). At Pendleton, a sparse population of downy brome and interrupted windgrass was controlled 96 to 100% by all imazamox treatments. Downy brome was controlled 84 to 98% at the Davenport site. At Davenport and Pendleton, wheat biomass were not lower than the untreated check for any treatment. However, at Genesee, wheat biomass was unexplainably less in the 0.047 lb ai/A spring applied imazamox treatment compared to the untreated control. Wheat seed yield and test weight was not significantly different among treatments and the untreated check at Genesee and Davenport. At Pendleton, fall applied imazamox at 0.140 lb ai/A reduced wheat yield by 7% compared to the untreated control and fall applied imazamox at the 0.094 lb ai/A and 0.140 lb ai/A rate reduced wheat test weights compared to the untreated check.

Table 2. Wheat injury, head number, biomass, grain yield and test weight in imazamox soil persistence studies near Genesee, ID in 2006.

Treatment	Rate	Application timing	Wheat injury[1]	Wheat			
				Head[2]	Biomass	Yield	Test weight
	lb ai/A		%	#/m	grams/m	bu/A	lb/bu
Imazamox	0.047	Fall	0	154	369	95	60.3
Imazamox	0.094	Fall	30	158	367	118	60.7
Imazamox	0.140	Fall	50	129	306	102	60.7
Imazamox	0.047	Spring	1	123	268	94	59.3
Imazamox	0.094	Spring	1	162	375	102	59.3
Imazamox	0.140	Spring	1	146	347	97	60.3
Untreated check			---	165	366	112	59.7
LSD (0.05)			9	38	76	NS	NS

[1]Wheat injury was evaluated seven days after spring herbicide application on May 2, 2006. Means are pooled over tillage because tillage is not yet a factor.
[2]Average number of heads/m on June 21, 2006.

Table 3. Wheat injury, downy brome control, head number, biomass, grain yield and test weight in imazamox soil persistence near Davenport, WA in 2006.

Treatment	Rate	Application timing	Wheat injury[1]	Downy brome control[2]	Wheat			
					Heads[3]	Biomass	Yield	Test weight
	lb ai/A		%	%	#/m	grams/m	bu/A	lb/bu
Imazamox	0.047	Fall	1	84	97	203	81	62.6
Imazamox	0.094	Fall	23	98	98	199	77	62.6
Imazamox	0.140	Fall	54	95	92	196	69	62.6
Imazamox	0.047	Spring	13	92	118	240	80	62.8
Imazamox	0.094	Spring	19	96	106	220	83	62.5
Imazamox	0.140	Spring	29	93	106	219	77	62.5
Untreated check			---	---	115	236	87	62.6
LSD (0.05)			11	13	24	NS	NS	NS

[1]Wheat injury was evaluated 21 days after spring application on May 18, 2006. Means are pooled over tillage because tillage is not yet a factor.
[2]Downy brome control was evaluated on May 18, 2006.
[3]Average number of heads/m on June 16, 2006.

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

Treatment	Rate	Application timing	Wheat injury[1]	Wheat			
				Heads[2]	Biomass	Yield	Test weight
	lb ai/A		%	#/m	grams/m	bu/A	lb/bu
Imazamox	0.047	Fall	3	106	228	85	59.3
Imazamox	0.094	Fall	19	94	207	82	58.2
Imazamox	0.140	Fall	54	89	203	77	58.1
Imazamox	0.047	Spring	3	109	244	92	59.3
Imazamox	0.094	Spring	22	114	199	83	59.0
Imazamox	0.140	Spring	44	128	180	81	59.2
Untreated check			---	105	229	83	59.6
LSD (0.05)			2	28	NS	7	1

[1]Wheat injury was evaluated seven days after spring application on May 2, 2006. Means are pooled over tillage because tillage is not yet a factor.
[2]Average number of heads/m on June 19, 2006.

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 553 specimens for identification in 2006. The utilization of the lab was close to the 564 submissions from 2005 (Figure 1). Three hundred and fourty-three exotic species were identified. Twenty-nine digital images were submitted for identification. Four species reported were new to the state, bristly dog's tail grass (*Cynosurus echinatus*), rugosa rose (*Rosa rugosa*), multiflora rose (*Rosa multiflora*) and porcupine tomato (*Solanum pyracanthum*) (Table 1). The lab identified 27 exotic species that were new county records (see Tables 1, 2 and Figure 2). A total of 31 counties submitted samples, down from 34 counties in 2005 (Figure 3). Porcupine tomato (*Solanum pyracanthum*) was reported for the first time to the Pacific Northwest and is not listed in the USDA Plants Database. Porcupine tomato can be ordered from a nursery in California and also online. 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.

County	Family	Scientific Name	Common Name
Ada	Solanaceae	*Solanum pyracanthum*	porcupine tomato*
Idaho	Poaceae	*Cynosurus echinatus*	bristly dog's tail grass
Latah	Rosaceae	*Rosa multiflora*	multiflora rose
Latah	Rosaceae	*Rosa rugosa*	rugosa rose

*species reported new to the Pacific Northwest, plant was sold as an ornamental

Table 2 . Identified exotic species new to a county based on the Invaders Database System in 2006.

County	Family	Scientific Name	Common Name
Ada	Apiaceae	*Anthriscus caucalis*	bur chervil
Bonneville	Fabaceae	*Lathyrus latifolius*	everlasting pea
Boundary	Haloragaceae	*Myriophyllum spicatum*	Eurasian watermilfoil
Boundary	Asteraceae	*Carthamus tinctorius*	safflower
Canyon	Asteraceae	*Tragopogon dubius*	western salsify
Canyon	Apiaceae	*Daucus carota*	wild carrot
Canyon	Brassicaceae	*Draba verna*	spring whitlowgrass
Canyon	Poaceae	*Bromus secalinus*	cheat
Clearwater	Euphorbiaceae	*Euphorbia myrsinites*	myrtle spurge
Clearwater	Fabaceae	*Trifolium arvense*	rabbitfoot clover
Idaho	Solanaceae	*Solanum nigrum*	black nightshade
Idaho	Solanaceae	*Solanum sarrachoides*	hairy nightshade
Jerome	Asteraceae	*Anthemis arvensis*	corn chamomile
Latah	Asteraceae	*Centaurea montana*	mountain knapweed
Lewis	Cucurbitaceae	*Bryonia alba*	white bryony
Lewis	Caryophyllaceae	*Silene vulgaris*	bladder campion
Lewis	Asteraceae	*Centaurea pratensis*	meadow knapweed
Lewis	Apiaceae	*Daucus carota*	wild carrot
Lincoln	Poaceae	*Aegilops cylindrica*	jointed goatgrass
Nez Perce	Cyperaceae	*Cyperus esculentus*	yellow nutsedge
Nez Perce	Malvaceae	*Hibiscus trionum*	venice mallow
Shoshone	Caryophyllaceae	*Spergula arvensis*	corn spurry
Valley	Malvaceae	*Abutilon theophrasti*	velvetleaf

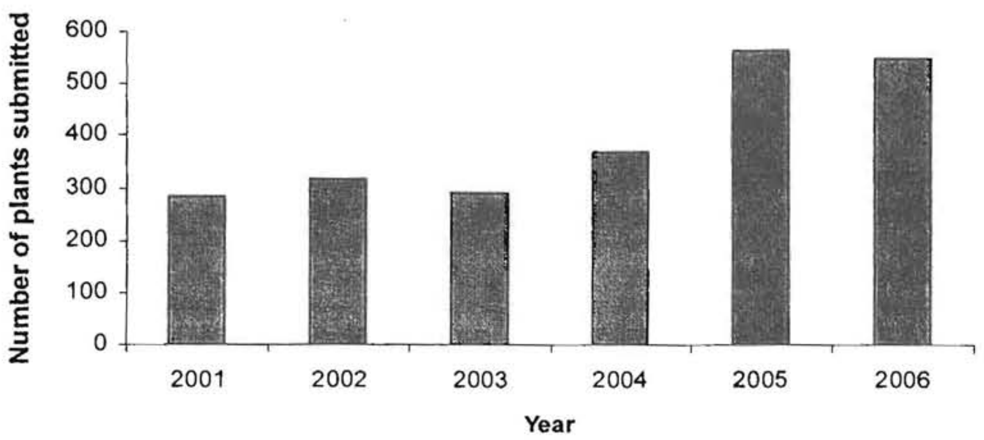

Figure 1. Erickson Weed Diagnostic Laboratory received 553 plant specimens for identification in 2006. The utilization of the lab was close to the 564 submissions in 2005.

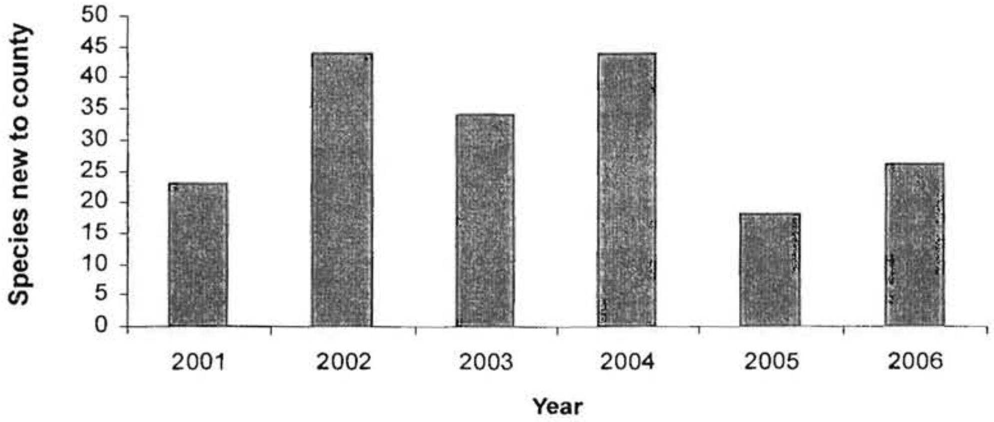

Figure 2. The lab identified 27 exotic species that were new Idaho county records.

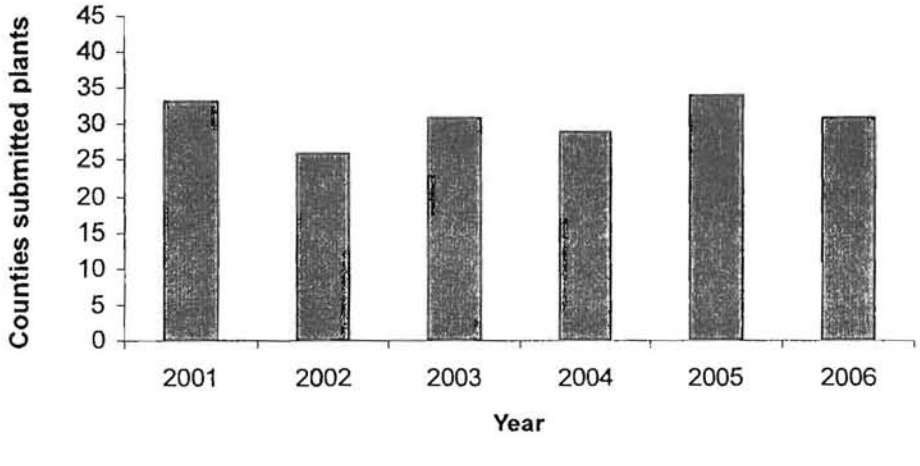

Figure 3. Thirty one Idaho counties submitted plants, down from thirty four counties in 2005.

Prickly lettuce and wild radish control with postemergence herbicides. Carl E. Bell, Randy Smith, Bruce Kidd, and John Ekhoff. (Cooperative Extension, University of California, San Diego, CA 92123; Dow Agrosciences, Clovis, CA 93619; Dow Agrosciences, Murrieta, CA 92562; and California Department of Fish and Game, San Diego, CA 92123). A field study was conducted in San Diego, CA in 2006 to evaluate aminopyralid, clopyralid, glyphosate, and triclopyr applied postemergence for control of prickly lettuce and wild radish on a non-crop site. The experiment utilized a completely randomized design with four replications. Plot size was 5 by 25 feet. Herbicides were applied on May 9, 2006 with a CO_2 backpack sprayer using 3 – 8002vs flat fan nozzles on a boom covering 5 feet at 40 psi and a spray volume of 48 gpa. All treatments except glyphosate included non-ionic surfactant at 0.25% v/v. Prickly lettuce plants were bolting with flowering shoots, from 2 to 3 feet tall. Wild radish was also 2 to3 feet tall with abundant flowers and some mature seed. Weather on May 9, 2006 was 65 F, cloudy skies, and calm. Weed control was visually evaluated on May 25 for both weeds and on June 23, 2006for prickly lettuce. Triclopyr and glyphosate treatments were effective for control of prickly lettuce at the May 25 and June 23 evaluations. Aminopyralid was effective when evaluated in June, but not at the earlier date. Glyphosate was also very effective on wild radish. Aminopyralid appeared to have some effect on wild radish. Clopyralid were not sufficiently effective on either weed species.

Table . Prickly lettuce and wild radish control with postemergence herbicides in, San Diego, CA.

		Weed control		
		Prickly lettuce		Wild radish
Treatment	Rate	May 25, 2006	June 23, 2006	May 25, 2006
	lb ae/A	%	%	%
Aminopyralid	0.05	58	76	12
Aminopyralid	0.08	76	82	35
Aminopyralid	0.1	82	95	58
Clopyralid	0.25	61	58	4
Triclopyr	1	90	96	76
Glyphosate	3	98	100	96
Untreated control		0	0	0

Herbicide evaluation for onionweed control. Carl E. Bell (Cooperative Extension, University of California, 5555 Overland Ave, suite 4101, San Diego, CA 92123). A field study was conducted in San Diego, CA in 2005 to investigate potential herbicides for control of onionweed. The experiment utilized a completely randomized design with four replications. Plot size was 5 by 6 feet. Herbicides were applied on July 19, 2005 with a CO_2 backpack sprayer using 3 - 8004vs flat fan nozzles on a boom covering 5 feet at 40 psi for a spray volume of 55 gpa. Onionweed at time of application was mature and variable, ranging from 20 to 50 leaves, 8 to 24 inches tall, and flowering. Weather at time of application was 75 F, clear skies, and a 3-5 MPH wind. Herbicide treatments included glyphosate, chlorsulfuron, and imazapyr (Table). Onionweed control was visually evaluated on July 7, 2005 and March 21, 2006. Chlorsulfuron was the only herbicide to successfully control onionweed.

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

		Weed control		
Treatment	Rate	August 2, 2005	September 7, 2005	March 21, 2006
	lb ai/A	-------------------------	%-------------------------	
Glyphosate	2.5	1	1	10
Glyphosate	5	31	35	42
Chlorsulfuron	0.094	35	92	98
Imazapyr	0.5	31	73	35
Imazapyr + glyphosate	0.5 + 2.5	7	31	42
Untreated control		0	0	0

Chlorsulfuron rate evaluation for onionweed control. Carl E. Bell[1], Jessica Vinge[2], Marcus Spiegelberg[2] , and Mark Girard[3]. ([1]Cooperative Extension, University of California, San Diego, CA 92123; [2]Center for Natural Lands Management, San Diego, CA 92107; and [3]Habitat Restoration Sciences, Carlsbad, CA 92008). A field study was conducted in San Diego, CA in 2006 to investigate chlorsulfuron rates for control of onionweed and non-target effects on native vegetation (Table). The experiment utilized a randomized complete block design with four replications. Plot size was 5 by 25 feet. Chlorsulfuron was applied on April 13, 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 59 gpa. Onionweed at time of application was variable, ranging from 10 to 50 leaves, 3 to 24 inches tall, with some flowers on older plants and some seed. A variety of native species were present in the treatment plots, these were treated along with the onionweed. Weather at time of application was 65 F, clear skies, and a 3-5 MPH wind. Plots were visually evaluated for onionweed control and injury to native plants on June 1 and June 27, 2006 (Table). Onionweed seed production relative to chlorsulfuron rate was estimated from 3 – 1 square foot random samples per plot of plants collected on June 27, 2006. Seed were combined by plot, cleaned and weighed (Table). Seed number was directly counted or by weighing 200 seed in a sample for an estimate of weight per seed times the total seed weight. There was a positive correlation between herbicide rate and onionweed control and the highest rate was required for acceptable control. All rates caused flowers to abort shortly after treatment and caused a similar decrease in seed production. Native vegetation populations were not consistent between plots, so many of the evaluations were not replicated and data are not shown. Damage to native vegetation was variable and most severe at the highest rate, with several herbaceous annuals killed and some herbaceous perennials injured. One shrub (buckwheat, *Eriogonum fasiculatum*) appears to be tolerant of the highest rate of chlorsulfuron.

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

	Weed control		Seed estimates	
Chlorsulfuron rate	June 1, 2006	June 27, 2006	Seed weight	Seed number
lb ai/A	%	%	g/3 ft^2/plot	#/ 3 ft^2/plot
0	0	0	15.3	10453
0.024	42	65	2.4	1601
0.047	69	69	0.3	289
0.094	90	99	1.4	1151

Chlorsulfuron and triclopyr for control of perennial pepperweed. Carl E. Bell (Cooperative Extension, University of California, 5555 Overland Ave, suite 4101, San Diego, CA 92123). A field study was conducted in San Diego, CA in 2005 with two objectives; to compare chlorsulfuron alone or chlorsulfuron plus triclopyr to see if triclopyr could substitute for one half of the chlorsulfuron, and to evaluate 6 different timing and growth stage combinations for control of established perennial pepperweed. The experiment utilized a randomized complete block design with four replications. Plot size was 5 by 10 feet. Herbicides were applied with a CO_2 backpack sprayer using 3 flat fan nozzles on a boom covering 5 feet. Perennial perpperweed growth stage, weather, and application parameters are shown in Table 1. All treatments included a non-ionic surfactant at 1% v/v. No untreated control plots were included, but there were buffer areas of untreated perennial pepperweed between replicate blocks. Weed control was visually evaluated on the June and August treatment dates, and the following spring on April 18, 2006. All treatments controlled 100% of the perennial pepperweed, so these data are not shown. Table 2 has the herbicide treatments and timings. Substituting triclopyr for one half of the chlorsulfuron did not decrease weed control. In like manner, application timing and two versus one treatment did not seem to change the degree of control.

Table 1. Perennial pepperweed experiment application and site parameters, San Diego, CA.

Application date	April 13, 2005	June 10, 2005	August 11, 2005
Perennial pepperweed growth stage	3 ft tall, no flowers, few tillers	3-4 ft tall, flowers	3-4 ft tall, flowers
Air temperature (F)	65	65	85
Wind (MPH)	0-2	0-2	0-2
Cloud cover (%)	100	100	0
Nozzle size	8002vs	8004vs	8004vs
Pressure (psi)	30	40	40
Spray volume (gpa)	29	44	53

Table 2. Herbicide treatments and timing for perennial pepperweed control, San Diego, CA. All treatments controlled 100% of the perennial pepperweed one year after treatment.

Treatment	Rate	Application date and timing
	lb ai/A	
Chlorsulfuron	0.094	April 13, 2005
Chlorsulfuron	0.094	April 13 & June 10, 2005
Chlorsulfuron	0.094	April 13 & August 11, 2005
Chlorsulfuron	0.094	June 10, 2005
Chlorsulfuron	0.094	June 10 & August 11, 2005
Chlorsulfuron	0.094	August 11, 2005
Chlorsulfuron plus triclopyr	0.047 + 1	April 13, 2005
Chlorsulfuron plus triclopyr	0.047 + 1	April 13 & June 10, 2005
Chlorsulfuron plus triclopyr	0.047 + 1	April 13 & August 11, 2005
Chlorsulfuron plus triclopyr	0.047 + 1	June 10, 2005
Chlorsulfuron plus triclopyr	0.047 + 1	June 10 & August 11, 2005
Chlorsulfuron plus triclopyr	0.047 + 1	August 11, 2005

Artichoke thistle control with postemergence herbicides. Carl E. Bell, Randy Smith, Bruce Kidd, and Bill Winans, (Cooperative Extension, University of California, San Diego, CA 92123; Dow Agrosciences, Clovis, CA 93619; Dow Agrosciences, Murrieta, CA 92562; and County of San Diego Department of Agriculture, Weights, and Measures, San Diego, CA 92123). Two field studies were conducted in San Diego, CA in 2006 to evaluate aminopyralid, clopyralid, glyphosate, and triclopyr applied postemergence for control of artichoke thistle on a non-crop site. Experiment 1 utilized a randomized complete block design with four replications. Plot size was 6 by 25 feet. Herbicides were applied on January 13, 2006 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 44 gpa. Artichoke plants at time of application were from 3 to 18 inches high. Weather on January 13, 2006 was 65 F, clear skies, and winds 3-5 mph. Experiment 2 used a completely randomized design with four replications. Plot size was 10 by 15 feet. Herbicides were applied on March 24, 2006 with a CO_2 backpack sprayer using 3 – 8004vs flat fan nozzles on a boom covering 5 feet at 40 psi and a spray volume of 56 gpa. Artichoke plants in this experiment were 4 to 18 inches tall. Weather on March 24 was 75 F, clear skies, with winds 0-3 mph. None of the artichoke plants in either experiment had flower stalks. All treatments in both experiments except for glyphosate, included non-ionic surfactant at 0.25% v/v. Weed control was visually evaluated for both experiments on May 10, 2006. Aminopyralid and glyphosate treatments were effective for control of artichoke thistle in both experiments. Triclopyr and clopyralid were not sufficiently effective.

Table . Artichoke thistle control with postemergence herbicides, San Diego, CA.

		Artichoke thistle control[1]	
Treatment	Rate	Experiment one	Experiment two
	lb ae/A	%	%
Aminopyralid	0.05	93	TNI[2]
Aminopyralid	0.08	88	98
Aminopyralid	0.1	98	96
Clopyralid	0.25	73	85
Triclopyr	1	85	TNI
Glyphosate	3	96	98
Untreated control		0	0

[1]Evaluated on May 10, 2006.
[2]TNI – treatment not included.

Efficacy of benthic barriers as a control measure for Eurasian watermilfoil. Karen Laitala and Timothy S. Prather (Plant Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established in Coeur d'Alene Lake near Plummer, ID to evaluate optimum coverage time, maintenance requirements, and non-target aquatic community response to removable fabric weed barriers as a control measure for Eurasian watermilfoil (*Myriophyllum spicatum* L.). The study was arranged in a randomized complete block design with four replications and included an untreated check. A total of 16 panels were constructed from a sheet of Typar® spun geotextile fabric mounted on a frame of weighted one-inch diameter PVC pipe. Disassembled panels were transported to the test plot site by boat, assembled, and placed in the plot by a diver May 15, 2006. Four barriers were installed over subplots within each block and one 3 x 3m control area was left uncovered. One randomly selected barrier from each of the four blocks was removed at three 4 week intervals and one 2 week interval for a total treatment time of 12 weeks ending August 7, 2006. Above sediment biomass (0.25 m^2) was collected within each sub-plot pre- and post- treatment. Samples were sorted by species, dried at 70°C for 72 hours, and weighed. Analysis of variance repeated measures was conducted to determine the effect of benthic barrier duration on Eurasian watermilfoil biomass.

Benthic barrier placement reduced Eurasian watermilfoil biomass 100% weeks 8 through 12. Eurasian watermilfoil growth resumed in treatments 4 through 8 weeks and plots for these treatments were resampled (Figure 1). Data has not yet been analyzed for associated species or resampled plots.

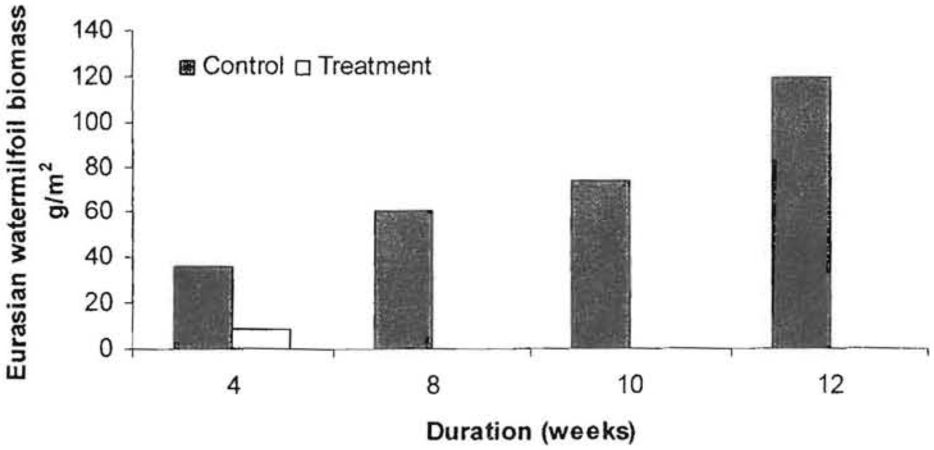

Figure 1. Effects of benthic barrier placement duration on Eurasian watermilfoil biomass in comparison with uncovered control.

<u>Effect of sediment on efficacy of benthic barriers as a control measure for Eurasian watermilfoil.</u> Karen Laitala and Timothy S. Prather (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). A study was established in a walk-in growth chamber to evaluate the effect of sediment depth on Eurasian watermilfoil establishment and growth. The study was arranged in a randomized complete block design with five sediment depth treatments and four replications. Typar® spun geotextile fabric was fitted to PVC pipe 4.8 cm diameter and height ranging from 0 to 5 cm. Sediment was placed within the rings, over the geotextile fabric at depths of 0, 2, 3, 4, and 5 cm and the rings were placed in aquaria. A 10 cm apical shoot section of Eurasian watermilfoil was placed on the surface of the sediment or fabric (0 cm depth). Four weeks after planting, shoots and root mass were harvested, dried at 70°C for 72 hours, and weighed. Analysis of variance repeated measures was conducted to determine the effects of sediment depth on above sediment plant biomass production (Figure 1) and root biomass production (Figure 2). Both above sediment plant growth and root production exhibited a general trend of increased production with increased sediment depth.

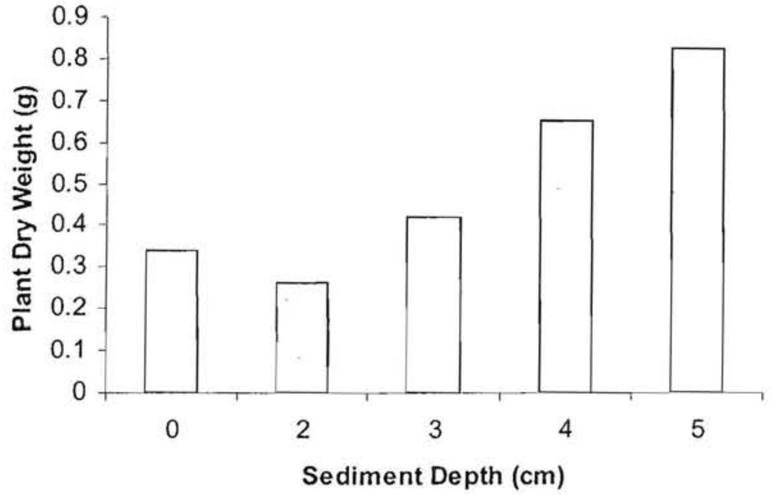

Figure 1. Mean Eurasian watermilfoil plant dry weight yield after 4 weeks.

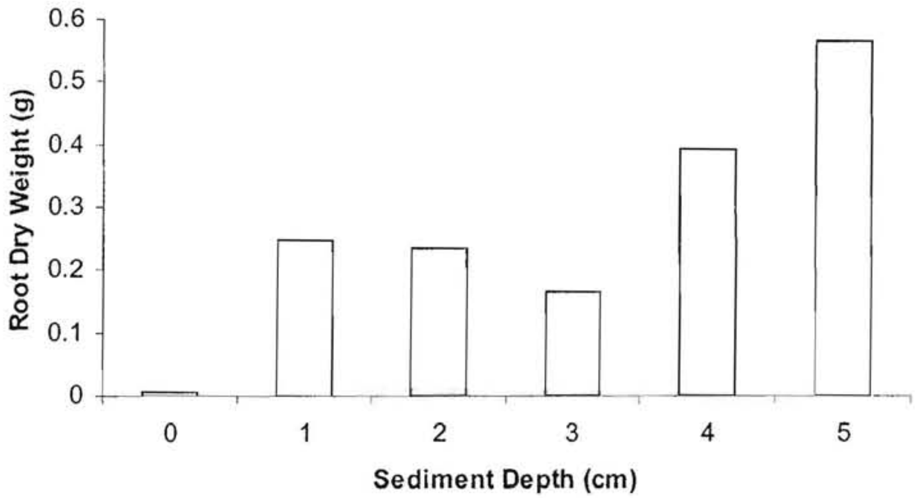

Figure 2. Mean Eurasian watermilfoil root dry weight yield after 4 weeks.

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