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FOREWORD

The 2006 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.

Traci Rauch and Joan Campbell
Co-editors, Research Progress Report
Western Society of Weed Science

WESTERN SOCIETY OF WEED SCIENCE

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Annual grass control with sulfometuron methyl and chlorosulfuron. Tim Prather, Larry Lass, and John Wallace. (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 chlorosulfuron 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

Downy brome and medusahead control ranged from 80 to 98% and 93 to 100%, respectively, two months after treatment. 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. Downy brome seed production ranged from 2 to 8% of the untreated check 3.5 months after treatment. Seed production was similar across treatments.

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

		Annual grass control[1]		Seed production[2]
Treatment[3]	Rate	BRTE[4]	TACA8	BRTE
	oz ai / A	---------------%---------------		%
Sulfometuron methyl + chlorsulfuron	1.125 + 0.5625	97	100	2
Sulfometuron methyl + chlorsulfuron	0.75 + 0.375	96	100	3
Sulfometuron methyl + chlorsulfuron	0.5625 + 0.2813	90	100	4
Sulfometuron methyl + chlorsulfuron	0.375 + 0.1875	79	100	6
Sulfometuron methyl	1.125	98	100	2
Sulfometuron methyl	0.75	95	100	2
Sulfometuron methyl	0.5625	92	100	5
Sulfometuron methyl	0.375	79	93	8
Untreated check	0	0	0	100
Tukey's Studentized Range HSD (0.05)		19	11	9

[1] Downy brome and medusahead control evaluated on May 31, 2005

[2] Downy brome seed production evaluated on July 14, 2005.

[3] 100% non-ionic surfactant (Syl-Tac) at 0.50% v/v was applied with all treatments

[4] BRTE = downy brome, TACA8 = medusahead

Sulfur cinquefoil control with metsulfuron. Timothy S. Prather. (Plant Science Division, University of Idaho, Moscow, Idaho, 83844-2339). A study was conducted near Council, ID in an abandoned alfalfa-hay field to compare levels of control of sulfur cinquefoil using imazethapyr, metsulfuron, triclopyr/clopyralid and imazapic. Individual plots were 10 by 30 feet, arranged in a randomized complete block design with four replications. Treatments were applied on April 21, 2003, using a CO_2 backpack sprayer equipped with flat fan nozzles calibrated to deliver 20 gpa (Table 1). Applications were made when sulfur cinquefoil plants were 2 to 3" in diameter.

Table 1. Application and soil data

Application date	April 21, 2003
Air temperature (F)	64
Relative humidity (%)	90
Wind (mph/direction)	1/W
Cloud cover (%)	100
Soil temperature at surface (F)	80
Soil temperature at 2 inches (F)	70
Soil temperature at 6 inches (F)	55

Plots were visually evaluated on July 5, 2003 for sulfur cinquefoil and bulbous bluegrass control as well as alfalfa injury (Table 2). Sulfur cinquefoil was best controlled using triclopyr/clopyralid (97%), but alfalfa injury was high with this treatment (75%). Metsulfuron treatments provided moderate control of cinquefoil (60-78%), but also had high injury rates for alfalfa (74-100%). Bulbous bluegrass was not visibly controlled with any treatment except for the high rate of imazapic, where control was poor.

Table 2. Sulfur cinquefoil control with metsulfuron

		Weed control[3]		Alfalfa
Treatment[1]	Rate	PTLRC	POABU	Injury
	oz ai/A[2]	-------------------%-------------------		%
Imazethapyr	1	38	0	9
Imazethapyr	2	38	0	10
Metsulfuron	0.3	60	0	97
Metsulfuron	0.45	66	0	100
Metsulfuron	0.6	70	0	74
Metsulfuron	0.9	78	0	97
Triclopyr/clopyralid	0.56	97	0	75
Imazapic	1	35	0	18
Imazapic	2	55	30	53
Untreated check		8	0	8
LSD (0.05)		17	16	33

[1] All treatments applied with surfactant at .30% v/v.

[2] Triclopyr/clopyralid and imazapic rates expressed as lb ae/A.

[3] Weeds evaluated are: sulfur cinquefoil (PTLRC) and bulbous bluegrass (POABU).

Clematis control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) *Clematis orientalis* (CLEOR) was established near Georgetown, Colorado dating back to the mining times in the late 19th century. CLEOR has extensive climbing vines that smother grass, shrubs, and trees. In recent times, CLEOR has rapidly expanded its range along the steep slopes and canyons of the Front Range in Colorado. Due to growth patterns and locations CLEOR is difficult to control. CLEOR often grows on trees and along ditches where many herbicides cannot be used. CLEOR grows as a dense viney canopy and is often found in steep rough terrain making herbicide application very difficult.

Two experiments were established near Georgetown, CO to evaluate chemical control of CLEOR. Both studies were sprayed on July 25, 2001 at adjacent rangeland sites but included different herbicides. The experiments were designed as randomized complete blocks with four replications.

Herbicides in both studies were applied when CLEOR was in early flower 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 30 feet. Application information for both studies is presented in Table 1. Visual evaluations for control compared to non-treated plots were collected in October 2001, July 2002 and 2003, August 2004, and September 2005. Tables 2 and 3 reflect data for each study and will be discussed separately.

Study 1. Metsulfuron controlled 50 to 70% of CLEOR approximately 70 days after treatment (DAT). Metsulfuron at 0.3 oz ai/a controlled 52% of CLEOR 1 year after treatment (YAT) and 21% at 2 YAT. However, metsulfuron at 0.6 or 0.9 oz ai/a controlled 86% or greater CLEOR 1 YAT to 4 YAT. Clopyralid failed to control CLEOR, but 2,4-D amine at 32 oz ai/a controlled 100% of CLEOR 1 to 4 YAT.

Study 2. Imazapic controlled CLEOR slowly. Imazapic at 3 oz ai/a controlled only 36% of CLEOR 70 DAT, but controlled 96% of CLEOR 1 YAT. Imazapic controlled 76% of CLEOR 2 to 4 YAT. Quinclorac failed to control CLEOR. Picloram at 8 oz ai/a controlled 100% of CLEOR at all 5 evaluation dates.

All treatments prevented CLEOR seedset 70 DAT in both studies. Picloram was the only treatment that caused grass injury (leaf curling). Snowberry (*Symphoricarpos albus)* and common gooseberry (*Ribes inerme)*, were killed by 2,4-D, picloram, and imazapic + 2,4-D treatments. Metulfuron, imazapic, and clopyralid treatments injured snowberry and common gooseberry but they recovered 2 YAT. Temporary minor herbicide injury to native species may be more acceptable than eventual death resulting from CLEOR invasion.

Table 1. Application data for clematis control in Colorado.

Environmental data	
Application date	July 25, 2001
Application time	10:30 am
Air temperature, F	80
Relative humidity, %	31
Wind speed, mph	0 to 2

Application date	Species	Common Name	Growth stage	Height
				--(in.)--
July 25, 2001	CLEOR	Oriental clematis	Early flower	36 to 72
	AGRSM	Western wheatgrass	Flower	12 to 18
	BROIN	Smooth brome	Flower	18 to 26

Table 2. Clematis control in Colorado (Study 1).

		Clematis control				
Herbicide[1]	Rate	October 2001	July 2002	July 2003	August 2004	September 2005
	oz ai/a	(%)				
Metsulfuron	0.3	50	52	21	25	25
Metsulfuron	0.5	64	94	76	75	78
Metsulfuron	0.6	65	93	95	86	86
Metsulfuron	0.9	70	95	89	88	90
2,4-D amine	32.0	89	100	100	100	100
Clopyralid	4.0	26	36	0	0	0
Control		0	0	0	0	0
LSD (0.05)		11	25	19	26	27

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

Table 3. Clematis control in Colorado (Study 2).

		Clematis control				
Herbicide[1]	Rate	October 2001	July 2002	July 2003	August 2004	September 2005
	oz ai/a	(%)				
Imazapic	3	36	96	86	76	78
Imazapic +2,4-D	3 + 6	55	100	100	96	96
Quinclorac	6	20	38	0	0	0
Picloram	8	100	100	100	100	100
Control		0	0	0	0	0
LSD (0.05)		12	13	21	22	23

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

Meadow hawkweed control using aminopyralid and other selective herbicides in an abandoned pasture near Santa, ID. Linda Wilson, Tim Prather, John Wallace 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 (GF-871), 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
Target weed	Meadow hawkweed	Meadow hawkweed
Weed growth stage	Bolting	Flowering
Application date	May 24, 2005	June 24, 2005
Air Temp (F)	54	57
Relative humidity (%)	46	57
Wind (mph, direction)	3-5, E	N/A
Cloud cover (%)	100	25
Soil temp at 2 inches (F)	56	N/A

Meadow hawkweed control was evaluated on June 24 and July 27, 2005 in plots that were treated at the bolting stage, and on July 27 and August 24, 2005 in plots that were treated at the flowering stage (Table 2). Treatments were visually evaluated with control based on percent seed reduction and rosette mortality in comparison to the untreated check. Each treatment prevented meadow hawkweed seed production one and two months after treatment (MAT). Treatments varied by the percent mortality of meadow hawkweed rosettes. The application of aminopyralid at both rates and the mixture of triclopyr and clopyralid provided greater meadow hawkweed control than clopyralid one and two months after treatment. The application of aminopyralid at 1.75 oz ae/A provided greater meadow hawkweed control than at 0.75 oz ae/A, but was not different in comparison to the mixture of triclopyr and clopyralid two months after treatment. Aminopyralid at both rates and the mixture of triclopyr and clopyralid provided greater meadow hawkweed control when applied at the bolting growth stage in comparison to the flower stage two months after treatment.

Table 2. Meadow hawkweed control with aminopyralid (GF-871) and other herbicides in an abandoned pasture near Santa, Idaho in 2005.

			Meadow hawkweed control	
Treatment[1]	Rate	Growth Stage	1 MAT[2]	2 MAT
	oz ae / A		-------------%-------------	
Aminopyralid	0.75	bolt	84	96
Aminopyralid	1.75	bolt	97	100
Clopyralid	5	bolt	50	79
Triclopyr/clopyralid	14	bolt	83	99
Aminopyralid	0.75	flower/seed set	84	78
Aminopyralid	1.75	flower/seed set	89	88
Clopyralid	5	flower/seed set	70	74
Triclopyr/clopyralid	14	flower/seed set	76	83
Untreated check	0		0	0
Tukey's Studentized Range HSD (0.05)			17	4

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

[2] Months after treatment

Control of meadow hawkweed with aminopyralid and surfactant in abandoned pasture near Santa, ID. Linda Wilson, Tim Prather, John Wallace 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 (GF-871) or clopyralid applied at the bolting stage with various surfactants. Surfactants included an organosilicone and seed oil blend (X77), 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 on June 24 and July 27, 2005 (Table 2). Treatments were visually evaluated with control based on percent seed reduction and rosette mortality in comparison to the untreated check. Each treatment prevented meadow hawkweed seed production one and two months after treatment (MAT). Treatments varied by the percent mortality of meadow hawkweed rosettes. The type of surfactant did not affect meadow hawkweed control at each herbicide rate one and two months after treatment. Aminopyralid applied at the rates of 0.75, 1.25, and 1.75 oz ae/A provided similar meadow hawkweed control two months after treatment. Applications of clopyralid at 5 oz ae/A and aminopyralid at 0.3 oz ae/A resulted in lower meadow hawkweed control in comparison to other treatments.

Table 2. Meadow hawkweed control with the application of aminopyralid (GF-871) or clopyralid using various surfactants at the bolting stage near Santa, ID in 2005.

Treatment	Rate	Meadow hawkweed control	
		1 MAT [1]	2 MAT
	oz ae / A	----------------%	----------------
Aminopyralid	0.3	57	66
Aminopyralid + NIS [2]	0.3	56	70
Aminopyralid + Blend [3]	0.3	58	66
Aminopyralid + Ammonium sulfate [4]	0.3	57	75
Aminopyralid	0.75	75	97
Aminopyralid + NI	0.75	76	97
Aminopyralid + Blend	0.75	81	95
Aminopyralid + Ammonium sulfate	0.75	75	99
Aminopyralid	1.25	90	100
Aminopyralid + NIS	1.25	91	99
Aminopyralid + Blend	1.25	91	100
Aminopyralid + Ammonium sulfate	1.25	92	98
Aminopyralid	1.75	91	100
Aminopyralid + NIS	1.75	91	100
Aminopyralid + Blend	1.75	87	99
Aminopyralid + Ammonium sulfate	1.75	81	98
Clopyralid	5	56	79
Clopyralid + NIS	5	68	77
Clopyralid + Blend	5	62	81
Clopyralid + Ammonium sulfate	5	67	82
Untreated check	0	0	0
Tukey's Studentized Range HSD (0.05)		28	13

[1] Months after treatment

[2] NIS = Non Ionic Sufactant (R-11) applied at a rate of 0.25% v/v

[3] Blend = organosilicone and seed oil blend (X-77) applied at a rate of 0.13% v/v

[4] Ammonium sulfate applied at a rate of 5% v/v

Control of meadow hawkweed using herbicide and fertilizer near Santa, ID. Linda Wilson, Tim Prather, and John Wallace (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established in May, 2003 to determine the effects of herbicide and fertilizer applications for the control of meadow hawkweed (*Hieracium caespitosum* Dumort) in silt-loam soil in an abandoned pasture near Santa, ID.

The experiment was designed as a split-plot with two whole-plot factors (herbicide, no herbicide) and three sub-plot factors (no fertilizer, low fertilizer rate, high fertilizer rate). At two sites, whole plots were arranged in a randomized complete block with four blocks at each site. Sub-plot size was 30 by 30 feet. Clopyralid was applied at a rate of 8 oz ae/A with ammonium sulfate at a rate of 1.0% v/v on May 6, 2003. Herbicide was applied with a tractor-mounted spraying unit calibrated to deliver 17 gpa. Fertilizer treatments were applied with hand-held broadcast spreaders on May 15, 2003. Gold Medal (23-5-5, 1% Fe, 14% S) was applied at 40 and 80 lbs/A. Before the experiment was initiated, a low, medium, and high meadow hawkweed cover micro-plot (0.5 x 0.5 m) was permanently marked in each sub-plot. Canopy cover was estimated for grasses (Idaho fescue, colonial bentgrass, bluebunch wheatgrass, timothy, mountain brome, timber oatgrass, and quackgrass), forbs (sulfur cinquefoil, oxeye daisy, strawberry), and hawkweed in each micro-plot. Canopy cover was reevaluated by species on July 12, 2005, approximately two years after treatment (Table 1). Analysis of variance was conducted in a mixed model to determine the effects of herbicide and fertilizer treatments on hawkweed, grasses, and forbs at each initial hawkweed cover: low, medium, and high.

Table 1. Effect of herbicide and fertilizer treatments on hawkweed, grass, and forb cover in low, medium, and high hawkweed cover micro-plots in abandoned pasture near Santa, ID in 2005.

2003 hawkweed cover [1]	Treatment		2005 canopy cover (0.5 x 0.5 m)								
	Clopyralid [2]	Fertilizer	Hawkweed			Grasses			Forbs		
	oz ae / A	lbs / A	---% change [3] ---								
Low	0	0	12	a [4]	(9) [5]	-14	c	(89)	2	ab	(0)
Low	0	40	9	a	(14)	-7	bc	(77)	2	ab	(0)
Low	0	80	7	ab	(12)	-9	bc	(88)	1	b	(0)
Low	8	0	-11	c	(11)	4	ab	(86)	7	a	(0)
Low	8	40	-6	bc	(6)	1	ab	(94)	1	b	(1)
Low	8	80	-18	c	(19)	13	a	(81)	2	ab	(0)
Medium	0	0	8	a	(45)	-12	b	(51)	4	bc	(1)
Medium	0	40	18	a	(39)	-10	b	(50)	2	c	(0)
Medium	0	80	13	a	(46)	-15	b	(50)	2	c	(1)
Medium	8	0	-52	b	(52)	37	a	(44)	13	a	(0)
Medium	8	40	-50	b	(50)	42	a	(48)	6	abc	(1)
Medium	8	80	-50	b	(50)	48	a	(41)	9	ab	(1)
High	0	0	0	b	(76)	2	c	(6)	13	ab	(1)
High	0	40	11	ab	(77)	-1	c	(7)	4	b	(1)
High	0	80	17	a	(73)	-1	c	(8)	4	b	(1)
High	8	0	-82	c	(82)	65	ab	(8)	24	a	(1)
High	8	40	-81	c	(82)	74	a	(9)	15	ab	(1)
High	8	80	-79	c	(79)	60	b	(7)	22	a	(1)

[1] 2003 meadow hawkweed cover classes: low (< 30% cover), medium (40-60% cover), and high (>70% cover)

[2] Ammonium sulfate (Solution 32) applied at a rate of 1.0% v/v with all treatments

[3] Percent change derived from differences between July 2005 and May 2003 evaluations

[4] Different letters indicate significant difference ($P < 0.05$) within hawkweed cover class (2003) and vegetation cover class (2005)

[5] Numbers in parentheses indicate pre-treatment percent cover in May, 2003

The application of clopyralid at 8 oz ae/A decreased (P = .0002) hawkweed cover, increased (P = .0004) grass cover, and had no effect ($P > 0.05$) on forb cover two years after treatment in plots characterized by low meadow hawkweed cover at the initiation of the experiment (Table 1). Fertilizer treatments did not affect ($P > 0.05$) hawkweed and grass cover and no interaction between herbicide and fertilizer treatments was detected. However, forb canopy cover was greater ($P = 0.04$) in plots receiving no fertilizer in comparison to treatments at both rates of fertilizer.

The application of clopyralid at 8 oz ae/A decreased ($P < .0001$) meadow hawkweed cover, and increased ($P < 0.01$) both grass and forb cover two years after treatment in plots characterized by medium hawkweed cover at the initiation of the experiment (Table 1). Fertilizer did not affect ($P > 0.05$) hawkweed, grass, and forb cover and no interaction between herbicide and fertilizer treatments was detected.

The application of clopyralid at 8 oz ae/A decreased ($P < .0001$) meadow hawkweed cover, and increased ($P < 0.01$) both grass and forb cover two years after treatment in plots characterized by high hawkweed cover at the initiation of the experiment (Table 1). The high rate of fertilizer increased ($P < 0.05$) meadow hawkweed cover in comparison to the fertilizer control in the herbicide control plots, but was similar to the low rate of fertilizer. Fertilizer treatments did not affect ($P > 0.05$) the change in cover of grass and forbs. Interactions between fertilizer and herbicide treatments were not detected.

Low-cover hawkweed micro-plots were dominated by Idaho fescue at the initiation of the study, and thus, resulted in negligible changes in grass cover in the herbicide and no herbicide treatments (Table 2). Grass species that colonized medium and high-cover hawkweed micro-plots two years after treatment included Idaho fescue, colonial bentgrass, bluebunch wheatgrass, and timothy. General species-specific trends in response to fertilizer treatments were not detected.

Table 2. Percent canopy cover of grasses in July 2005 in micro-plots characterized by low, medium, or high meadow hawkweed cover in May 2003.

			Grass canopy cover (0.5 x 0.5 m) [1]				
	Treatment			Post-treatment by species (2005)			
Hawkweed cover (2003)	Clopyralid[2]	Fertilizer	Pre-treatment total (2003)	Idaho fescue	Colonial bentgrass	Bluebunch wheatgrass	Timothy
	oz ae / A	lbs / A	%	---------------------------	-%-	------------------------------	
Low[3]	0	0	89	73	0	0	0
Low	0	40	77	69	0	0	0
Low	0	80	88	79	0	0	0
Low	8	0	86	90	0	0	0
Low	8	40	94	94	0	0	0
Low	8	80	81	84	8	0	0
Med	0	0	51	34	0	1	0
Med	0	40	50	28	0	9	1
Med	0	80	50	32	0	1	0
Med	8	0	44	54	8	7	11
Med	8	40	48	73	0	1	12
Med	8	80	41	79	3	1	5
High	0	0	6	2	0	1	0
High	0	40	7	2	0	0	0
High	0	80	8	4	0	0	0
High	8	0	8	40	20	7	6
High	8	40	9	37	29	4	13
High	8	80	7	31	22	0	3

[1] Other grasses present at the site in low densities included: mountain brome, timber oatgrass, and quackgrass

[2] Ammonium sulfate (Solution 32) applied at a rate of 1.0% v/v with all treatments

[3] 2003 meadow hawkweed cover classes: low (< 30% cover), medium (40-60% cover), and high (>70% cover)

Diffuse knapweed control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) Diffuse knapweed (CENDE) is a biennial or short-lived perennial that reproduces and spreads by seed. CENDE grows in numerous environmental settings in Colorado where it displaces native plants and other desirable vegetation.

An experiment was established near Larkspur, CO to evaluate CENDE control with aminopyralid, aminopyralid + 2,4-D amine, picloram, or clopyralid. Aminopyralid (Milestone) is a new compound manufactured by Dow AgroSciences that has been labeled for noxious and invasive weed control. Aminopyralid can be used up to the water's edge and is environmentally safe. It has no special use permits and is labeled for range, pasture, natural areas, roadsides, right-of-ways, and non-crop areas.

The experiment was designed as a split block with four replications. Herbicides were applied in April, May, June, August, or September 2004 when CENDE was in rosette, bolt, flower, or fall growth stages, respectively. All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles calibrated at 21 gal/A at 14 psi. Plot size was 10 by 30 feet. Other application information is presented in Table 1.

Visual evaluations for control compared to non-treated plots were collected in September 2004, and June and August 2005 (Table 2). CENDE control varied when sprayed at different application timings. Flower or fall treatments controlled approximately 100% of CENDE bolted plants and 72 to 100% of CENDE seedlings approximately 10 to 14 months after treatment (MAT). Rosette and bolt treatments controlled 76 to 100% of bolted plants and 0 to 15% of seedling rosettes (approximately 5 to 16 MAT). Rosette and bolt timings did not control CENDE seedlings as well as treatments applied at bud, bolt, or fall. Lack of CENDE seedlings control may have been a result of CENDE emerging in response to extremely high rainfall amounts in June and July 2004 after the rosette and bolt treatments were sprayed. Picloram or clopyralid treatments that normally work extremely well at these timings also failed to control seedling rosettes that emerged in June and July 2004. Other research conducted with aminopyralid has shown excellent residual activity to control CENDE and other susceptible weed species.

Aminopyralid controlled 81 to 100% of CENDE bolted plants and 72 to 100% of seedling rosettes approximately 12 to 16 MAT when applied after the bolting growth stage in this study. Aminopyralid sprayed at 5 or 7 oz/a controlled CENDE similarly. CENDE control did not increase when 2,4-D amine was tank mixed with aminopyralid. Aminopyralid provided quick "burndown" of CENDE (data not included in this report). CENDE control with aminopyralid (5 or 7 oz/a) was similar to picloram (16 oz/a) or clopyralid (11 oz/a) treatments at all application timings except at the bolt timing where aminopyralid controlled 70 or 76% (5 or 7 oz/a) of CENDE seedlings compared to 0% control with clopyralid.

Table 1. Application data for diffuse knapweed control in Colorado.

Environmental data					
Application date	April 15, 2004	May 11, 2004	June 22, 2004	August 4, 2004	September 29, 2004
Timing	rosette	bolt	bud	flower	fall
Air temperature, F	57	61	62	74	62
Relative humidity, %	38	41	71	37	41

Application date	Timing	Common name	Growth stage	Height	Diameter
				---(in.)---	---(in)---
April 15, 2004	rosette	diffuse knapweed	bolted plants		4 to 6
			seedlings		½ to 2
May 11, 2004	bolt	diffuse knapweed	bolted plants	2 to 4	4 to 6
			seedlings		½ to 2
June 22, 2004	bud	diffuse knapweed	bolted plants	11 to 21	5 to 9
			seedlings		½ to 5
August 4, 2004	flower	diffuse knapweed	bolted plants	11 to 21	5 to 9
			seedlings		½ to 5
September 29, 2004	fall	diffuse knapweed	rosettes		½ to10

Table 2. Diffuse knapweed control in Colorado.

			Diffuse knapweed control					
			September 2004		June 2005		August 2005	
Herbicide[1]	Rate	Application timing	Bolted[2]	Seedling[2]	Bolted[2]	Seedling[2]	Bolted[2]	Seedling[2]
	oz ai/A		(%)					
Amino pyralid	5	Rosette	100	5	100	0	100	0
	7	Rosette	100	5	96	5	100	0
Amino pyralid + 2,4-D Amine	5 + 32	Rosette	100	5	74	0	76	0
Picloram	16	Rosette	100	9	86	15	90	15
Clopyralid	11	Rosette	100	0	83	0	87	0
Amino pyralid	5	Bolt	100	65	85	68	90	70
	7	Bolt	100	87	88	75	93	76
Amino pyralid + 2,4-D Amine	5 + 32	Bolt	100	70	77	64	78	56
Picloram	16	Bolt	100	93	94	92	100	85
Clopyralid	11	Bolt	100	0	83	0	82	0
Amino pyralid	5	Bud	100	85	87	87	81	77
	7	Bud	100	98	91	93	91	91
Amino pyralid + 2,4-D Amine	5 + 32	Bud	100	91	88	96	89	85
Picloram	16	Bud	100	94	96	93	94	91
Clopyralid	11	Bud	100	81	96	86	99	90
Amino pyralid	5	Flower		100	100	100	100	100
	7	Flower		100	100	100	100	100
Amino pyralid + 2,4-D Amine	5 + 32	Flower		100	100	100	100	99
Picloram	16	Flower		99	100	100	100	100
Clopyralid	11	Flower		100	100	100	100	99
Amino pyralid	5	Fall			100	100	100	72
	7	Fall			100	100	100	90
Amino pyralid + 2,4-D Amine	5 + 32	Fall			100	100	100	91
Picloram	16	Fall			100	100	100	89
Clopyralid	11	Fall			100	97	100	83
Control								
LSD (0.05)			6	4	13	15	13	18

[1] Non-ionic surfactant (Activator 90) added to all treatments at 0.25% v/v.

[2] Control of bolted and seedling diffuse knapweed plants evaluated separately.

Russian knapweed control with metsulfuron methyl and chlorosulfuron on the Snake River floodplain. Tim Prather, Larry Lass, and John Wallace. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Parma, Idaho on the Snake River floodplain to evaluate the control of Russian knapweed (*Acroptilon repens* (L.) DC.) with metsulfuron methyl and chlorosulfuron. The experiment was designed as a randomized complete block with three replications. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer at 20 gpa (Table 1).

Table 1. Application data

Location	Parma, Idaho
Target weed	Russian knapweed
Weed growth stage	seedling
Application date	January 19, 2005
Air Temp (F)	43
Relative humidity (%)	67
Wind (mph, direction)	2, W
Cloud cover (%)	100
Soil temp at 2 inches (F)	30

Russian knapweed control was evaluated visually on April 7, May 31, and July 15, 2005 (Table 2). Control varied across evaluation dates. Herbicide mixtures of metsulfuron methyl at 0.3 oz ai/A and chlorosulfuron at 0.38 oz ai/A provided better control than either herbicide alone. Herbicide mixtures of metsulfuron methyl at 0.6 oz ai/A and chlorosulfuron at 0.75 and 1.5 oz ai/A provided 99 and 98% control, respectively, six months following treatment. Other combinations of these herbicides provided less control six months after treatment. High rates of metsulfuron methyl (0.6 oz ai/A) in combination with chlorosulfuron provided better control than low rates (0.15 oz ai/A).

Table 2. Russian knapweed control with various herbicides near Parma, Idaho in 2005.

		Russian knapweed control		
Treatment[1]	Rate	April 7	May 31	July 15
	oz ai / A	----------------	%	----------------
Metsulfuron methyl + chlorosulfuron	0.15 + 0.19	23	26	3
Metsulfuron methyl + chlorosulfuron	0.3 + 0.38	78	79	78
Metsulfuron methyl + chlorosulfuron	0.6 + 0.75	76	100	99
Metsulfuron methyl + chlorosulfuron	0.15 + 0.09	46	70	31
Metsulfuron methyl + chlorosulfuron	0.6 + 0.38	73	96	66
Metsulfuron methyl + chlorosulfuron	0.15 + 0.38	46	70	43
Metsulfuron methyl + chlorosulfuron	0.6 + 1.5	70	100	98
Chlorosulfuron	0.38	26	23	10
Metsulfuron methyl	0.3	73	86	20
Imazapic	2[2]	43	66	13
Untreated check	0	3	0	0
Tukey's Studentized Range HSD (0.05)		67	60	57

[1] Crop oil concentrate at 32 oz/A was applied with all treatments

[2] Imazapic rate is expressed as lb ae/A

Control of spotted knapweed and leafy spurge with chlorsulfuron applied alone or with various herbicides. Rodney G. Lym. (Plant Sciences Department, North Dakota State University, Fargo, ND 58105). Previous research at North Dakota State University found that metsulfuron controls some troublesome weeds, such as scentless chamomile (*Matricaria chamomilla* L.) and fringed sage (*Artemisia frigida* Willd.), which 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 chlorsulfuron applied alone or with metsulfuron or various auxin herbicides for control of spotted knapweed and leafy spurge.

The spotted knapweed experiments were established on June 9, 2004, 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 30 feet and replicated three times in a randomized complete block design. Spotted knapweed was in the rosette to early-bolt growth stage and 1 to 8 inches tall. The first experiment evaluated spotted knapweed control with chlorsulfuron applied alone or with clopyralid or picloram while the second experiment evaluated chlorsulfuron applied with metsulfuron. Control was based on a visual estimate of percent stand reduction as compared to the untreated check.

Chlorsulfuron applied alone or with metsulfuron did not provide satisfactory control of spotted knapweed (Tables 1 and 2). Spotted knapweed control averaged 93% 12 MAT (months after treatment) when chlorsulfuron was applied with clopyralid or picloram at 4 oz/A. Spotted knapweed control 12 MAT tended to decline when chlorsulfuron was applied with clopyralid at 2 oz/A and only averaged 58% compared to 88% with clopyralid alone.

The third experiment was established to evaluate leafy spurge control with chlorsulfuron applied alone or with metsulfuron. The experiment was established on a dense leafy spurge stand near Walcott, ND, on June 7, 2004. Herbicides were applied as previously described and the experimental design was similar except the plots were 9 by 30 feet.

Chlorsulfuron applied alone or with metsulfuron did not control leafy spurge at any rate evaluated (Table 3). The standard treatment of picloram plus 2,4-D at 3 and 12 MAT provided 73 and 58% leafy spurge control, respectively.

In summary, chlorsulfuron applied alone or with metsulfuron did not provide satisfactory control of either spotted knapweed or leafy spurge. Weed control with chlorsulfuron applied with clopyralid or picloram was not better than the auxin-type herbicides applied alone.

Table 1. Spotted knapweed control with chlorsulfuron applied alone or with picloram applied on June 9, 2004, near Hawley, MN.

		Months after treatment		
Treatment[1]	Rate	2	3	12
	oz/A	% control		
Chlorsulfuron	0.75	0	0	0
Chlorsulfuron	1.5	7	8	0
Chlorsulfuron + clopyralid	0.75 + 2	56	44	59
Chlorsulfuron + clopyralid	0.75 + 4	85	99	100
Chlorsulfuron + clopyralid	1.5 + 2	63	61	57
Chlorsulfuron + clopyralid	1.5 + 4	88	99	98
Clopyralid	2	73	95	88
Clopyralid	4	95	99	99
Chlorsulfuron + picloram	0.75 + 4	85	97	95
Chlorsulfuron + picloram	1.5 + 4	64	90	79
Picloram	4	56	96	95
LSD (0.05)		18	26	16

[1] Surfactant Kinetic at 0.125% by Helena Chemical Co., Memphis, TN, was applied with all treatments.

Table 2. Spotted knapweed control with metsulfuron and/or chlorsulfuron applied on June 9, 2004, near Hawley, MN.

		Months after treatment		
Treatment[1]	Rate	2	3	12
	oz/A	% control		
Metsulfuron + chlorsulfuron	0.15 + 0.166	11	3	3
Metsulfuron + chlorsulfuron	0.3 + 0.375	13	10	0
Metsulfuron + chlorsulfuron	0.6 + 0.75	39	22	0
Metsulfuron + chlorsulfuron	0.15 + 0.046	8	3	3
Metsulfuron + chlorsulfuron	0.3 + 0.0938	11	2	3
Metsulfuron + chlorsulfuron	0.6 + 0.188	12	12	3
Metsulfuron + chlorsulfuron	0.0375 + 0.188	2	0	0
Metsulfuron + chlorsulfuron	0.075 + 0.375	8	2	2
Metsulfuron + chlorsulfuron	0.60 + 0.75	23	15	3
Chlorsulfuron	0.188	0	0	0
Chlorsulfuron	0.375	3	0	3
Chlorsulfuron	0.75	8	0	0
Picloram + 2,4-D	8 + 16	100	100	100
LSD (0.05)		5	9	7

[1] Methylated seed oil at 1 qt/A, Scoil by AGSCO, Grand Forks, ND, was applied with treatments except picloram plus 2,4-D.

Table 3. Leafy spurge control with metsulfuron and/or chlorsulfuron applied on June 7, 2004, near Walcott, ND.

		Months after treatment		
Treatment[1]	Rate	2	3	12
	—— oz/A ——		—— % control ——	
Metsulfuron + chlorsulfuron	0.15 + 0.166	20	5	3
Metsulfuron + chlorsulfuron	0.3 + 0.375	3	2	5
Metsulfuron + chlorsulfuron	0.6 + 0.75	33	13	5
Metsulfuron + chlorsulfuron	0.15 + 0.046	8	3	0
Metsulfuron + chlorsulfuron	0.3 + 0.0938	5	2	3
Metsulfuron + chlorsulfuron	0.6 + 0.188	28	7	0
Metsulfuron + chlorsulfuron	0.0375 + 0.188	0	0	0
Metsulfuron + chlorsulfuron	0.075 + 0.375	3	0	0
Metsulfuron + chlorsulfuron	0.60 + 0.75	7	3	2
Chlorsulfuron	0.188	3	0	0
Chlorsulfuron	0.375	0	0	0
Chlorsulfuron	0.75	0	2	5
Picloram + 2,4-D	8 + 16	91	73	58
LSD (0.05)		33	14	10

[1] Methylated seed oil at 1 qt/A, Scoil by AGSCO, Grand Forks, ND, was applied with all treatments except picloram plus 2,4-D.

Medusahead rye control in rangeland. Sandra M. Frost, Larry H. Bennett, and Daniel A. Ball (Oregon State University – CBARC, Pendleton, OR 97801). A study was established on rangeland administered by the Confederated Tribes of the Umatilla Indian Reservation, near Pendleton, OR to evaluate herbicide treatments for control of medusahead rye. Plots were 9 by 30 ft arranged in a randomized complete block design with 3 replications. Soil at the site was a silt loam (24.6% sand, 57.9% silt, 17.5% clay, 2.0% organic matter, 6.5 pH, and CEC of 23.7 meq/100g). Herbicide treatments were applied using a 9 ft hand-held boom, CO_2 pressured sprayer delivering 16 gpa at 30 psi. Fall treatments were applied November 4, 2004 when medusahead rye was at the 2 to 2.5 leaf stage (Table 1). Spring treatments were applied on March 4, 2005. Control of medusahead rye was visually evaluated on June 9 and September 23, 2005. Mention of products used in this trial should not be considered to be a product endorsement or recommendation for commercial use.

Table 1. Application conditions.

	Nov 4, 2004	Mar 4, 2005
Timing	Fall	Spring
Medusahead rye (leaf)	2-2.5	--
Air temperature (F)	40	55
Relative humidity (%)	83	60
Wind speed (mph)	2	4
Soil temperature (F at 1 inch)	44	58
Cloud cover (%)	0	0

Results indicated that glyphosate, at 0.5 lb ai/a, applied in split treatments gave excellent control of medusahead rye that continued until the September rating (Table 2). Imazapic + glyphosate tankmixed (0.125 lb ai/a + 0.5 lb ai/a) gave excellent early control (95%) and good control at the September rating (88%). Sulfometron methyl + chlorsulfuron at both rates gave fair control (73 to 82%) of medusahead rye at the September rating. The remaining treatments gave poor control of medusahead rye. Split applications of glyphosate and the imazapic + glyphosate treatment eliminated most of the vegetation in the plots, including forbs.

Table 2. Medusahead rye control on rangeland.

Treatment[1]	Rate	Timing	Medusahead rye control	
			6/9/05	9/23/05
	-----lb ai/a-----		--------%--------	
Untreated control	-----	Fall	0	0
Propoxycarbazone-sodium + NIS	0.03 + 0.25% v/v	Fall	0	3
Propoxycarbazone-sodium + NIS	0.04 + 0.25% v/v	Fall	0	0
Propoxycarbazone-sodium + NIS	0.05 + 0.25% v/v	Fall	0	7
AE F130060 + propoxycarbazone-sodium + NIS	0.009 + 0.01 + 0.25% v/v	Fall	17	7
AE F130060 + propoxycarbazone-sodium + NIS	0.013 + 0.03 + 0.25% v/v	Fall	22	10
AE F130060 + AE F107892 + NIS	0.013 + 0.013 + 0.25% v/v	Fall	13	0
AE F130060 + AE F107892 + propoxycarbazone-sodium + NIS	0.009 + 0.009 + 0.01 + 0.25% v/v	Fall	8	3
AE F130060 + AE F107892 + propoxycarbazone-sodium + NIS	0.013 + 0.013 + 0.03 + 0.25% v/v	Fall	10	3
Imazapic + MSO	0.125 + 1% v/v	Fall	67	45
Imazapic + glyphosate	0.125 + 0.5	Fall	95	88
Sulfosulfuron + glyphosate	0.059 + 0.5	Fall	42	27
Sulfosulfuron + NIS	0.059 + 0.25% v/v	Fall	7	0
Glyphosate / glyphosate	0.5 + 0.5	Fall / Spring	95	92
DPX-E9636 + MSO	0.03 + 1% v/v	Fall	62	48
DPX-E9636 + MSO	0.06 + 1% v/v	Fall	82	78
Sulfometuron methyl + chlorsulfuron + MSO	0.035 + 0.018 + 1% v/v	Fall	80	82
Sulfometuron methyl + chlorsulfuron + MSO	0.047 + 0.023 + 1% v/v	Fall	83	73
LSD (0.05)			21	18

[1] NIS = non-ionic surfactant; MSO = methylated seed oil.

Table 2. Comparing hebicides to mechanical techniques to control Mediterranean sage.

			Mediterranean sage control		
Herbicide[1,2]	Rate	Application timing	June 2004	October 2004	April 2005
	oz ai/a		---------------------------(%)	------------------------	
Metsulfuron	0.6	Rosette	88	100	91
Metsulfuron + 2,4-D amine	0.6 + 16.0	Rosette	100	100	100
Chlorsulfuron + 2,4-D amine	0.8 + 16.0	Rosette	90	96	96
Picloram	8.0	Rosette	96	82	77
Picloram	12.0	Rosette	100	97	93
Picloram + chlorsulfuron	8.0 + 0.8	Rosette	98	100	100
Clopyralid	6.0	Rosette	47	12	12
Clopyralid + 2,4-D amine	3.0 + 16.0	Rosette	95	83	80
Diflufenzopyr + dicamba	1.6 + 8.0	Rosette	61	52	67
Glyphosate	16.0	Rosette	92	75	65
Imazapic	2.0	Rosette	68	73	67
Imazapic + 2,4-D amine	2.0 + 16.0	Rosette	95	98	97
2,4-D amine	16.0	Rosette	68	62	57
2,4-D ester	16.0	Rosette	99	98	92
Alldown[3]		Rosette	23	10	10
Dig		Rosette	74	75	40
Dig deep		Rosette	87	79	67
Flamer		Rosette	23	13	7
Control		Rosette	0	0	0
LSD (0.05)			21	21	20

[1] Non-ionic surfactant added to all metsulfuron, chlorsulfuron, clopyralid, 2,4-D, and picloram treatments at 0.25% v/v.

[2] Methylated seed oil added to all imazapic treatments at 1 quart/acre.

[3] *Alldown* is a non-selective weed and grass herbicide made from 5.0% citric acid, 0.2% Garlic. Other ingredients include: 94.8% acetic acid, yucca extracts, and water. These treatments were spot sprayed with 100% concentrate solution that was provided in manufacture's bottle.

Potential rapid bioassay to evaluate treatment effects on saltcedar. Ruth Richards and Ralph E. Whitesides. (Department of Plants, Soils and Biometeorology, Utah State University, Logan, Utah 84322-4820) Two herbicide treatments and grazing by goats were evaluated for effectiveness in controlling saltcedar (TAARA) in a poorly managed, irrigated pasture in Lake Shore, Utah. The soil is a Bramwell silty clay loam with 2.6 percent organic matter and pH 8.0. On May 26, 2004, triclopyr amine or imazapyr was applied at the rate of 1% v/v. The foliage was sprayed to wet using an 8003 flat fan nozzle at 40 psi. Plots not treated with herbicide were grazed by goats. Grazing occurred four times: May 31, June 30, August 4, and September 6, 2004. The original grazing period was 24 hours and gradually reduced to 12 hours by the end of the season when plant biomass was limited. There were 10 to12 goats in each 16 by 16 foot plot to provide equivalent animal biomass.

Saltcedar treatments are typically evaluated 2 to 3 years after treatment. To develop a rapid bioassay system, stem cuttings were taken from each saltcedar plot to compare regrowth potential from stored energy reserves. Cuttings were taken in the fall (October 7, 2004) and in the spring (May 3, 2005). Each cutting was 12 inches long and approximately 0.25 inch in diameter. The cuttings were propagated in a sandy soil and watered daily for 1 minute every 6 hours for 18 weeks. The dry weights of the root and shoot materials were then compared and no differences were found among treatments using this method of evaluation. Cuttings from untreated and ungrazed saltcedar plants were also grown in the greenhouse under the same conditions as described above. After 14 weeks, plants were treated with 1% v/v of imazapyr or triclopyr amine. Seven weeks after treatment, dry weights of root and shoot materials were compared and no significant differences were found among treatments. Neither of the bioassay techniques, stem cuttings harvested after field treatments or untreated stem cuttings that were treated and then evaluated, provided a dependable or rapid (18-21 weeks) evaluation method to assess saltcedar control.

Saltcedar control with grazing compared to herbicides. Ruth Richards and Ralph E. Whitesides. (Department of Plants, Soils and Biometeorology, Utah State University, Logan, Utah 84322-4820) Two herbicide treatments and grazing by goats were evaluated for effectiveness in controlling saltcedar (TAARA) in a poorly managed, irrigated pasture in Lake Shore, Utah. The soil is a Bramwell silty clay loam with 2.6 percent organic matter and pH 8.0. On May 26, 2004 triclopyr amine and imazapyr were applied at the rate of 1% v/v plus MSO. The foliage was sprayed to wet using an 8003 flat fan nozzle at 40 psi. Plots not treated with herbicide were grazed by goats. Grazing occurred four times: May 31, June 30, August 4, and September 6, 2004. The original grazing period was 24 hours and gradually reduced to 12 hours by the end of the season when plant biomass was limited. There were 10 to 12 goats in each 16 by 16 foot plot to provide equivalent animal biomass. Visual evaluations estimate grazing to be the best control at the end of the treatment year. At the end of year two, visual estimates showed imazapyr to be the best long-term control (Table).

On June 21, 2005 the regrowth in the plots that were grazed in 2004 was subsequently treated with each of the test herbicides. Both herbicides were applied at 2% v/v plus MSO. Fifteen months after the initial treatments, visual evaluations showed that grazing in the first treatment year followed by imazapyr in year two gave the highest level of control from sequential treatments (94%) compared to grazing followed by triclopyr (89%) and the grazed control (29%). No treatment was more effective than imazapyr alone.

Table. Visual evaluations of saltcedar control.

		TAARA control		
Treatment	Rate or Timing	Oct 2004	May 2005	Oct 2005
		-----------------	%	-----------------
Control		0c	0c	0d
Triclopyr amine	1% v/v	53b	58b	45b
Imazapyr	1% v/v	68ab	100a	98a
Grazing	May 31, Jun 30, Aug 4, Sep 6	84a	79b	29c
Grazing (2004) + Imazapyr (2005)	2 % v/v	-	-	94a
Grazing (2004) + Triclopyr (2005)	2 % v/v	-	-	89a
LSD (0.05)		26.8	18.8	9.6

Means followed by the same letter are not significantly different.

Control of rush skeletonweed with aminopyralid near Horseshoe Bend, Idaho. Tim Prather, Larry Lass, and John Wallace. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Horseshoe Bend, Idaho in Idaho Parks and Recreation land to evaluate the control of rush skeletonweed (*Chondrilla juncea* L.) using aminopyralid (GF-871), clopyralid, and picloram. The experiment was designed as a randomized complete block with four replications. Plot size was 10 by 30 feet. All treatments were applied with a CO_2-pressurized backpack sprayer calibrated to deliver 20 gpa at 40 psi and 3 mph (Table 1).

Table 1. Application data

Location	Horeshoe Bend, ID
Target weed	Rush skeletonweed
Weed growth stage	1-2 inches dia
Application date	April 6, 2005
Air Temp (F)	58
Relative humidity (%)	41
Wind (mph, direction)	3, W
Cloud cover (%)	10
Soil temp at 2 inches (F)	48

Rush skeletonweed control was evaluated visually on May 31 and July 14, 2005. All herbicide treatments provided satisfactory rush skeletonweed control (Table 2). Control ranged from 92 to 100% on May 31 and July 14, 2005. Aminopyralid at 1.75 oz ae/A resulted in greater rush skeletonweed control when compared to aminopyralid at 0.75 oz ae/A, but was similar to all other rates of aminopyralid, and the picloram and clopyralid treatments.

Table 2. Rush skeletonweed control with aminopyralid (GF-871), clopyralid, and picloram near Horseshoe Bend, Idaho in 2005.

		Rush skeletonweed control	
Treatment[1]	Rate	May 31	July 14
	oz ae / A	----------------------%----------------------	
Aminopyralid	0.75	93	93
Aminopyralid	1	92	99
Aminopyralid	1.25	99	99
Aminopyralid	1.5	95	99
Aminopyralid	1.75	100	100
Clopyralid	6	100	97
Picloram	8	100	100
Untreated check	0	0	0
Tukey's studentized range HSD (0.05)		8	6

[1] 100% non-ionic surfactant (Syl-Tac) at 0.25% v/v was applied with all treatments

Myrtle spurge control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) Myrtle spurge (EPHMY) is an invasive ornamental that has escaped into sensitive ecosystems 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 3 replications. Herbicides (table 2) were applied on October 7, 2004 when EPHMY was in fall vegetative growth stage. All treatments were applied with a CO_2-pressurized backpack sprayer using 11003LP flat fan nozzles calibrated 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 January, April, and July 2005 (Table 2). Dicamba plus 2,4-D, 2,4-D amine, and 2,4-D acid controlled 83 to 93% of EPHMY from approximately 3 to 9 months after treatment (MAT). Dicamba sprayed alone controlled 55 to 79% of EPHMY 3 to 9 MAT. Picloram (16 oz/A) controlled EPHMY slowly. Picloram controlled 35% of EPHMY 3 MAT and 68 to 73% 7 to 9 MAT. Plateau controlled less than 50% of EPHMY in this experiment.

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 this study. A handpull treatment was added to the spring study that controlled 90 to 93% of EPHMY approximately 60 DAT.

Myrtle spurge has a very large diameter tap root (1 to 2' deep) at this particular study site. It appeared that some of the treatments killed the smaller plants but larger plants with larger root systems were more difficult to control. Many of these larger plants had regrowth after initial kill of top-growth. It may take higher concentrations of herbicides or sequential treatments of herbicides to control these larger EPHMY plants.

Handpulling may be a viable option if the entire root systems are pulled. A few EPHMY seedling plants emerged from seed in handpull plots 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 in skin or eyes. Digging EPHMY plants would also work but it was too rocky at this site to dig. This study will be evaluated in 2006 for EPHMY control longevity.

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

Environmental data	
Application date	October 7, 2004
Application time	10:00 AM
Air temperature, F	63
Relative humidity, %	27
Wind speed, mph	0 to 2

Application date	Species	Common name	Growth stage	Height
				---(in.)---
October 7, 2004	EPHMY	myrtle spurge	vegetative	4 to 9

Table 2. Myrtle spurge control in Colorado.

Herbicide[1,2,3]	Rate	Application timing	Myrtle spurge control			
			January	April	July	October
	oz/A		----------%----------			
Picloram	16	Fall	30	73	68	67
Imazapic	12	Fall	22	55	27	27
Dicamba	32	Fall	45	79	65	65
Dicamba + 2,4-D Amine	17 + 47	Fall	92	98	93	85
2,4-D Acid	136	Fall	88	94	80	80
2-4-D Ester	64	Fall	83	95	82	83
Glyphosate	32	Fall	43	47	37	35
Control		Fall	0	0	0	0
LSD (0.05)			24	23	23	26

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

[2] Methylated seed oil added to all imazapic treatments at 1 qt/A.

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

Yellow starthistle control with aminopyralid on Idaho rangeland. Tim Prather, Larry Lass, and John Wallace. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). An experiment was established near Lapwai, ID in roadside vegetation to evaluate yellow starthistle (*Centaurea solstitialis* L.) control with aminopyralid (GF-871), clopyralid, and picloram at the rosette and bolting growth stages. 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	Lapwai, ID
Target weed	Yellow starthistle	Yellow starthistle
Weed growth stage	Rosette	Bolting
Application date	April 25, 2005	June 6, 2005
Air Temp (F)	62	58
Relative humidity (%)	53	54
Wind (mph, direction)	2-4, W	2-5, W
Cloud cover (%)	0	60
Soil temp at 2 inches (F)	60	62

Yellow starthistle control was evaluated on July 26, 2005 (Table 2). All aminopyralid rates provided excellent yellow starthistle control following rosette (100%) and bolting (90-100%) applications. Control did not differ statistically in comparison between rosette and bolting applications. Aminopyralid rates provided similar levels of control.

Table 2. Yellow starthistle control with various herbicides near Lapwai, Idaho in 2005.

Treatment [1]	Rate	Growth Stage	Yellow starthistle control
	oz ae / A		%
Aminopyralid	0.75	rosette	100
Aminopyralid	1	rosette	100
Aminopyralid	1.25	rosette	100
Aminopyralid	1.5	rosette	100
Clopyralid	3	rosette	100
Picloram	6	rosette	100
Aminopyralid	1	bolt	90
Aminopyralid	1.5	bolt	100
Aminopyralid	1.75	bolt	98
Aminopyralid + 2,4-D (A)	1 + 16	bolt	100
Aminopyralid + 2,4-D (A)	1.5 + 16	bolt	100
Clopyralid	3	bolt	100
Picloram	6	bolt	100
Check			
Tukey's Studentized Range HSD (0.05)			13

[1] 100% non-ionic surfactant (Syl-Tac) at 0.25% v/v was applied with all treatments

Yellow starthistle control and grass tolerance with various herbicide combinations. Timothy S. Prather. (Plant Science Division, University of Idaho, Moscow, Idaho, 83844-2339). A trial was conducted south of Lewiston, Idaho to evaluate yellow starthistle control using a range of herbicides. Plots were established in a grass field infested with yellow starthistle in a randomized complete block design with four replications. Individual plots were 10 feet by 30 feet. Treatments were applied to pre-bolting rosettes on June 3, 2003, using a backpack sprayer equipped with flat fan nozzles calibrated to deliver 20 gpa.

Table 1. Application and soil data.

Location	Lewiston, ID
Application date	June 3, 2003
Air temperature (F)	68
Relative humidity (%)	60
Wind (mph/direction)	0-3/N
Cloud cover (%)	0
Soil temperature at surface (F)	72
Soil temperature at 2 inches (F)	66
Soil temperature at 6 inches (F)	60

Grass was not visibly injured in any of the plots (data not shown). The best control was achieved with a combination of metsulfuron, 2,4-D and diglocolamine (93%). This treatment did not differ significantly from other treatments, with one exception. The triclopyr/clopyralid treatment provided significantly less yellow starthistle control (70% control) than the previously mentioned treatment (93% control).

Table 2. Yellow starthistle control and grass tolerance with various herbicide combinations.

Treatment[1]	Rate	Yellow starthistle control
	lb ai/A[2]	%
Metsulfuron + 2,4-D + diglocolamine	0.019 + 1.0 + 0.5	91
Metsulfuron + 2,4-D + diglocolamine	0.019 + 0.5 + 0.5	89
2,4-D + diglocolamine	1.0 + 0.5	83
MCPA + diglocolamine	0.5 + 0.5	89
Metsulfuron + 2,4-D + diglocolamine	0.038 + 1.0 + 0.5	93
Metsulfuron + fluroxypyr	0.038 + 0.188	83
Fluroxypyr	0.188	83
Triclopyr/clopyralid	0.187	70
Metsulfuron + triclopyr/clopyralid	0.016 + 0.187	80
Untreated check		0
LSD (0.05)		14

[1] All treatments applied with surfactant at .30% v/v.

[2] Triclopyr/clopyralid rates in lb ae/A.

Tansy control with metsulfuron and triasulfuron. Timothy S. Prather. (Plant Science Division, University of Idaho, Moscow, Idaho, 83844-2339). In the fall of 2002, a trial was conducted in Potlach, Idaho, to evaluate tansy control using metsulfuron and triasulfuron. Established plots were 10 feet by 40 feet, arranged in a randomized complete block design with four replications. Treatments were applied in September of 2002, when plants were at 100% flower, using a backpack sprayer calibrated to deliver 10 gpa (Table 1).

Table 1. Application and soil data

Location	Potlach, ID
Application date	September, 2002
Air temperature (F)	69
Relative humidity (%)	42
Wind (mph, direction)	2/SW
Cloud cover (%)	100
Soil temp at surface (F)	70
Soil temp at 2 inches (F)	60
Soil temp at 6 inches (F)	56
Dew/frost	0

Tansy control was evaluated visually on July 5, 2003. Excellent control (98%) of tansy was achieved using the high rate of metsulfuron. Lower rates of metsulfuron provided moderate control (74%), but did not differ significantly from control achieved using triasulfuron, which provided poor control (15-19%).

Table 2. Tansy control with metsulfuron and triasulfuron

Treatment	Rate	Tansy control
	oz ai/A[1]	%
Metsulfuron	0.3	74
Metsulfuron	0.6	74
Metsulfuron	0.9	98
Triasulfuron	0.3	15
Triasulfuron	0.6	19
Metsulfuron + triclopyr/clopyralid	0.3 + 0.25	74
Untreated check		3
LSD (0.05)		40

[1] Triclopyr/clopyralid rates in lb ae/A.

Cutleaf teasel control in Colorado. James R. Sebastian and K.G. Beck. (Department of Bioagriculture Sciences and Pest Management, Colorado State University, Fort Collins, CO 80523) Cutleaf teasel (DIWLA) is a biennial that has recently become a problem on wet rangeland sites and along roadsides in Colorado.

An experiment was established in Jefferson County, CO to evaluate DIWLA control. The experiment was designed as a randomized complete block with four replications. Herbicides were applied on June 23, 2003 when DIWLA was in rosette or bolting growth stages (Table 2). 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. Non-ionic surfactant was added at 0.25% v/v to all metsulfuron and chlorsulfuron treatments and methylated seed oil was added to all imazapic treatments at 1 qt/A.

Visual evaluations for control compared to non-treated plots were collected in October 2003 and 2004, and July 2005 (Table 2). Metsulfuron alone controlled 90 to 100% of DIWLA rosettes in 2003 and controlled 70 to 83% of DIWLA rosettes in 2004. Metsulfuron plus chlorsulfuron plus 2,4-D Ester (0.3 + 0.4 + 6 oz/ac) controlled 96% of rosettes and 100% of bolted plants in October 2004 (approximately 16 months after treatment (MAT). Control of DIWLA rosettes with this herbicide combination dropped to 51% in July 2005 (approximately 24 MAT) which was similar to Metsulfuron (> 0.3 oz ai/A) and Chlorsulfuron + 2,4-D Ester.

Clopyralid controlled 99 to 100% of DIWLA rosettes and bolted plants the year of treatment, but only controlled 9% of the rosettes and 100 or 84% of the bolted DIWLA plants 16 or 24 MAT. It may be possible to prevent seed production with these treatments for 3 consecutive growing seasons. Clopyralid has the additional benefit of controlling Canada thistle (CIRAR) which is often found in areas with teasel. If both DIWLA and CIRAR are present it would be advantageous to use clopyralid to control both weed species except where a high water table is present.

Chlorsulfuron + 2,4-D Ester controlled DIWLA similar to imazapic. Both of these treatments controlled 73 to 83% of DIWLA rosettes and bolted plants in 2003 and 69 to 83% of rosettes in 2004. All treatments in this study controlled 98 to 100% of DIWLA bolted plants 16 MAT in 2004.

Control of DIWLA did not vary among imazapic treatments; from 73 to 79% and 81 to 82% of bolting and rosette plants respectively were controlled the season of application. All rates prevented bolting and seed set in 2004, about 1 YAT, but residual control of rosettes ranged from 69 to 83%.

Table 1. Application data for cutleaf teasel control in Colorado.

Environmental data	
Application date	June 23, 2003
Application time	9:45 am
Air temperature, F	67
Relative humidity, %	41
Wind speed, mph	1 to 3

Application date	Species	Common name	Growth stage	Height
			-------(in.)-------	----(in.)--
June 23, 2003	DIWLA	Cutleaf teasel	1st year rosettes	1/2 to 14 diameter
	DIWLA	Cutleaf teasel	2nd year rosettes	16 to 24

Table 2. Cutleaf teasel control in Colorado.

			Teasel control					
		Application	October 2003		October 2004		July 2005	
Herbicide[1,2]	Rate	timing	Rosette	Bolting	Rosette	Bolting	Rosette	Bolting
			(%)					
	oz ai/a							
Metsulfuron	0.3	Rosette	90	97	70	100	36	70
Metsulfuron	0.5	Rosette	100	96	82	100	55	88
Metsulfuron	0.6	Rosette	95	99	83	100	50	100
Imazapic	8.0	Rosette	82	73	69	100	33	85
Imazapic	10.0	Rosette	81	79	72	100	33	75
Imazapic	12.0	Rosette	81	74	83	100	39	100
Clopyralid	6.0	Rosette	100	99	9	100	8	84
2,4-D ester	16.0	Rosette	94	91	38	100	13	100
Chlorsulfuron + 2,4-D ester	0.4 + 6.0	Rosette	83	75	73	98	40	85
Chlorsulfuron + metsulfuron + 2,4-D ester	0.4 + 0.3 + 6.0	Rosette	95	94	96	100	51	100
Control		Rosette	0	0	0	0	0	0
LSD (0.05)			13	12	16	2	27	35

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

[2] Methylated seed oil added to all imazapic treatments at 1 qt/A.

Control of invasive weeds with aminopyralid in North Dakota. Rodney G. Lym and Luke W. Samuel. (Plant Sciences Department, 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 various timing and use rates of aminopyralid for control of absinth wormwood, Canada thistle, leafy spurge, and perennial sowthistle.

Aminopyralid was spring- or fall-applied at rates ranging from 0.75 oz ae/A to the maximum potential use rate of 1.75 oz/A 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 and replicated three or four times in a randomized complete block design at two locations for all species, except leafy spurge had one location. Control of each species was evaluated visually using percent stand reduction compared to the untreated control. Results were compared to a standard herbicide applied at the general use rate for each weed species.

An experiment to evaluate control of absinth wormwood, Canada thistle, and perennial sowthistle with aminopyralid applied alone in the spring or fall was established near Jamestown, ND. Treatments were applied June 4 or October 6, 2003. Spring-applied treatments were to absinth wormwood actively growing and 12 to 24 inches tall, Canada thistle 12 to 18 inches tall, and perennial sowthistle 6 to 12 inches tall. Canada thistle and perennial sowthistle were in the rosette to early bolt growth stage. Fall-applied treatments were to absinth wormwood, Canada thistle, and perennial sowthistle rosettes, which developed after the plants had been mowed in July.

Absinth wormwood control 12 MAT (months after treatment) for spring or 9 MAT for fall treatments by aminopyralid averaged 98% regardless of rate or date or treatment (Table 1). Canada thistle control 12 MAT with spring-applied aminopyralid averaged 85% over all rates, compared to 65% over all rates for fall-applied aminopyralid. Canada thistle control 12 MAT with spring- or fall-applied picloram at 6 oz/A was 90 and 83%, respectively, whereas spring- or fall-applied clopyralid provided 70 and 19% control, respectively. Canada thistle control 15 MAT with spring-applied aminopyralid decreased to approximately 27% on all rates, compared to picloram and clopyralid at 6 oz/A with 40 and 17% control, respectively. Perennial sowthistle control 12 and 9 MAT with spring-applied or fall-applied aminopyralid was approximately 95% regardless of rate.

A second study was established at two locations to further evaluate aminopyralid applied alone or with 2,4-D for absinth wormwood control near Eckelson and near Jamestown. Treatments were applied May 27, 2004, near Eckelson and Jamestown, ND, to 1 to 14 inch tall absinth wormwood.

Absinth wormwood control was similar whether aminopyralid was applied alone or with 2,4-D, but control varied by location (Table 2). Absinth wormwood control 3 MAT averaged 96% at Jamestown but only 84% at Eckelson. Control 12 MAT remained 90% or better at Jamestown when aminopyralid was applied at 1.5 oz/A or higher alone or with 2,4-D while the same treatments at Eckelson only averaged 62%. Absinth wormwood control with the standard treatment of picloram plus 2,4-D at 2 + 8 oz/A was also higher at Jamestown (90%) than Eckelson (36%). The decreased control at the Eckelson compared to Jamestown sites may have been due to high precipitation which caused flooding at Eckelson in the spring of 2005.

A third experiment was established to evaluate Canada thistle and perennial sowthistle control with aminopyralid on unused cropland near Fargo, ND. Herbicides were applied June 2 and October 1, 2003. Spring-applied treatments were on June 2, 2003, to Canada thistle and perennial sowthistle plants 4 to 8 inches tall in the rosette growth stage. Fall-applied treatments were on Oct. 1, 2003, to Canada thistle and perennial sowthistle rosettes, which developed after the plants had been mowed in July.

Canada thistle control was very high whether aminopyralid was spring- or fall-applied , averaging 95% 24 MAT, and 97% 21 MAT, respectively (Table 3). Concurrently, Canada thistle control with picloram or clopyralid averaged 93 and 97% 24 or 21 MAT, respectively. Perennial sowthistle control with spring-applied aminopyralid over all rates averaged 95% 15 MAT with fall-applied aminopyralid averaged 98% 12 MAT.

A fourth experiment was established to further evaluate Canada thistle control with aminopyralid near Jamestown and Fargo, ND. Spring treatments were applied June 3, 2004 to 14 to 16 inch tall Canada thistle in the early bolt growth stage at Jamestown, and June 4, 2004 to Canada thistle rosettes that were 6 to 8 inches tall at Fargo. The Jamestown site was disturbed in September 2004 so no further evaluations could be made. The fall treatments in Fargo were applied September 30, 2004, to Canada thistle rosettes that were 4 to 8 inches tall after the plants had been mowed in July 2004.

Canada thistle control at Fargo 3 MAT with aminopyralid averaged 98% regardless of rate, but at Jamestown 3 MAT ranged from 81 to 93% when aminopyralid was applied from 1.25 to 1.75 oz/A (Table 4). Canada thistle control 3 MAT by picloram plus 2,4-D at 4 + 30 oz/A was 85 and 89% at Fargo and Jamestown, respectively, while control with clopyralid plus 2,4-D at 4 + 24 oz/A averaged 89 and 59%, respectively. Differences in Canada thistle control may have been due to increased Canada thistle density and cover at Jamestown compared to Fargo.

Leafy spurge control with aminopyralid applied in the spring or fall was evaluated near Ekre, ND. The herbicides were applied June 3, 2003, to 8 to 36 inch tall leafy spurge in the true flower growth stage, or September 15, 2003, to plants in the fall regrowth stage and 18 to 36 inches tall. Aminopyralid did not provide satisfactory control of leafy spurge regardless of herbicide rate or application date (Table 5).

In summary, aminopyralid effectively controlled absinth wormwood, perennial sowthistle, and Canada thistle at much lower use rates than currently used herbicides. Aminopyralid control of Canada thistle may be influenced by Canada thistle density and cover, with generally better control at the low density sites. In general, control of the composite family weeds was similar whether aminopyralid was applied in the spring or fall and whether applied alone or with 2,4-D. Spring- or fall-applied aminopyralid did not control leafy spurge satisfactorily at the proposed use rates.

Table 1. Canada thistle, absinth wormwood, and perennial sowthistle control with aminopyralid and other auxin-type herbicides applied in June or October 2003 near Jamestown, ND.

		Time after treatment / weed species						
		3 MAT[1]			12 MAT			15 MAT
Treatment[2]	Rate	CT[1]	ABS[1]	PS[1]	CT	ABS	PS	CT
Spring applied	– oz/A –				% control			
Aminopyralid	0.75	93	99	98	70	100	85	24
Aminopyralid	1	96	99	98	90	98	78	39
Aminopyralid	1.25	96	100	98	87	100	99	26
Aminopyralid	1.5	92	99	98	91	100	97	30
Aminopyralid	1.75	94	100	98	87	100	99	16
Picloram	6	94	99	99	90	100	100	41
Clopyralid	6	97	99	98	70	100	42	17
Dicamba	16	59	99	96	33	97	54	12
2,4-D	24	49	73	75	36	63	31	36
LSD (0.05)		18	12	18				
Fall applied					9 MAT			12 MAT
Aminopyralid	0.75				99	95	100	52
Aminopyralid	1				100	98	96	63
Aminopyralid	1.25				99	99	97	56
Aminopyralid	1.5				100	99	99	74
Aminopyralid	1.75				100	98	100	80
Picloram	6				99	100	100	83
Clopyralid	6				96	78	30	19
Dicamba + diflufenzopyr[3]	3 + 1.2				80	35	33	9
Dicamba	16				94	100	38	0
LSD (0.05)					25	19	34	31

[1] Abbreviatons: MAT = months after treatment; CT = Canada thistle; ABS = Absinth wormwood; PS = perennial sowthistle.

[2] Surfactant Activator 90 at 0.25% v/v applied with all treatments, Loveland Industries, Greeley, CO 80632.

[3] Commercial formulation - Overdrive by BASF Corp., Research Triangle Park, NC 27709.

Table 2. Absinth wormwood control with aminopyralid applied alone or with 2,4-D in May 2004 at Eckelson or Jamestown, ND.

		Location / time after treatment			
		Jamestown		Eckelson	
Treatment[1]	Rate	3 MAT[2]	12 MAT	3 MAT	12 MAT
	— oz/A —	% control			
Aminopyralid	0.75	92	77	88	63
Aminopyralid	1	93	88	64	37
Aminopyralid	1.25	97	67	99	56
Aminopyralid	1.5	99	90	75	57
Aminopyralid	1.75	99	92	98	92
Aminopyralid + 2,4-D	1 + 11.4	98	74	99	87
Aminopyralid + 2,4-D	1.5 + 11.4	98	98	61	36
Aminopyralid + 2,4-D	1 + 0.15	94	86	88	57
Aminopyralid + metsulfuron	0.75 + 11.4	95	86	76	61
2,4-D	15.2	15	11	8	0
Dicamba + 2,4-D[3]	11.5 + 4	54	30	42	35
Picloram + 2,4-D[4]	2.2 + 8	94	90	86	36
LSD (0.05)		15	26	36	NS

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

[2] Abbreviation: MAT = months after treatment.

[3] Commercial formulation - Weedmaster by BASF Corp., Research Triangle Park, NC 27709.

[4] Commercial formulation - Grazon by Dow AgroSciences, Indianapolis, IN 46268.

Table 3. Canada thistle and perennial sowthistle control with aminopyralid and other auxin-type herbicides applied in June or October 2003 at Fargo, ND.

		Time after treatment / weed species						
		3 MAT[1]		12 MAT		15 MAT		24 MAT
Treatment[2]	Rate	CT[1]	PS[1]	CT	PS	CT	PS	CT
Spring applied	– oz/A –	% control						
Aminopyralid	0.75	99	99	95	70	92	95	97
Aminopyralid	1	100	97	99	93	95	95	93
Aminopyralid	1.25	100	99	94	98	91	97	92
Aminopyralid	1.5	100	99	93	83	92	95	96
Aminopyralid	1.75	100	100	99	98	97	99	99
Picloram	6	100	100	95	100	92	98	89
Clopyralid	6	95	99	94	96	91	94	94
Dicamba	16	63	88	71	43	85	90	92
2,4-D	24	45	70	57	19	59	36	61
LSD (0.05)		24	6					
Fall applied				9 MAT		12 MAT		21 MAT
Aminopyralid	0.75			100	100	98	97	98
Aminopyralid	1			100	99	92	97	95
Aminopyralid	1.25			100	100	99	99	97
Aminopyralid	1.5			100	100	100	98	98
Aminopyralid	1.75			100	100	99	99	96
Picloram	6			99	100	98	98	98
Clopyralid	6			99	98	90	98	95
Dicamba + diflu[1,3]	3 + 1.2			88	3	66	32	89
Dicamba	16			85	73	88	95	78
LSD (0.05)				18	25	16	23	17

[1] Abbreviations: MAT = months after treatment; CT = Canada thistle; PS = perennial sowthistle; diflu = diflufenzopyr.

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

[3] Commercial formulation - Overdrive by BASF Corp., Research Triangle Park, NC 27709.

Table 4. Canada thistle control with aminopyralid and other auxin-type herbicides applied in June or September 2004 at Fargo or Jamestown, ND.

		Location / time after treatment		
		Fargo		Jamestown
Treatment[1]	Rate	3 MAT[2]	12 MAT	3 MAT[3]
Spring applied	— oz/A —	— % control —		
Aminopyralid	1.25	99	48	81
Aminopyralid	1.5	99	40	93
Aminopyralid	1.75	97	57	93
Picloram + 2,4-D	4 + 30	85	18	89
Clopyralid + 2,4-D[4]	4.5 + 24	89	30	59
Dicamba + 2,4-D	16 + 15	19	0	36
LSD (0.05)		17		21
Fall applied			9 MAT	
Aminopyralid	1.25		100	
Aminopyralid	1.5		100	
Aminopyralid	1.75		100	
Picloram	4		97	
Clopyralid + 2,4-D[4]	4.5 + 24		76	
Dicamba	16		75	
LSD (0.05)			36	

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

[2] Abbreviations: MAT = months after treatment.

[3] Experiment site was disturbed and no further evaluations were made.

[4] Commercial formulation - Curtail by Dow AgroSciences, Indianapolis, IN 46268.

Table 5. Control of leafy spurge with aminopyralid and other auxin-type herbicides applied in June or September 2003 near Ekre, ND.

		Time after spring-application		Time after fall-application
Treatment[1]	Rate	3 MAT[2]	12 MAT	9 MAT
	– oz/A –	— % control —		
Aminopyralid	0.75	0	8	11
Aminopyralid	1.25	15	9	50
Aminopyralid	1.75	20	9	58
Picloram + 2,4-D	4 + 16	75	51	91
LSD (0.05)		29	— 18 —	

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

[2] Abbreviations: MAT = months after treatment.

Evaluation of rimsulfuron as a potential herbicide for Marion blackberries. Diane Kaufman and Jason Harpole. (North Willamette Research and Extension Center, Oregon State University, Aurora, OR 97002) A study was established in a three year old planting of 'Marion' blackberry to examine the effect of three rates of rimsulfuron applied pre-emergence in early spring on blackberry plant growth and vigor. The soil is a Quatama silt loam soil with 4% organic matter. Treatments were applied on April 9, 2005 to a 5-foot swath along the base of the berry plants using a CO_2 pressurized backpack sprayer set at 40 psi. Plots 30 feet long by 10 feet wide (five plants) were arranged in a randomized complete block design with four replications. Because some primocanes were present at the time of application, effect on primocane growth was monitored during the growing season. However, because primocane burn-back was not the objective of this trial, no adjuvant was added to treatments.

There were no signs of damage to fruiting canes from any rate of rimsulfuron. Primocane growth was measured on May 13 and June 7, 2005 (Table 1).

Table 1. Primocane height.

Treatment	Rate	Mean primocane height May 13, 2005	Mean primocane height June 7, 2005
	lb ai/A	inches	inches
Rimsulfuron	0.0156	8.25	31.5
Rimsulfuron	0.0312	7.12	25.5
Rimsulfuron	0.0624	7.12	16.9
Diuron + napropamide (grower standard)	2 + 2	46.5	73.5
LSD (0.05)		6.04	6.72

At the middle and high rates, rimsulfuron caused a slight burn along the 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, primocane growth in plots treated with rimsulfuron was significantly less on May 13 and June 7, 2005 than in plots treated with the diuron + napropamide standard.

Final cane measurements were taken on August 15, 2005 prior to training primocanes to the wire (Table 2). Measurements are based on three plants per plot.

Table 2. Primocane growth measurements,

Treatment	Total number of canes/3 plants	Mean number of canes	Total cane growth	Mean cane height	Cane diameter
			feet	Feet	mm
Rimsulf 0.0156	25.5	8.5	113.5	13.4	10.6
Rimsulf 0.0312	26.5	8.8	99.6	11.3	10.6
Rimsulf 0.0624	25.2	8.4	91.8	10.9	10.8
Diuron+Naprop	14.2	4.8	115.8	24.4	12.2
LSD (0.05)	6.98	2.33	23.42	4.17	1.13

There were significantly more canes in plots treated with rimsulfuron than in plots treated with the diuron + napropamide standard. There was more total cane growth in plots treated with diuron + napropamide than in plots treated with the high rate of rimsulfuron. Mean cane height (total cane growth/mean number of canes) was significantly greater in plots treated with diuron + napropamide than in any rimsulfuron plots. However, cane diameter was greater in the diuron + napropamide plots. It is interesting to note that, even though rimsulfuron did not burn back existing primocanes, it held back subsequent primocane growth in a way similar to typical cane-burning products (carfentrazone-ethyl or oxyfluorfen) and resulted in a similar pattern of increased cane number and decreased cane height and diameter.

Weed control was excellent (90-100%) in all treatments through mid-August.

Weed control strategies in second year strawberries. Diane Kaufman, Ed Peachey, and Jason Harpole. (North Willamette Research and Extension Center, Oregon State University, Aurora, OR 97002) This is the second year of a study evaluating quality of weed control and effect on strawberry plant growth from selected herbicides and/or cultural practices. A planting of 'Totem' strawberries was established on May 23, 2003 in a Quatama silt loam soil with 4% organic matter at the North Willamette Research and Extension Center (NWREC). Plots 4 rows wide (13.3 feet) by 25 feet long were arranged in a randomized complete block design with four replications. Herbicides were applied using a CO_2 pressurized backpack sprayer with a 4-nozzle boom (TeeJet 8002, flat fan) set at 40 psi and a rate of 20 gallons of spray per acre.

A report of first year yield and weed control data appears in WSWS Research Progress Reports, 2005. By way of summary, a winter application of the following herbicides resulted in similar first year yields: metolachlor; dimethenamid-P; rimsulfuron; and sulfentrazone + dimethenamid-P. The only winter-applied herbicide that reduced yield was imazapic, which caused considerable damage. Yields were highest in the organic plots (bark mulch applied for weed control) and plots treated with sulfentrazone in which runners were removed in the fall (grower standard practice). Although the presence of runners throughout fall and winter resulted in excellent weed suppression, this practice reduced yields. Unfortunately first year yield data was skewed by an unexpected infection of leather rot, which affected all plots except those managed organically.

Second year treatments (Table 1) began at renovation (July 16, 2004) and continued in fall (October 5, 2004) through winter (January 5, 2005). The main objective was to evaluate the effect of renovation treatments on weed control and yield in the second fruiting year. Fall treatments consisted of either simazine (grower standard) or metolachlor. All plots were treated with sulfentrazone + napropamide (grower standard) in winter, with the exception of those plots in which the effect of runners over fall and winter were evaluated for weed control and organically managed plots.

Table 1. Treatments and herbicide rates.

Treatment	Rate
Renovation/Fall/Winter	(lb ai/A)
Terbacil/Metolachlor/Sulfentrazone+Napropamide (S+N)	0.3/1.0/0.1875+2.0
Metolachlor/Simazine/S+N	1.0/1.0/0.1875+2.0
Rimsulfuron/Simazine/S+N	0.0156/1.0/0.1875+2.0
S+N+runners/Metolachlor/nothing [1]	0.1875+2.0/1.0/nothing
S+N - runners/Metolachlor/nothing	0.1875+2.0/1.0/nothing
Weeded control	-----
Weedy control	-----
Imazapic/Simazine/S+D [2]	0.062/1.0/0.1875+2.0
Organic [2]	------

[1] Plots treated with sulfentrazone+napropamide at renovation were divided into two different cultural practices: runners removed/tucked into the berry row (- runners); runners allowed to fill in the area between rows (+ runners).

[2] Plots treated with imazapic at renovation and plots managed organically were beside blocked plots and, therefore, not within the experimental design.

Weed control was evaluated on April 11 and June 21, 2005 (Table 2).

Table 2. Overall weed control, expressed as percent control compared to weedy check plots.

Treatment	April 11, 2005 [1]	June 12, 2005 [2]
Terbacil/Metolachlor/S+N	98.8	90.0
Metolachlor/Simazine.S+N	97.5	81.2
Rimsulfuron/Simazine/S+N	100	73.8
S+N+runners/Metolachlor/nothing	98.8	82.0
S+N – runners/Metolachlor/nothing	97.5	70.0
LSD (0.05)	ns	ns
Imazapic/Simazine/S+D	97.5	79.2
Organic	97.5	92.0

[1] Primary weeds present April 11, 2005: annual bluegrass; groundsel; shepherdspurse; sowthistle; prickly lettuce; dandelion; black medic.

[2] Primary weeds present June 12, 2005: groundsel; sowthistle; crabgrass; hawksbeard; barnyardgrass; prickly lettuce; scarlet pimpernel; vetch; dandelion; black medic.

Overall weed control was excellent (90-100%) across all treatments on April 11, 2005, but had decreased to some extent by the June 21 evaluation date. However, overall weed control remained excellent in the terbacil/metolachlor/s+d and organic treatments. Overall weed control was good (80-89%) in plots treated with metolachlor/simazine/s+d and sulfentrazone+napropamide + runners/metolachlor/nothing, and fair (70-79%) in plots treated with rimsulfuron/simazine/s+d, sulfentrazone+napropamide – runners/metolachlor/nothing, and imazapic/simazine/s+d. Bark mulch, applied to a depth of 5-6 inches in the organically managed plots in October, 2003, continued to provide excellent control of annual weeds through harvest, 2005. However, crabgrass was beginning to grow through the mulch at the time of the June weed evaluation. The mulch was not effective against dock or Canada thistle (removed by hand). However it provided good control of common dandelion.

Fruit was picked twice in June from a 5-foot length of row per plot (Table 3).

Table 3. Yield data, June, 2005.

Treatment	Total marketable yield	Adjusted berry size
	grams	grams
Terbacil/Metolachlor/S+N	1,809	6.67
Metolachlor/Simazine/S+N	2,034	7.32
Rimsulfuron/Simazine/S+N	2,356	7.16
S+N+runners/Metolachlor/nothing	1,272	7.18
S+N-runners/Metolachlor/nothing	2,362	7.70
Hand weeded control	1,807	7.04
Weedy control	2,162	7.10
LSD (0.05)	496	ns
Imazapic/Simazine/S+D	2,036	5.79
Organic	2,078	8.50

The highest marketable yields were in plots treated at renovation, 2004 with metolachlor, rimsulfuron, sulfentrazone+napropamide – runners, and in the weedy control. Marketable yields in plots treated at renovation with imazapic and organically managed plots were comparable to those in the highest yielding plots in the statistically analyzed treatments. Fruit size was smaller than expected across all treatments. There were no differences in adjusted berry size among treatments in the statistically analyzed plots.

Evaluation of selected post-emergence herbicides for use in newly established strawberries. Diane Kaufman, Ed Peachey, and Jason Harpole. (North Willamette Research and Extension Center, Oregon State University, Aurora, OR 97002) A study was established in newly planted 'Totem' strawberry to evaluate plant tolerance to the following herbicides applied over the top of strawberry plants 70 days after planting: desmedipham + phenmedipham (Betamix); flucarbazone-sodium (Everest); and V10142. Strawberry plants were established on a Quatama silt loam soil with 4% organic matter at the North Willamette Research and Extension Center (NWREC) on June 15, 2005. Treatments were applied on August 23, 2005 using a CO_2 pressurized backpack sprayer with a 4-nozzle boom (TeeJet 8002 flat fan) set at 40 psi and a rate of 30 gallons of spray per acre. Plots four 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.

Plants were visually rated for signs of phytotoxicity on August 30 and September 23, 2005 (Table 1).

Table 1. Phytotoxicity ratings of herbicides applied 10 weeks after planting.

Treatment	Rate	Phytotoxicity rating [1] August 30	Phytotoxicity rating [1] September 26
	lb ai/A		
Desmedipham+phenmedipham	0.4875	0.3	0.0
Flucarbazone-sodium	0.033	3.0	3.4
V10142	0.10	3.2	2.0
Untreated control	-----	0.0	0.0
LSD (0.05)		0.36	0.22

[1] Phytotoxicity ratings are based on a scale of 0-5 with 0= no damage and 5= dead.

There was very little damage from desmedipham+phenmedipham on 8/30 (an occasional red spot on leaves) and no visible damage on 9/26/05. 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.

Plant growth measurements were taken from four plants per plot on October 7, 2005 (Table 2).

Table 2. Strawberry plant growth measurements.

Treatment	Number of leaves	Number of runners	Plant diameter
			cm
Desmedipham+phenmedipham	13.75	7.88	31.6
Flucarbazone-sodium	8.88	3.19	28.5
V10142	13.00	2.62	26.5
Untreated control	12.62	6.78	31.9
LSD (0.05)	3.74	2.07	Ns

There were significantly more leaves on plants treated with desmedipham+phenmedipham or V10142 than on plants treated with flucarbazone-sodium. There were significantly more runners on plants treated with desmedipham+ phenmedipham or in 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 desmedipham + phenmedipham. Runners in plots treated with flucarbazone-sodium 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.

Effect on weeds present at the time of application was also noted on the 8/30/05 evaluation date. Desmedipham + phenmedipham caused a yellowing on leaves of small pigweed, shepherdspurse, and seedling common dandelion plants. It had no effect on pineappleweed, false dandelion, groundsel, vetch, Canada thistle, or established common dandelion plants. Flucarbazone-sodium caused a yellowing on leaves of small sowthistle and common dandelion seedlings. It had no effect on groundsel, annual bluegrass, or established sowthistle or common dandelion plants.

V10142 caused a yellowing on leaves of small seedling pigweed, sowthistle, shepherdspurse, and common dandelion plants. It had no effect on annual bluegrass, crabgrass, groundsel, vetch, black medic, or Canada thistle.

A mixture of simazine + napropamide was applied to all plots on October 6, 2005 (standard grower practice). Treatments will be applied to additional rows of strawberries in early spring, 2006 in order to compare effect on strawberry plant growth from a summer (August) versus early spring (March, before new growth has begun) application. Plant growth will be monitored during spring and yield data will be collected from a 5-foot length of row per plot in June, 2006.

Crop response to carfentrazone applied preemergence. Rick A. Boydston and Robert Parker. (USDA-ARS and Washington State University, Prosser, WA 99350) Soil activity of carfentrazone was tested in greenhouse trials with five crops planted at various times in relation to herbicide application date. Carfentrazone was applied at 0.03 lb ai/a alone or in combination with DCPA at 5.3 lb ai/a to 8 by 8 inch flats containing a loamy sand soil on April 28, 2005. Five crops were seeded April 22, 24, 26, 28, and May 5, 2005 corresponding to six, four, and two days prior to herbicide application, immediately after herbicide application, and 7 days after herbicide application. All five crops were seeded in a single flat and separate flats were utilized on each seeding date. Onion and sugar beet were also seeded again at 22 days after herbicide application. 'Waltham 29' broccoli, 'Golden Acre' cabbage, 'PM21' sugarbeet, 'Crockett' onion, and 'Redwing' onion were seeded 0.5 inch deep and 'Black Seeded Simpson' lettuce was seeded 0.25 inch deep. Treatments were arranged in a completely randomized design replicated three times. Flats were placed in a greenhouse maintained at 80 F day and 70 F night. The number of live seedlings of each crop was determined on May 12, May 19, and May 26, 2005 and onion live seedlings again on June 17, 2005.

Table. Live seedlings of five crops following carfentrazone treatments applied preemergence April 28, 2005. Crops were seeded at five planting dates on a loamy sand soil in greenhouse flats at Prosser, WA in 2005.

		---------------- May 26, 2005			------------------	----- June 17, 2005	----
Planting date[1]/herbicide[2]	Rate	Cabbage	Broccoli	Sugar beet	Lettuce	'Crockett' Onion	'Redwing' Onion
	lb ai/a	--------------------	(number live seedlings/row)				--------------------
6 days prior							
Nontreated	--	9.0	8.0	9.3	18.0	8.3	9.0
Carfentrazone + DCPA	0.03 + 5.3	0	0	0	0	1.3	1.0
Carfentrazone	0.03	0	0	0	0	0.3	0
4 days prior							
Nontreated	--	6.7	6.0	8.3	15.7	9.0	9.3
Carfentrazone + DCPA	0.03 + 5.3	0	0	0	0	2.3	2.0
Carfentrazone	0.03	0	0	0	0	1.3	1.0
2 days prior							
Nontreated	--	7.3	7.7	8.3	20.0	9.7	9.3
Carfentrazone + DCPA	0.03 + 5.3	0	0	0.3	6.3	0.3	1.0
Carfentrazone	0.029	0	0	0	7.3	1.0	2.3
0 days prior							
Nontreated	--	5.7	6.7	10.0	23.3	9.0	9.3
Carfentrazone + DCPA	0.03 + 5.3	0	0	0	12.7	0.3	0.3
Carfentrazone	0.03	0	0	0	17.3	0	0
7 days after							
Nontreated	--	6.7	6.7	8.7	22.3	8.7	10.0
Carfentrazone + DCPA	0.03 + 5.3	0	0	0.3	23.0	0.7	1.0
Carfentrazone	0.03	0	0.7	0.7	21.3	0	0
LSD (0.05)		1.9	2.2	1.8	4.6	2.0	2.1

[1] Planting date in relationship to herbicide application date.

[2] Nonionic surfactant (R-11) at 0.25% v/v was applied with all herbicide treatments.

All crops were severely injured and the number of live seedlings reduced by carfentrazone applied at 0.029 lb ai/a or carfentrazone at 0.029 lb ai/a plus DCPA at 5.3 lb ai/a regardless of planting date (Table). Lettuce emerged sooner than other crops and most plants had emerged within 3 days of planting. Lettuce seedlings that were emerged at the time of carfentrazone application (from the first two planting dates) were all killed. Lettuce stand was not reduced when planted 7 days after carfentrazone application, but surviving plants were necrotic with malformed growth and smaller compared to nontreated checks. Broccoli, cabbage, and sugar beet emerged in 2 to 5 days after planting. Broccoli, cabbage, and sugar beet were all severely injured and stands nearly eliminated by carfentrazone or carfentrazone plus DCPA at all planting dates (Table). Onions were slowest to emerge, usually taking about 6 to 8 days to emerge after planting. Onion stand was severely reduced by both herbicide treatments at all planting dates (Table). Onions that survived herbicide treatments were usually stunted and chlorotic and often died within a week or two after emergence. About 10% of onions survived and eventually some plants grew normally. Onions and sugar beets planted May 20, 2005, 22 days after carfentrazone application, were severely injured and plant stand reduced by 82 and 86%, respectively (data not shown).

Brassica crop tolerance to dimethenamid-p. Ed Peachey, Robert McReynolds, and Martin Histand (Horticulture Dept, Oregon State University, Corvallis, OR 97330, and NWREC, Aurora, OR 97002) Experiments were conducted on a silt loam soil with and OM content of 6.53 % (LOI) to determine crop tolerance to dimethenamid-p. Dimethenamid-p treatments (Table 1) were applied PES, EPOST, and PES + EPOST to crops listed in Table 2. Trifluralin (PPI) and napropamide (PES) were applied to minimize the need for hand-weeding of broccoli, cabbage, cauliflower, Chinese cabbage, and pak choi; napropamide (PES) was applied to turnips and rutabagas. Crops were grown in separate plots with the exception of turnips and rutabagas, which were grown side by side (2 rows of each per plot). Plots were 4.5 ft by 15 ft in a randomized complete block design with 4 replications. Four rows of each crop were planted in each plot with 18 inches between rows and 4 inches between seeds in the row. All treatments were applied with a hand-held boom with 4 nozzles on a 20 inch spacing, pressured with CO_2 at 30-40 PSI, and delivered in 20 gpa of water. Herbicides were incorporated with irrigation water shortly after planting, and the surface kept damp to improve emergence by irrigating regularly until emergence was complete. EPOST treatments were applied shortly after the first true leaf emerged (Table 2) followed by irrigation the next day. After initial emergence, crop injury, and phytotoxicity ratings at 3 WAP, plots were cultivated and hand-weeded. Cabbage, cauliflower, Chinese cabbage, and pak choi were thinned to a minimum of 18 inches between plants. Crops were harvested, graded, and weighed as appropriate for each crop. Means are separated with Fisher's Protected LSD at alpha 0.05 unless specified.

Dimethenamid-p PES provided very good control of hairy nightshade and other summer annuals in Brassica crops when applied over trifluralin (PPI) and napropamide (PES) (Table 3). Weed control was less (76%) when dimethenamid-p was applied EPOST to 1/2 to 1 true-leaf brassica crops. Stunting caused by dimethenamid-p was least with broccoli and greatest with Chinese cabbage (Tables 4-8; Figure 1). Emergence of Chinese cabbage, cabbage, and pak choi may have been reduced slightly by dimethenamid-p applied PES. Yield of broccoli was not impacted by dimethenamid-p applied PES, EPOST, or PES+EPOST with the exception of dimethenamid applied PES+EPOST at 0.75 and 1.5 lbs ai/A, respectively (Table 4). Cabbage and cauliflower yield may have been reduced slightly with dimethenamid-p at 0.75 lbs ai/A PES. Chinese cabbage and pak choi yields were significantly reduced by dimethenamid-p applied both PES and EPOST. Turnips appeared to be more tolerant than rutabagas to dimethenamid-p (Table 9). Stunting was significant at 3 WAP for both crops, and yields were depressed compared to the hand-weeded check plots. Dimethenamid-p may be suited for weed control in processed broccoli, cauliflower, cabbage, cauliflower, turnips and rutabagas. Fresh market crops such as turnips and rutabagas may be less suited if days-to-maturity is extremely important. Future research should compare tolerance of other *Brassica oleracea, B. rapa, and B. napus* crops to dimethenamid-p.

Table 1. Herbicide treatments applied to vegetables crops.

	Treatment	Timing	Rate
			lbs ai/A
1	Dimethenamid-p	PES	0.375
2	Dimethenamid-p	PES	0.75
3	Dimethenamid-p	EPOST	0.75
4	Dimethenamid-p	EPOST	1.5
5	Dimethenamid-p	PES + EPOST	0.375 +0.75
6	Dimethenamid-p	PES + EPOST	0.75 + 1.5
7	Hand-weeded	-	-
8	Cultivated once[1]	-	-

Table 2. Vegetable varieties and cultural practices.

	Crop	Variety	Percent germ and test date	Planting date	Planting depth	EPOST (treatments 3 and 4)		EPOST (treatments 5 and 6)	
					inches	date	timing	date	timing
1	Broccoli	Southern Comet	87 (11/04)	6/24	½ to ¾	7/5	½ -1 true lf[1]	7/5	½ -1 true lf
2	Cabbage	Late Flat Dutch	90 (11/04)	6/24	½ to ¾	7/5	½ -1 true lf	7/7	½ -1 true lf
3	Cauliflower	Snowball improved	90 (11/04)	6/24	½ to ¾	7/5	½ -1 true lf	7/7	½ -1 true lf
4	Chinese cabbage	Blues	95 (11/04)	6/24	½ to ¾	7/2	½ -1 true lf	7/5	½ -1 true lf
5	Pak choi	Joi Choi	99 (12/04)	6/24	½ to ¾	7/2	½ -1 true lf	7/5	½ -1 true lf
6	Rutabagas	American Purple Top	86 (11/04)	6/29	¾-1in	7/11	½ leaf	7/15	2 leaf
7	Turnips	Purple Top White Globe	96 (11/04)	6/29	¾-1 in	7/11	1½ leaf	7/15	2 leaf

[1] Appearance of 2nd true leaf was recorded as 1-leaf growth stage.

[2] WBP: weeks before planting

Table 3. Weed control (primarily hairy nightshade) at 3 WAP with dimethenamid-p applied over trifluralin (PPI) and napropamide (PES). Values are average of data from five Brassica vegetable crops that were planted on June 24, 2005 (n=20).

Treatment	Herbicide	Timing	Rate	Weed control	SD
			lb ai/A	----------%	---------
1	Dimethenamid-p	PES	0.375	99	3
2	Dimethenamid-p	PES	0.75	99	3
3	Dimethenamid-p	EPOST	0.75	76	22
4	Dimethenamid-p	EPOST	1.5	85	16
5	Dimethenamid-p	PES + EPOST	0.375 + 0.75	99	3
6	Dimethenamid-p	PES + EPOST	0.75 + 1.5	99	3
7	Check (trifluralin + napropamide)	-	-	0	0

Table 4. Effect of dimethenamid-p on broccoli growth and yield.

					Sum or avg. of 2 harvests (10 and 11 WAP)			
Treatment	Plant stand	Phyto-toxicity	Stunting	Weed control	Number heads	Total yield	Avg. head diameter	Avg. head wt
	no./8.2 ft	0-10	%	%	no./20 ft of row	t/A	inches	lbs
1	17	0	6	99	27	7.4	5.1	0.39
2	15	0	11	100	24	7.1	5.2	0.41
3	17	0.3	9	58	25	7.3	5.1	0.43
4	17	0	6	64	28	7.0	4.8	0.34
5	17	0	11	100	25	7.5	5.1	0.40
6	15	0	30	100	20	5.9	4.7	0.45
7	14	0	3	-	25	7.1	5.1	0.39
8	17	0	1	0	22	5.0	4.8	0.31
FPLSD	ns	ns	15	18	ns	1.5[1]	ns	ns

[1] P = 0.10

Table 5. Effect of dimethenamid-p on cabbage growth and yield.

					Harvest (13 WAP)		
Treatment	Plant stand	Phytotoxicity	Stunting	Weed control	Number heads	Total yield	Avg. head wt
	no./8.2 ft	0-10	%	%	no./10 ft of row	t/A	Lbs.
1	38	0	15	96	6.3	55.8	6.2
2	28	0	38	98	6.0	47.8	5.4
3	35	1	5	69	6.3	47.2	5.2
4	32	2	18	81	7.0	58.4	5.8
5	32	4	25	98	6.8	55.4	5.7
6	31	1	35	97	6.0	54.2	6.3
7	33	0	4	0	6.8	53.5	5.5
8	37	0	5	0	6.5	28.3	3.0
FPLSD	7	3.4	16	10	1.6	13.8	1.1

Table 6. Effect of dimethenamid-p on cauliflower growth and yield.

					Harvest (13 WAP)		
Treatment	Plant stand	Phytotoxicity	Stunting	Weed control	Number heads	Total yield	Avg. head wt
	no./8.2 ft	0-10	%	%	no./10 ft of row	t/A	lbs
1	14	0.3	23	98	5	16.6	1.0
2	13	0.5	48	96	4	14.5	1.2
3	16	1.0	30	64	4	11.3	0.8
4	17	0.8	25	80	5	14.8	0.9
5	15	1.0	36	96	4	11.1	1.0
6	15	0.7	37	98	3	11.3	1.1
7	17	0.0	5	0	5	17.2	1.0
8	18	0.0	0	0	0	0.8	0.3
FPLSD	ns	0.7	18	11	2	7.8	0.5

Table 7. Effect of dimethenamid-p on Chinese cabbage growth and yield.

					Harvest (42 DAP)		
Treatment	Plant stand	Phytotoxicity	Stunting	Weed control	Number heads	Total yield	Avg. head wt
	no./8.2 ft	0-10	%	%	no/20 ft of row	t/A	Lbs
1	16	4.0	68	99	29	11.9	1.2
2	6	6.5	95	100	9	2.3	0.7
3	18	3.5	60	96	30	12.0	1.1
4	16	5.8	68	99	27	7.4	0.8
5	14	6.0	75	99	19	6.5	0.9
6	8	9.3	96	99	7	0.4	0.1
7	20	0.0	13	0.0	38	21.9	1.6
8	19	0.0	0	0.0	43	19.2	1.2
FPLSD	6	1.7	17	3	9	3.8	0.23

Table 8. Effect of dimethenamid-p on pak choi growth and yield.

					Harvests (40 DAP)		
Treatment	Plant stand	Phytotoxicity	Stunting	Weed control	Number heads	Total yield	Avg. head wt
	no./8.2 ft	0-10	%	%	no/20 ft of row	t/A	Lbs
1	21	4	48	100	42	14.4	1.0
2	18	8	83	100	30	7.6	0.7
3	22	4	48	95	43	14.7	1.0
4	23	6	63	100	45	11.1	0.7
5	22	6	68	100	43	12.6	0.8
6	17	10	90	100	21	2.1	0.3
7	24	0	3	0	48	22.3	1.3
8	23	0	0	0	72	25.3	1.3
FPLSD	2	2	8	5	27	2.2	0.3

Table 9. Effect of dimethenamid-p on turnip and rutabaga growth and yield.

	Turnip						Rutabaga					
				Harvest (7 WAP)						Harvest (7 WAP)		
Treatment	Stand	Stunting	Phyto-toxicity	Roots harvested	Root yield	Avg. root wt.	Stand	Stunting	Phyto-toxicity	Roots harvested	Root yield	Avg. root wt.
	no./6 ft	%	0-10	no./5 ft	t/A	lbs	no./6 ft	%	0-10	no./5 ft	t/A	lbs
1	13	3	0	11	15.3	0.49	18	23	0	15	25.6	0.54
2	12	18	0	8	12.0	0.46	12	68	3	7	18.6	0.81
3	15	10	0	9	13.6	0.45	18	18	1	14	22.0	0.49
4	12	30	1	9	12.8	0.45	16	43	3	12	19.8	0.52
5	14	5	0	9	12.5	0.43	16	35	1	11	17.6	0.49
6	12	20	0	9	10.0	0.37	12	68	4	8	14.9	0.55
7	13	0	0	10	18.4	0.59	17	0	0	12	30.6	0.76
8	14	0	0	9	14.1	0.48	20	5	0	13	28.6	0.69
FPLSD	ns	14	ns	ns	3.6	ns	5	14	1	4	5.9	ns

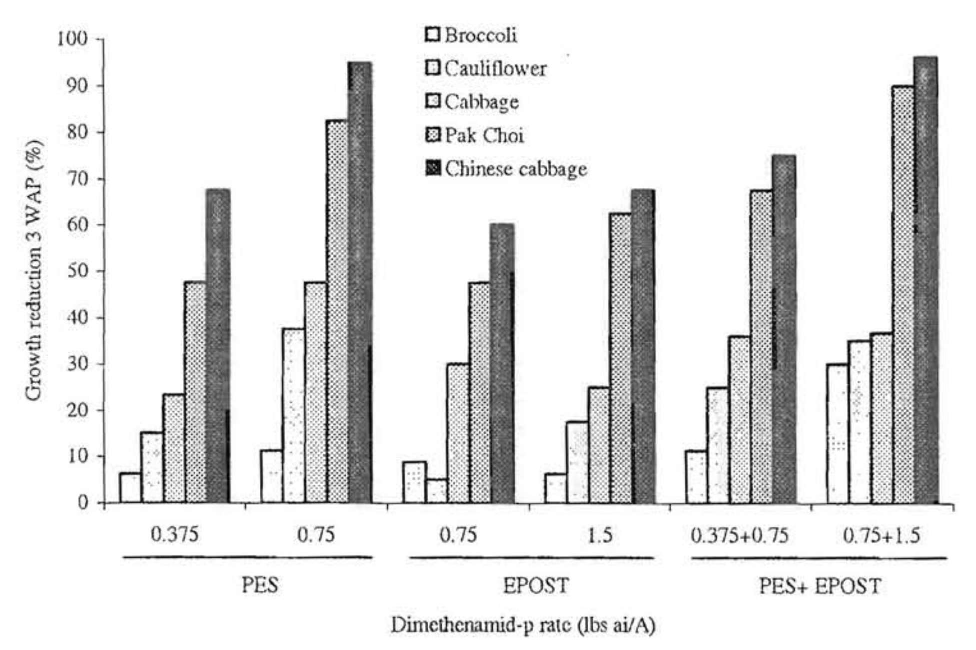

Figure. Effect of dimethenamid-p on growth of Brassica crops 3 WAP.

Vegetable crop tolerance to dimethenamid-p. Ed Peachey, Robert McReynolds, and Martin Histand (Horticulture Dept, Oregon State University, Corvallis, OR 97330, and NWREC, Aurora, OR 97002) Experiments were conducted on a silt loam soil with an OM content of 6.53% (LOI) to determine crop tolerance to dimethenamid-p. Crops were planted on June 29, 2005 and dimethenamid-p treatments (Table 1) applied PES, EPOST, and PES + EPOST to crops listed in Table 2. All vegetables except spinach and parsley were paired with another crop (2 rows of 2 vegetables per plot). Plots were 4.5 ft by 15 ft, with 4 rows per plot on 18 inch centers, and in a randomized complete block design with 4 replications. All treatments were applied with a hand-held boom with 4 nozzles on a 20 inch spacing, pressured with CO_2 at 30-40 PSI, and delivered in 20 gpa of water. Herbicides were incorporated with irrigation water shortly after planting, and the surface kept damp to improve emergence by irrigating regularly until emergence had ceased. EPOST treatments were applied shortly after the first true leaf emerged (Table 2) followed by irrigation the next day. After initial emergence, crop injury, and phytotoxicity ratings at 3 WAP, plots were cultivated and hand-weeded. All crops except parsley and parsnips were harvested.

Coriander and spinach yields were not reduced by dimethenamid-p applied PES at 0.375 lbs ai/A, even though growth was significantly reduced for spinach at 3 WAP (Table 3). Parsley and parsnip growth was significantly reduced by dimethenamid-p (Table 4), and the estimated yield of most treatments was so low that harvest was unwarranted. Parsnip emergence was very poor, possibly because of heat induced seed dormancy. Bunching onions were tolerant to dimethenamid-p at 0.375 lbs ai/A (Table 5). Leek response to dimethenamid-p was similar to onions (data not shown), and the crop will be harvested in February.

Table 1. Herbicide treatments applied to vegetables crops.

	Treatment	Timing	Rate
			lbs ai/A
1	Dimethenamid-p	PES	0.375
2	Dimethenamid-p	PES	0.75
3	Dimethenamid-p	EPOST	0.75
4	Dimethenamid-p	EPOST	1.5
5	Dimethenamid-p	PES + EPOST	0.375 +0.75
6	Dimethenamid-p	PES + EPOST	0.75 + 1.5
7	Hand-weeded	-	-

Table 2. Vegetable varieties and cultural practices.

	Crop	Variety	Percent germ and test date	Seed rate	Planting depth	EPOST (treatments 3 and 4)		EPOST (treatments 5 and 6)	
				No./ft	inches	date	timing	date	timing
1	Coriander	LS	95 (10/04)	10	½ to ¾	7/15	2 leaf	7/15	2 leaf
2	Leeks	Arkansas winter leek	93 (8/04)	6	½ to ¾	7/15	loop stage	7/15	loop stage
3	Onions, bunching	Southport White Globe	83 (11/04)	12	½ to ¾	7/15	1st leaf unfolded	7/15	1st leaf unfolded
4	Parsley	Dark Green Italian	95 (2/05)	20	¼ to ½	7/15	cotyledon	7/15	cotyledon
5	Parsnips	Cobham improved	96 (11/04)	4	½ to ¾	7/15	cotyledon	7/19	1st leaf emerging
6	Spinach	Olympia	92 (11/04)	3	¾-1 in	7/11	2 leaf	7/15	2 leaf

[1] Appearance of 2nd true leaf was recorded as 1-leaf growth stage.

[2] WBP: weeks before planting

Table 3. Effect of dimethenamid-p on coriander and spinach growth and yield.

	Coriander				Spinach				
Treatment	Stand	Phyto-toxicity	Stunting	Yield (8 WAP)	Stand	Stunting	Phyto-toxicity	No. plants harvested (7 WAP)	Yield (7 WAP)
	no./5 ft	0-10	%	lbs/5 ft of row	no./3 ft	%	0-10	lbs/8.2 ft of row	t/A
1	40	0.0	0	2.1	9	38	1	23	23.2
2	42	0.8	30	1.4	8	65	3	19	14.7
3	39	2.0	1	1.5	10	50	4	22	20.0
4	42	2.5	8	1.3	11	55	4	21	10.6
5	44	2.5	25	1.2	10	45	2	24	18.8
6	40	3.5	63	0.3	8	78	4	15	6.2
7	45	0.0	0	1.9	8	0	0	19	16.9
FPLSD (0.05)	ns	1.4	8.9	0.4	3	13	1	6	7

Table 4. Effect of dimethenamid-p on parsley and parsnip growth and yield.

	Parsley					Parsnips					
Treatment	Stand	Phyto-toxicity		Stunting	Est. growth reduction (8 WAP)	Stand	Stunting	Phyto-toxicity		Plants surviving (8 WAP)	Est. growth reduction (8 WAP)
	no./5 ft	Obs.[1]	0-10	%	%	no./5 ft	%	Obs.	0-10	no./5 ft	%
1	11	*4*	0	33	70	2	65	*3*	0	2	61
2	0	*0*[2]	-	100	100	0	99	*1*	0	0.1	100
3	26	*4*	1	15	81	6	0	*3*	0	4	25
4	28	*4*	1	23	76	9	0	*4*	0	4	20
5	5	*3*	0	84	100	3	66	*3*	0	0.7	95
6	1	*1*	0	95	100	0	100	*0*	-	0	100
7	40	*4*	0	0	0	8	0	*4*	0	4	20
FPLSD (0.05)	15	ns		23	0	4	23	ns		2	28

[1] Number of observations

[2] Insufficient survival to make rating

Table5. Effect of dimethenamid-p on growth and yield of bunching onions.

				Harvest (9 WAP)		
Treatment	Stand	Stunting	Phyto-toxicity	Plants harvested	Wt.	Avg. root wt.
	no./5 ft	%	0-10	no./5 ft	lbs/5ft of row	oz.
1	44	0	0	58	2.4	0.7
2	13	20	0	16	0.7	0.6
3	27	0	0	28	1.1	0.6
4	20	0	1	30	1.0	0.5
5	38	8	0	49	2.0	0.7
6	29	13	1	26	0.9	0.5
7	21	0	0	27	1.1	0.6
FPLSD (0.05)	23	18	ns	32	1.2	ns

Screening of preplant incorporated, pre- and post emergence herbicides in leafy vegetables, leafy greens, and herbs. Steven A. Fennimore and John S. Rachuy. (Department of Plant Sciences, University of California-Davis, Salinas, CA, 93905).

The search for new herbicide options for cool-season vegetables and herbs is necessary because of limited weed control options for those crops. The objective of this study was to identify new potential herbicides for lettuce, spinach, swiss chard, collard, kale, dill and cilantro. Head lettuce 'Sniper', leaf lettuce 'Green Towers', spinach 'Whale', swiss chard 'Fordhook', kale 'Winterbor', collard 'Flash', dill 'Dukat' and cilantro 'Leisure' were screened in the field (sandy loam soil, with pH of 7.2 and 1.0% organic matter) for tolerance to herbicides at the University of California/USDA Agricultural Research Station, Salinas, California. In addition, two weed species, redroot pigweed (*amaranthus retroflexus L.*) and common purslane (*Portulaca oleracea* L.), were also included. Triallate was applied preplant (PPI) at 1.0, 1.25 and 1.5 lb ai/A, and incorporated mechanically during bed shaping. Preemergence herbicides (PRE) and rates tested (in lb ai/A) were: dimethenamid-p at 0.066, ethofumesate at 1.0, flucarbazone-sodium at 0.02, flufenacet at 0.4, KIH-485 at 0.089, oxyfluorfen at 0.25, pendimethalin at 0.75, penoksulam at 0.0223, prometryn at 1.0, S-metolachlor at 0.66, sulfentrazone at 0.075, trifluralin at 1.0 and V-10142 at 0.1. Post-emergence herbicides (POST) included: desmedipham / phenmedipham at 0.4, dimethenamid-p at 0.066, ethofumesate at 1.0, flucarbazone-sodium at 0.02, flufenacet at 0.4, KIH-485 at 0.089, oxyfluorfen at 0.25, pendimethalin at 0.75, penoksulam at 0.0268 + methylated seed oil at 1% v/v, prometryn at 1.0, S-metolachlor at 0.66, sulfentrazone at 0.075, triallate at 1.0, 1.25 and 1.5, triflusulfuron-methyl at 0.016 (for three sequential applications) and V-10142 at 0.1. All PPI, PRE and POST treatments were applied as a water-based spray solution at a target rate of 40 gpa. Preplant Incorporated treatments were applied on August 5, three days prior to planting. The planting date for both crops and weeds was August 8, 2005. Preemergence treatments were applied on August 9. Single POST treatments were applied on August 29, when most crop species were at two to five true leaves. Triflusulfuron-methyl was applied post-emergence on August 29, September 7 and 14, when the swiss chard was at 2 to 3, 4 to 6 and 6 to 8 true leaves, respectively. Crop phytotoxicity and percent weed control ratings were recorded on September 6 and 21, at 32 and 47 days after preplant incorporated treatment, 28 and 43 days after preemergence treatment (DAT), and 8 and 23 days after post-emergence treatment, respectively. Crop stand evaluations and biomass (fresh weight) samples were collected on September 23 for collard, September 26 for head lettuce, September 27 for leaf lettuce, September 29 for spinach, October 3 for kale, October 4 for swiss chard, October 6 for cilantro and October 10 for dill. All crop and weed assessment data were subjected to analysis of variance, with mean separation performed using LSD (P=0.05).

The criteria for acceptable crop injury (considered "safe" for commercial use) was a mean phytotoxicity rating of ≤ 2.0 (0 = no injury, 10 = plant death) at the September 21 rating date. Analysis of the individual crop biomass data involved comparison of the herbicide treatment means with that of the hand-weeded check. For each crop, the herbicide that produced biomass equal to or greater than the hand-weeded check (Tables 3 and 4), in combination with being safe on the crop (Tables 1 and 2), were: **Head lettuce**; PRE applications of flucarbazone-sodium (0.02) and sulfentrazone (0.075), and POST applications of ethofumesate (1.0) and triallate (1.0, 1.25, and 1.5). **Leaf lettuce**; PPI applications of triallate (1.0 and 1.25), PRE applications of ethofumesate (1.0), flucarbazone-sodium (0.02) and sulfentrazone (0.075), and POST applications of ethofumesate (1.0), flufenacet (0.4), pendimethalin (0.75), S-metolachlor (0.66) and triallate (1.0, 1.25, and 1.5). **Spinach**; PPI applications of triallate (1.0, 1.25, and 1.5), PRE applications of ethofumesate (1.0), flucarbazone-sodium (0.02), flufenacet (0.4) and S-metolachlor (0.66), and POST applications of dimethenamid-p (0.66), ethofumesate (1.0), flufenacet (0.4), KIH-485 (0.089), S-metolachlor (0.66), pendimethalin (0.75) and triallate (1.0, 1.25, and 1.5). **Dill**; PPI applications of triallate (1.0, 1.25, and 1.5), PRE applications of ethofumesate (1.0), flufenacet (0.4), pendimethalin (0.75), prometryn (1.0), sulfentrazone (0.075) and trifluralin (1.0), and POST applications of ethofumesate (1.0), flufenacet (0.4), KIH-485 (0.089), oxyfluorfen (0.25), pendimethalin (0.75), prometryn (1.0), S -metolachlor (0.66) and triallate (1.0, 1.25, and 1.5). **Cilantro**; PPI applications of triallate (1.0, 1.25, and 1.5), PRE applications of ethofumesate (1.0), flucarbazone-sodium (0.02), flufenacet (0.4), pendimethalin (0.75), prometryn (1.0), S-metolachlor (0.66), sulfentrazone (0.075) and trifluralin (1.0), and POST applications of desmedipham / phenmedipham (0.4), ethofumesate (1.0), flufenacet (0.4), KIH-485 (0.089), pendimethalin (0.75), prometryn (1.0), S-metolachlor (0.66) and triallate (1.0, 1.25, and 1.5). **Collard**; PPI applications of triallate (1.0, 1.25, and 1.5), PRE applications of ethofumesate (1.0), flucarbazone-sodium (0.02), S-metolachlor (0.66), sulfentrazone (0.075) and trifluralin (1.0), and POST applications of ethofumesate (1.0), flufenacet (0.4), KIH-485 (0.089), oxyfluorfen (0.25), pendimethalin (0.75), S-metolachlor (0.66), sulfentrazone (0.075) and triallate (1.0, 1.25, and 1.5). **Kale**; PPI applications of triallate (1.0, 1.25, and 1.5), PRE applications of ethofumesate (1.0), flucarbazone-sodium (0.02), sulfentrazone (0.075) and trifluralin (1.0), and POST applications of desmedipham / phenmedipham (0.4), dimethenamid-p (0.66), ethofumesate (1.0), flufenacet (0.4), KIH-485 (0.089), oxyfluorfen (0.25), pendimethalin (0.75), S-metolachlor (0.66), sulfentrazone (0.075) and triallate (1.0, 1.25, and 1.5). **Swiss chard**; PPI applications of triallate (1.0, 1.25, and 1.5), PRE applications of ethofumesate (1.0) and POST applications of dimethenamid-p (0.66), ethofumesate (1.0), flufenacet (0.4), pendimethalin (0.75), S-metolachlor (0.66), triallate (1.0, 1.25, and 1.5) and triflusulfuron-methyl (0.016; applied three times). All treatments not previously mentioned resulted in significantly lower biomass amounts and / or unacceptable crop injury.

The level of weed control by each treatment was evaluated on September 6 and 21 by a visual rating of the percent control of each planted weed species. The criterion for acceptable weed control was an efficacy of ≥ 80% at the September 21 rating date (based on the treatment mean, with the untreated check used as comparison). The herbicides that provided acceptable control by weed species (Table 5) were: **Redroot pigweed**; PRE applications of dimethenamid-p (0.66), flufenacet (0.4), KIH-485 (0.089), oxyfluorfen (0.25), pendimethalin (0.75), penoksulam (0.0223), S-metolachlor (0.66), trifluralin (1.0), and V-10142 (0.1), and POST applications of desmedipham / phenmedipham (0.4), flucarbazone-sodium (0.02), KIH-485 (0.089), penoksulam + methylated seed oil (0.0268 + 1% v/v), prometryn (1.0) and sulfentrazone (0.075). **Common purslane**; PPI applications of triallate (1.25 and 1.5), PRE applications of dimethenamid-p (0.66), ethofumesate (1.0), flufenacet (0.4), KIH-485 (0.089), oxyfluorfen (0.25), pendimethalin (0.75), penoksulam (0.0223), and trifluralin (1.0), and POST applications of desmedipham / phenmedipham (0.4), ethofumesate (1.0), KIH-485 (0.089), oxyfluorfen (0.25), penoksulam + methylated seed oil (0.0268 + 1% v/v), prometryn (1.0), sulfentrazone (0.075) and triallate (1.5) (Table 5). All treatments not previously mentioned resulted in unacceptable weed control.

Table 1. Phytotoxicity ratings for head lettuce, leaf lettuce, spinach and dill.

			Head lettuce		Leaf lettuce		Spinach		Dill	
Herbicide	**Stage**	**Rate**	**9/6**	**9/21**	**9/6**	**9/21**	**9/6**	**9/21**	**9/6**	**9/21**
		lb ai A^{-1}	---------- 0 = no injury, 10 = dead ----------							
Untreated Check (UTC)	-	-	0	0	0	0	0	0	0	0
Hand-Weeded Check	-	-	0	0	0	0	0	0	0	0
Triallate 4EC	PPI	1.0	3.0	2.3	2.4	0.9	1.6	1.4	0.5	0
Triallate 4EC	PPI	1.25	6.4	4.3	4.4	1.1	0	0.5	0	0
Triallate 4EC	PPI	1.5	5.4	3.6	5.9	2.8	1.3	1.1	0.3	0
Dimethenamid-p 6EC	Pre	0.66	9.9	9.8	9.6	9.6	8.3	7.6	9.0	9.0
Ethofumesate 4SC	Pre	1.0	5.8	3.5	3.1	1.0	0.3	0.3	0.5	0
Flucarbazone-sodium 70WG	Pre	0.02	1.5	1.4	0.8	0.3	2.0	1.1	3.0	3.4
Flufenacet 60DF	Pre	0.4	9.4	9.4	8.5	7.3	1.3	0.8	1.5	0.5
KIH-485 60WG	Pre	0.089	9.1	8.3	7.6	6.4	8.9	9.1	8.9	8.9
Oxyfluorfen 4F	Pre	0.25	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Pendimethalin 3.8EC	Pre	0.75	10.0	10.0	10.0	10.0	9.9	10.0	0.5	0
Penoksulam 2SC	Pre	0.0223	8.6	8.8	8.8	9.1	9.0	10.0	9.0	9.5
Prometryn 4F	Pre	1.0	10.0	10.0	10.0	10.0	10.0	10.0	0.8	0
S-metolachlor 7.62EC	Pre	0.66	8.3	7.0	8.0	6.9	1.9	0.8	6.3	4.6
Sulfentrazone 4F	Pre	0.075	3.9	1.0	2.6	0.4	9.6	9.3	1.5	0.3
Trifluralin 4L	Pre	1.0	5.8	3.5	7.4	7.3	4.4	3.4	0	0
V-10142 3.3FL	Pre	0.1	9.1	9.3	8.9	9.3	9.1	10.0	9.1	10.0
Desmedipham / Phenmedipham 1.3EC	Post	0.4	8.1	7.9	6.9	5.5	5.0	2.5	4.9	2.4
Dimethenamid-p 6EC	Post	0.66	5.8	7.4	3.6	4.4	1.5	1.5	1.5	2.8
Ethofumesate 4SC	Post	1.0	1.8	0.3	0	0	1.4	1.0	0	0
Flucarbazone-sodium 70WG	Post	0.02	5.6	3.3	4.6	1.8	3.4	6.1	5.6	8.8
Flufenacet 60DF	Post	0.4	3.0	2.9	2.8	1.3	1.3	1.0	0.3	0
KIH-485 60WG	Post	0.089	5.9	6.4	3.5	4.1	2.6	2.0	1.0	1.6
Oxyfluorfen 4F	Post	0.25	10.0	10.0	9.6	10.0	9.8	10.0	5.0	1.6
Pendimethalin 3.8EC	Post	0.75	3.9	4.4	2.3	0.5	0.8	0.3	0.3	0
Penoksulam 2SC	Post	0.0268 [1]	8.3	9.4	7.1	8.5	7.1	10.0	7.9	10.0
Prometryn 4F	Post	1.0	10.0	10.0	10.0	10.0	10.0	10.0	2.0	0.3
S-metolachlor 7.62EC	Post	0.66	2.0	2.8	1.3	1.4	0	0.6	1.0	0
Sulfentrazone 4F	Post	0.075	9.1	9.4	8.8	8.8	8.9	9.6	3.3	2.9
Triallate 4EC	Post	1.0	1.6	0.3	1.0	0	1.3	0	0	0
Triallate 4EC	Post	1.25	1.5	0.3	0	0	1.1	0	0	0
Triallate 4EC	Post	1.5	2.0	1.0	1.1	0	0.3	0	0.5	0
V-10142 3.3FL	Post	0.1	7.8	9.0	6.5	7.8	6.0	10.0	7.8	9.6
Triflusulfuron-methyl 50DF	Post 3X	0.016	-	8.8	-	8.0	-	7.5	-	8.1
LSD (0.05)			2.0	2.7	1.7	1.5	1.8	1.4	1.3	1.0
Days after preplant incorporated treatment (PPI)			32	47	32	47	32	47	32	47
Days after preemergence treatment (Pre)			28	43	28	43	28	43	28	43
Days after single post-emergence treatment (Post)			8	23	8	23	8	23	8	23
Days after third post-emergence treatment (Post 3X)			-	7	-	7	-	7	-	7

[1] Applied with methylated seed oil at 1% v/v.

Table 2. Phytotoxicity ratings for cilantro, collard, kale and swiss chard.

			Cilantro		Collard		Kale		Swiss chard	
Herbicide	**Stage**	**Rate**	**9/6**	**9/21**	**9/6**	**9/21**	**9/6**	**9/21**	**9/6**	**9/21**
		lb ai A^{-1}	0 = no injury, 10 = dead							
Untreated Check (UTC)	-	-	0	0	0	0	0	0	0	0
Hand-Weeded Check	-	-	0	0	0	0	0	0	0	0
Triallate 4EC	PPI	1.0	1.1	0.5	0	0	0	0	0.3	0
Triallate 4EC	PPI	1.25	0	0	0	0	0.3	0	1.5	0.5
Triallate 4EC	PPI	1.5	0.3	0	0	0	0	0	2.0	0
Dimethenamid-p 6EC	Pre	0.66	8.1	7.9	8.0	7.1	8.6	8.9	5.3	3.6
Ethofumesate 4SC	Pre	1.0	0	0	1.3	2.0	0.3	1.6	0.5	0.0
Flucarbazone-sodium 70WG	Pre	0.02	1.3	1.6	0	0.3	0	0.3	1.5	2.3
Flufenacet 60DF	Pre	0.4	1.3	0.3	7.3	5.4	9.0	8.4	6.3	4.0
KIH-485 60WG	Pre	0.089	5.5	4.9	6.9	7.1	7.9	8.4	9.5	9.9
Oxyfluorfen 4F	Pre	0.25	9.1	9.5	8.4	6.6	8.8	7.3	9.9	9.8
Pendimethalin 3.8EC	Pre	0.75	0.8	0	9.0	9.4	6.3	7.3	8.0	9.3
Penoksulam 2SC	Pre	0.0223	8.5	9.1	8.8	9.1	9.0	9.3	9.8	10.0
Prometryn 4F	Pre	1.0	0.8	0.3	10.0	10.0	10.0	10.0	10.0	10.0
S-metolachlor 7.62EC	Pre	0.66	1.8	0.9	5.5	1.3	5.9	3.3	4.9	2.3
Sulfentrazone 4F	Pre	0.075	0.6	0	0.3	0	0.3	0	5.8	6.6
Trifluralin 4L	Pre	1.0	0.3	0	0.3	0	1.0	0	5.4	3.5
V-10142 3.3FL	Pre	0.1	9.0	9.9	8.9	10.0	9.1	9.9	9.8	10.0
Desmedipham / Phenmedipham 1.3EC	Post	0.4	3.1	1.0	4.9	2.3	4.6	1.6	4.3	2.5
Dimethenamid-p 6EC	Post	0.66	2.5	3.8	0.8	1.6	0.5	0.8	1.6	0.5
Ethofumesate 4SC	Post	1.0	0	0	0	1.0	0	0.5	1.5	0.3
Flucarbazone-sodium 70WG	Post	0.02	3.4	3.5	4.0	5.0	4.4	6.5	5.8	9.3
Flufenacet 60DF	Post	0.4	0.8	0	0	0	0	0	3.5	1.3
KIH-485 60WG	Post	0.089	0.5	1.3	0.8	1.8	0.6	1.3	4.8	5.3
Oxyfluorfen 4F	Post	0.25	6.5	3.3	2.4	0.8	1.0	0	9.5	10.0
Pendimethalin 3.8EC	Post	0.75	0	0	0.3	0	0	0	1.3	2.0
Penoksulam 2SC	Post	0.0268 [1]	6.8	10.0	6.3	10.0	6.4	10.0	8.3	10.0
Prometryn 4F	Post	1.0	3.4	1.4	7.6	10.0	7.5	9.9	10.0	10.0
S-metolachlor 7.62EC	Post	0.66	1.3	0	0	0	0	0	0	0
Sulfentrazone 4F	Post	0.075	6.1	5.4	0.8	0	0.3	0	9.5	9.5
Triallate 4EC	Post	1.0	0.3	0	0.6	0.8	0.8	0.3	2.3	0.8
Triallate 4EC	Post	1.25	0.3	0	0	0	0	0	1.5	1.5
Triallate 4EC	Post	1.5	0.5	0	0.8	0.4	0.3	0	1.0	0.5
V-10142 3.3FL	Post	0.1	6.8	9.4	6.0	7.5	5.5	7.8	6.8	9.9
Triflusulfuron-methyl 50DF	Post 3X	0.016	-	8.9	-	3.9	-	2.3	-	0.8
LSD (0.05)			1.2	1.0	1.0	1.2	1.0	1.4	1.9	2.0
Days after preplant incorporated treatment (PPI)			32	47	32	47	32	47	32	47
Days after preemergence treatment (Pre)			28	43	28	43	28	43	28	43
Days after single post-emergence treatment (Post)			8	23	8	23	8	23	8	23
Days after third post-emergence treatment (Post 3X)			-	7	-	7	-	7	-	7

[1] Applied with methylated seed oil at 1% v/v.

Table 3. Crop stand and biomass (fresh weight) evaluations for head lettuce, leaf lettuce, spinach and dill.

Herbicide	Stage	Rate	Head lettuce		Leaf lettuce		Spinach		Dill[1]
			9/26		9/27		9/29		10/10
		lb ai A^{-1}	# $3ft^{-1}$	g $3ft^{-1}$	# $3ft^{-1}$	g $3ft^{-1}$	# $3ft^{-1}$	g $3ft^{-1}$	g $3ft^{-1}$
Untreated Check (UTC)	-	-	14.3	545.0	21.3	986.3	14.8	560.0	1675.0
Hand-Weeded Check	-	-	12.5	493.8	19.8	1025.0	13.8	615.8	1561.3
Triallate 4EC	PPI	1.0	9.0	386.3	17.5	872.5	11.3	514.5	1917.5
Triallate 4EC	PPI	1.25	6.5	332.5	17.3	822.5	13.0	640.0	1620.0
Triallate 4EC	PPI	1.5	8.3	357.5	17.0	650.0	14.3	665.0	1832.5
Dimethenamid-p 6EC	Pre	0.66	2.8	5.0	4.8	3.4	13.0	174.8	135.5
Ethofumesate 4SC	Pre	1.0	7.8	305.0	21.0	1011.3	13.8	665.0	1691.3
Flucarbazone-sodium 70WG	Pre	0.02	13.3	572.5	23.0	1146.3	13.0	431.3	755.0
Flufenacet 60DF	Pre	0.4	3.5	13.9	11.8	263.4	11.8	726.3	1630.0
KIH-485 60WG	Pre	0.089	6.0	62.3	15.3	336.3	8.5	22.9	164.0
Oxyfluorfen 4F	Pre	0.25	0	0	0	0	0	0	14.1
Pendimethalin 3.8EC	Pre	0.75	0.3	0.3	0	0	0.3	0.8	1997.5
Penoksulam 2SC	Pre	0.0223	16.8	23.8	22.5	21.0	2.0	0.3	212.6
Prometryn 4F	Pre	1.0	0	0	0	0	0.3	0.9	2283.8
S-metolachlor 7.62EC	Pre	0.66	8.3	151.3	16.3	255.0	15.8	703.8	763.8
Sulfentrazone 4F	Pre	0.075	15.8	587.5	22.5	1265.0	4.8	25.3	1846.3
Trifluralin 4L	Pre	1.0	11.0	490.0	8.8	171.8	10.8	489.5	2105.0
V-10142 3.3FL	Pre	0.1	13.5	20.5	20.8	12.0	1.5	0.1	0
Desmedipham / Phenmedipham 1.3EC	Post	0.4	5.0	81.0	9.8	362.5	12.8	583.8	1166.3
Dimethenamid-p 6EC	Post	0.66	11.0	153.8	22.8	588.8	15.0	492.5	1118.8
Ethofumesate 4SC	Post	1.0	16.3	857.5	24.8	1471.3	11.5	612.5	1558.8
Flucarbazone-sodium 70WG	Post	0.02	12.3	313.8	22.3	706.3	8.8	172.8	239.3
Flufenacet 60DF	Post	0.4	12.0	514.5	22.5	917.5	14.0	720.0	1607.5
KIH-485 60WG	Post	0.089	14.0	252.5	22.8	690.0	12.5	413.8	1451.3
Oxyfluorfen 4F	Post	0.25	0.3	0.1	0.3	0.3	0	0	1612.5
Pendimethalin 3.8EC	Post	0.75	9.5	253.8	23.3	936.3	12.3	439.3	1797.5
Penoksulam 2SC	Post	0.0268[2]	4.8	.4	16.5	42.4	0	0	0.1
Prometryn 4F	Post	1.0	0.3	2.8	0	0	0	0	1950.0
S-metolachlor 7.62EC	Post	0.66	13.3	573.8	23.5	1016.3	14.5	573.8	1483.8
Sulfentrazone 4F	Post	0.075	4.5	17.4	9.3	110.8	1.8	20.1	1777.5
Triallate 4EC	Post	1.0	13.0	666.3	22.3	1206.3	13.3	551.3	1663.8
Triallate 4EC	Post	1.25	17.3	842.5	24.3	1306.3	13.5	618.8	1737.5
Triallate 4EC	Post	1.5	13.5	700.0	23.8	1122.5	13.5	602.5	1678.8
V-10142 3.3FL	Post	0.1	6.5	18.4	17.0	175.0	0	0	8.4
Triflusulfuron-methyl 50DF	Post 3X	0.016	12.5	41.5	24.3	200.0	10.5	157.0	215.6
LSD (0.05)			5.7	246.8	4.7	263.9	3.7	177.0	300.9
Days after preplant incorporated treatment (PPI)			52	52	53	53	55	55	66
Days after preemergence treatment (Pre)			48	48	49	49	51	51	62
Days after single post-emergence treatment (Post)			28	28	29	29	31	31	42
Days after third post-emergence treatment (Post 3X)			12	12	13	13	15	15	26

[1] A stand evaluation was not taken for Dill

[2] Applied with methylated seed oil at 1% v/v.

Table 4. Crop stand and biomass (fresh weight) evaluations for cilantro, collard, kale and swiss chard.

			Cilantro [1]	**Collard**		**Kale**		**Swiss chard**	
Herbicide	**Stage**	**Rate**	**10/6**	**9/23**		**10/3**		**10/4**	
		lb ai A^{-1}	**g 3ft^{-1}**	**# 3ft^{-1}**	**g 3ft^{-1}**	**# 3ft^{-1}**	**g 3ft^{-1}**	**# 3ft^{-1}**	**g 3ft^{-1}**
Untreated Check (UTC)	-	-	731.3	15.0	430.0	20.0	1486.3	14.3	736.3
Hand-Weeded Check	-	-	792.5	13.0	472.5	18.5	1492.5	15.3	842.5
Triallate 4EC	PPI	1.0	678.8	15.5	492.5	19.0	1526.3	16.5	887.5
Triallate 4EC	PPI	1.25	890.0	15.5	500.0	20.0	1433.8	15.0	717.5
Triallate 4EC	PPI	1.5	965.0	15.3	613.8	19.8	1722.5	12.3	886.3
Dimethenamid-p 6EC	Pre	0.66	262.5	15.8	107.5	19.3	102.3	13.0	695.0
Ethofumesate 4SC	Pre	1.0	887.5	14.8	462.5	18.5	1308.8	9.5	1088.8
Flucarbazone-sodium 70WG	Pre	0.02	706.3	15.5	453.8	19.0	1358.8	9.5	563.8
Flufenacet 60DF	Pre	0.4	923.8	12.5	246.3	15.0	116.4	8.5	1181.3
KIH-485 60WG	Pre	0.089	670.0	13.3	113.8	19.5	219.0	7.0	3.6
Oxyfluorfen 4F	Pre	0.25	87.8	9.0	133.8	9.3	660.0	2.5	6.5
Pendimethalin 3.8EC	Pre	0.75	728.8	2.5	12.5	6.8	559.1	0.3	102.5
Penoksulam 2SC	Pre	0.0223	31.9	11.0	8.8	17.5	22.4	0	0
Prometryn 4F	Pre	1.0	727.5	0	0	0	0	0	0
S-metolachlor 7.62EC	Pre	0.66	883.8	13.8	380.0	20.3	883.8	5.3	722.5
Sulfentrazone 4F	Pre	0.075	1016.3	15.0	532.5	18.5	1946.3	4.8	139.4
Trifluralin 4L	Pre	1.0	915.0	16.3	518.8	19.0	1740.0	6.5	685.0
V-10142 3.3FL	Pre	0.1	1.6	0	0	19.0	1.1	0	0
Desmedipham / Phenmedipham 1.3EC	Post	0.4	923.8	14.0	272.5	18.0	1353.8	9.0	1205.0
Dimethenamid-p 6EC	Post	0.66	543.8	15.5	350.0	19.5	1216.3	12.5	931.3
Ethofumesate 4SC	Post	1.0	865.0	13.5	530.0	20.8	1531.3	7.5	790.0
Flucarbazone-sodium 70WG	Post	0.02	673.8	14.0	342.5	15.5	542.5	3.5	76.3
Flufenacet 60DF	Post	0.4	897.5	16.0	550.0	17.5	1573.8	7.5	637.5
KIH-485 60WG	Post	0.089	772.5	14.8	407.5	18.3	1330.0	8.0	161.1
Oxyfluorfen 4F	Post	0.25	601.3	14.0	466.3	19.8	1883.8	0.3	0.6
Pendimethalin 3.8EC	Post	0.75	838.8	14.5	433.8	19.3	1557.5	10.3	596.3
Penoksulam 2SC	Post	0.0268 [2]	0	0	0	1.0	0.1	0	0
Prometryn 4F	Post	1.0	648.8	0.5	1.3	1.3	6.3	0	0
S-metolachlor 7.62EC	Post	0.66	843.8	15.3	478.8	18.8	1472.5	15.0	1235.0
Sulfentrazone 4F	Post	0.075	423.8	14.8	576.3	20.5	2075.0	0.5	5.1
Triallate 4EC	Post	1.0	773.8	15.8	523.8	18.5	1483.8	8.3	686.3
Triallate 4EC	Post	1.25	847.5	15.3	495.0	21.3	1810.0	7.8	605.0
Triallate 4EC	Post	1.5	830.0	14.0	403.8	20.0	1538.8	8.8	705.0
V-10142 3.3FL	Post	0.1	14.5	11.5	93.8	15.8	134.0	1.0	8.3
Triflusulfuron-methyl 50DF	Post 3X	0.016	68.6	14.0	297.5	19.0	1000.0	12.5	806.3
LSD (0.05)			191.8	3.4	363.4	3.3	304.5	7.3	390.8
Days after preplant incorporated treatment (PPI)			62	49	49	59	59	60	60
Days after preemergence treatment (Pre)			58	45	45	55	55	56	56
Days after single post-emergence treatment (Post)			38	23	23	35	35	36	36
Days after third post-emergence treatment (Post 3X)			22	9	9	19	19	20	20

[1] A stand evaluation was not taken for Cilantro

[2] Applied with methylated seed oil at 1% v/v.

Table 5. Weed control ratings for redroot pigweed and common purslane.

Herbicide	Stage	Rate	Redroot pigweed 9/6	Redroot pigweed 9/21	Common purslane 9/6	Common purslane 9/21
		lb ai A^{-1}	%			
Untreated Check (UTC)	-	-	0	0	0	0
Hand-Weeded Check	-	-	0	0	0	0
Triallate 4EC	PPI	1.0	0	0	83.8	71.3
Triallate 4EC	PPI	1.25	7.5	2.5	87.5	87.5
Triallate 4EC	PPI	1.5	0	0	97.5	92.5
Dimethenamid-p 6EC	Pre	0.66	100.0	100.0	100.0	99.5
Ethofumesate 4SC	Pre	1.0	66.3	58.8	82.5	83.8
Flucarbazone-sodium 70WG	Pre	0.02	27.5	51.3	12.5	2.5
Flufenacet 60DF	Pre	0.4	97.5	97.5	97.5	98.3
KIH-485 60WG	Pre	0.089	100.0	100.0	98.8	100.0
Oxyfluorfen 4F	Pre	0.25	100.0	100.0	100.0	100.0
Pendimethalin 3.8EC	Pre	0.75	95.0	100.0	100.0	100.0
Penoksulam 2SC	Pre	0.0223	91.3	99.5	88.8	93.8
Prometryn 4F	Pre	1.0	100.0	77.5	100.0	77.5
S-metolachlor 7.62EC	Pre	0.66	93.8	96.3	72.5	70.0
Sulfentrazone 4F	Pre	0.075	70.0	70.0	21.3	17.5
Trifluralin 4L	Pre	1.0	100.0	100.0	98.8	98.8
V-10142 3.3FL	Pre	0.1	95.0	77.5	95	77.5
Desmedipham / Phenmedipham 1.3EC	Post	0.4	95.0	96.3	92.5	94.5
Dimethenamid-p 6EC	Post	0.66	45.0	71.3	42.5	50.0
Ethofumesate 4SC	Post	1.0	52.5	68.8	57.5	86.3
Flucarbazone-sodium 70WG	Post	0.02	65.0	95.0	50.0	56.3
Flufenacet 60DF	Post	0.4	48.8	52.5	45.0	28.8
KIH-485 60WG	Post	0.089	70.0	90.0	71.3	88.8
Oxyfluorfen 4F	Post	0.25	100.0	100.0	100.0	100.0
Pendimethalin 3.8EC	Post	0.75	15.0	36.3	40.0	73.8
Penoksulam 2SC	Post	0.0268 [1]	78.8	100.0	81.3	97.8
Prometryn 4F	Post	1.0	100.0	100.0	100.0	100.0
S-metolachlor 7.62EC	Post	0.66	40.0	40.0	42.5	22.5
Sulfentrazone 4F	Post	0.075	98.8	100.0	93.8	93.3
Triallate 4EC	Post	1.0	40.0	17.5	61.3	61.3
Triallate 4EC	Post	1.25	30.0	6.3	61.3	60.0
Triallate 4EC	Post	1.5	35.0	13.3	76.3	80.0
V-10142 3.3FL	Post	0.1	67.5	96.3	51.3	37.5
Triflusulfuron-methyl 50DF	Post 3X	0.016	-	65.0	-	41.3
LSD (0.05)			13.6	22.4	14.5	24.0
Days after preplant incorporated treatment (PPI)			32	47	32	47
Days after preemergence treatment (Pre)			28	43	28	43
Days after single post-emergence treatment (Post)			8	23	8	23
Days after third post-emergence treatment (Post 3X)			-	7	-	7

[1] Applied with methylated seed oil at 1% v/v.

Postemergence weed control study in bearing grapes. Mick Canevari, Paul Verdegaal, Donald Colbert, Randall Wittie and Scott Whitely. (Cooperative Extension, University of California, Stockton, CA) A field study was conducted to evaluate postemergence herbicides and combinations for weed control in an established vineyard, variety Sangiovese. 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 40 gpa. Unifilm 707 (NIS) was added to all herbicide treatments at 0.25% V/V. Visual evaluations on crop injury and weed control were taken 91 days after treatment (DAT), 124 DAT and 162 DAT.

Table 1. Application information.

Application date	February 24, 2005
Crop stage	dormant
Weed stage	ERICA 8-16 lf, 0.5-3.0 in diameter; ERMSE preemergence to cotyledon; DIGSA preemergence and PANCA preemergence
Air temperature (F)	64
Relative humidity (%)	63
Wind (mph)	1
Cloud cover (%)	95
Soil temperature at 2 in (F)	60
Texture	sandy loam

No treatments visibly injured the grapes (data not shown). Flumioxazin alone and flumioxazin + oryzalin treatments gave poor control of horseweed (ERICA) with excellent control of turkey mullein (ERMSE), large crabgrass (DIGSA) and witchgrass (PANCA). Oxyfluorfen + glyphosate + oryzalin gave excellent control of the above weed species except for turkey mullein. Glufosinate ammonium + oryzalin resulted in excellent control of horseweed and large crabgrass with no activity on turkey mullein. Witchgrass control was 88% 91 DAT, 63% 124 DAT and 0% on 162 DAT. Glyphosate + oryzalin gave 78% control of horseweed, 89% large crabgrass control with no control of turkey mullein. Witchgrass control 91 DAT was 90%, 83% on 124 DAT and only 50% on 162 DAT. Rimsulfuron gave excellent control of horseweed, turkey mullein and witchgrass. Large crabgrass control was excellent 91 and 124 DAT but fell of to 83% 162 DAT.

Table 2. Postemergence herbicides for weed control in bearing Sangiovese grapes near Woodbridge, California.

		Control[1]										
		ERICA DAT[2]		ERMSE DAT			DIGSA DAT			PANCA DAT		
Treatment[3]	Rate	91	124	91	124	162	91	124	162	91	124	162
	Lb ai/A	%										
Flumioxazin	0.375	27	23	100	100	100	100	100	100	100	100	98
Flumioxazin + oryzalin	0.375 + 3.0	28	20	98	96	94	100	100	99	100	100	99
Oxyfluorfen + glyphosate + oryzalin	1.0 + 1.0 + 3.0	99	96	37	20	0	100	97	95	99	99	93
Glufosinate ammonium + oryzalin	1.0 + 3.0	99	97	3	0	0	99	98	92	88	63	0
Glyphosate + oryzalin	1.0 + 3.0	83	78	0	0	0	97	95	89	90	83	50
Rimsulfuron	0.125	100	100	98	96	94	97	93	83	100	100	96
Untreated check	-	0	0	0	0	0	0	0	0	0	0	0
LSD (.05)		28.5	33.7	16.7	12.5	6.3	4.7	9.0	19.2	3.8	15.4	11.6

[1] Weeds evaluated for control were horseweed (ERICA), turkey mullein (ERMSE), large crabgrass (DIGSA) and witchgrass (PANCA).

[2] DAT = days after treatment. [3] Unifilm 707 (NIS) added to all treatments at 0.25% V/V.

Postemergence herbicides for controlling turkey mullein in grapes. Mick Canevari, Paul Verdegaal, Donald Colbert, Randall Wittie and Scott Whiteley. (Cooperative Extension, University of California, Stockton, CA 95205) A field study was conducted to evaluate postemergence herbicides for controlling turkey mullein (ERMSE) in an established Sangiovese grape vineyard. 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 32.4 gpa on April 20, 2005. Unifilm 707 (NIS) was added to all herbicide treatments at 0.25% V/V. Growth stages prior to treatment were; grapes 12 to 20 inch shoots and turkey mullein 20 % two to four leaf, 80% six to ten leaf and 0.5 to 1.5 inches in diameter. Soil texture was a sandy loam. Visual evaluations for crop injury and turkey mullein control were taken 6 days after treatment (DAT), 21 DAT, 26 DAT, 69 DAT and 107 DAT.

No treatments visibly injured the grapes. The only herbicide showing some 83% early burn down of turkey mullein was A7813 (paraquat inteon). Both rates of rimsulfuron gave poor turkey mullein control (55-62%). A7813 and glufosinate ammonium 107 DAT resulted in 89% and 99% turkey mullein control, respectively. Flumioxazin 69 DAT gave 90% turkey mullein control but fell off to 83% control 107 DAT.

Table. Postemergence herbicides for controlling turkey mullein in an established vineyard.

		Turkey Mullein Control - Days After Treatment					
				%			
Treatments	Rate lb ai/Acre	6 DAT	21 DAT	36 DAT	69 DAT	107 DAT	% Crop Injury
Glufosinate ammonium	1.0	37	100	100	100	99	0
Rimsulfuron	0.0625	7	33	62	62	55	0
Rimsulfuron	0.125	8	55	75	68	62	0
A7813	0.75	83	93	96	94	89	0
Flumioxazin	0.33	30	85	92	90	83	0
Check	-	0	0	0	0	0	0
LSD (.05)		10.1	13.0	16.8	26.7	31.4	

Postemergence weed control study in bearing merlot grapes. Mick Canevari, Paul Verdegaal, Donald Colbert, Randall Wittie and Scott Whiteley. (Cooperative Extension, University of California, Stockton, CA 95205) A field study was conducted to evaluate postemergence herbicide treatments for weed control in an established grape vineyard located near Woodbridge, CA. 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 40 gpa. Visual evaluations for crop injury and weed control were taken April 19, May 26 and August 5, 2005.

Table 1. Application information.

Application date	February 24, 2005
Crop stage	dormant
Weed stage	STEME 6-7 inch; LASCE 8-12 lf; SENVU 6-10 inch; SONOL 8-12 lf; CAPBP flowering; POAAN seed set; EROCI 6-14 inch; EPIPC 4-6 inch; ECHCG preemergence; DIGSA preemergence and PANCA preemergence
Air temperature (F)	52
Relative humidity (%)	92
Wind (mph)	0
Cloud cover (%)	95
Soil temperature at 2 in. (F)	48
Texture	sandy loam

No treatment visibly injured the grapes (data not shown). All rimsulfuron treatments gave excellent control of the above weed species except for redstem filaree (EROCI). Large crabgrass (DIGSA) control was excellent on the May 26th rating but fell off to 67 to 85% on the August 5th rating. A7813 alone provided excellent control of the above weed species except for annual sowthistle (SONOL), barnyardgrass (ECHCG), large crabgrass and witchgrass (PANCA). A7813 tank mixed with oxyflurfen and simazine gave complete control of all broadleaf species and annual bluegrass (POAAN). May 26 ratings showed 83 to 93% barnyardgrass control and 97 to 99% control of witchgrass. Large crabgrass control was poor. Flumioxazin alone resulted in 96 to 100% control of common chickweed (STEME), shepherdspurse (CAPBP), panicle willowweed (EPIPC), annual bluegrass, barnyardgrass, large crabgrass and witchgrass. It gave poor control of redstem filaree, common sowthistle, common groundsel (SENVU) with 80% prickly lettuce (LASCE) control. Flumioxazin + glyphosate + oryzalin gave 90 to 100% control of all weed species. Flumioxazin + oryzalin provided 86 to 100% control of the above weed species except for 57% annual sowthistle control and 20% on common groundsel. Flumioxazin + simazine gave similar weed control as Flumioxazin + oryzalin but the combination gave better annual sowthistle control 87%. Oxyfluorfen + oryzalin gave 90 to 100% control of prickly lettuce, panicle willowweed, and witchgrass. Poor control of redstem filaree, chickweed, annual bluegrass, shepherdspurse, sowthistle and groundsel. Barnyardgrass and large crabgrass control was 99% on May 26th but on August 5th it had dropped off to 83% and 86%, respectively. Oxyfluorfen + oryzalin + glyphosate gave 88 to 100% control of all weed species. Glufosinate ammonium + oryzalin resulted in 92 to 100% control of all weed species except for 58% large crabgrass control on the August 5th rating date. Glyphosate + oryzalin provided excellent control of the broadleaf species, annual bluegrass and witchgrass. May 26th rating showed 88% large crabgrass control with only 33% control on the August 5th date. Paraquat + oryzalin gave results similar to glyphosate + oryzalin.

Table 2. Postemergence herbicides for weed control in an established vineyard near Woodbridge, California.

		Weed Control[1]												
		EROCI	STEME	POAAN	CAPBP	EPIPC	SONOL	SENVU	LASCE	PANIC	ECHCX		DIGSA	
Treatment[2]	Rate	4/19	4/19	4/19	4/19	5/26	5/26	5/26	5/26	5/26	5/26	8/5	5/26	8/5
	lb ai/A							%						
Rimsulfuron + glyphosate	0.047 + 1.0	68	100	100	100	100	100	100	95	93	100	90	92	67
Rimsulfuron + glyphosate	0.0625 + 1.0	73	100	100	100	100	100	100	95	97	100	100	96	72
Rimsulfuron + glyphosate	0.125 + 1.0	80	100	100	100	100	100	100	92	100	100	97	99	85
Rimsulfuron + glyphosate + diuron	0.047 + 1.0 + 1.6	63	100	100	100	100	100	100	96	99	100	98	93	72
Rimsulfuron + glyphosate + diuron	0.0625 + 1.0 + 1.6	80	97	100	100	100	100	100	96	100	100	97	99	73
A7813	0.625	96	97	100	100	100	40	100	100	0	0	0	0	0
A7813	0.75	96	99	100	96	100	80	100	100	0	0	0	0	0
A7813 + simazine + oxyfluorfen	0.625 2.0 + 1.0	95	99	100	97	100	87	100	100	99	83	70	53	37
A7813 + simazine + oxyfluorfen	0.75 + 2.0 + 1.0	99	100	100	100	100	99	100	100	97	93	72	58	37
Flumioxazin	0.375	57	100	100	100	100	61	50	80	100	100	100	98	96
Flumioxazin	0.75	93	100	100	100	100	53	47	100	100	100	100	100	99
Flumioxazin + glyphosate + oryzalin	0.375 + 1.0 + 3.0	90	100	100	100	100	100	100	100	100	100	100	100	96
Flumioxazin oryzalin	0.375 + 3.0	86	100	100	100	100	57	20	93	100	99	95	99	90
Flumioxazin + simazine	0.375 + 2.0	88	100	100	100	100	87	40	100	100	98	92	100	94
Oxyfluorfen + oryzalin	1.0 + 3.0	58	73	67	53	100	40	43	90	100	99	83	99	86
Oxyfluorfen + glyphosate + oryzalin	1.0 + 1.0 3.0	88	100	100	100	100	100	100	100	100	100	89	100	88
Gluf[3] + oryzalin	1.0 + 3.0	99	100	100	100	100	100	99	100	100	99	92	93	58
Oryzalin + glyphosate	3.0 + 1.0	88	100	100	100	95	98	95	100	100	99	73	88	33
Oryzalin + paraquat	3.0 + 0.75	94	100	100	100	100	100	93	100	100	100	87	93	55
Check	-	0	0	0	0	0	0	0	0	0	0	0	0	0
LSD (P=.05)		14.8	3.8	5.6	3.6	5.9	21.6	13.0	12.1	5.2	5.2	16.8	7.6	24.2

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[1] Weeds evaluated for control were redstem filaree (EROCI), common chickweed (STEME), annual bluegrass(POAAN),shepherdspurse(CAPBP), panicle willowweed,(EPIPC), annual sowthistle (SONOL), common groundsel (SENVU), prickly lettuce (LASCE), witchgrass (PANIC), barnyardgrass (ECHCG) and large crabgrass (DIGSA).

[2] Unifilm 707(NIS) added to all treatments at 0.25% V/V

[3] Gluf = glufosinate ammonium

Comparisons of flumioxazin and rimsulfuron in preemergence two- and three-way tank mixtures for weed control in potatoes. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objective of this trial was to compare flumioxazin and rimsulfuron in 2- and 3-way tank mixtures with metribuzin, s-metolachlor, EPTC, pendimethalin and/or ethalfluralin for weed control, crop safety, and tuber yields in a field trial located at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 135 lb N, 25 lb P_2O_5, 1 lb Zn, 0.08 lb Cu, and 0.3 lb Mn/A based on soil tests, before planting 'Russet Burbank' potatoes on April 27, 2004. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.1% organic matter and pH 7.4. The experimental design was a randomized complete block with three replications and plot size was 9 by 30 ft.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 17, 2004, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 19, 2004 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. PRE treatments were incorporated by 0.7-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 40 redroot pigweed (AMARE), 40 common lambsquarters (CHEAL), 9 Kochia (KCHSC), 70 hairy nightshade (SOLSA), and 90 volunteer oat (AVESA) and 9 green foxtail (SETVI)/m^2 by July 2, 2004/row closure.

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. Potato vines were desiccated with 0.375 lb/A diquat August 31, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Sept 24, 2004 and graded according to USDA standards.

Two-way tank mixtures of flumioxazin or rimsulfuron combined with metribuzin provided similar control for all weed present, including SOLSA, and control ranged from 88 to 100% (Table 1). Similarly, combinations of either flumioxazin or rimsulfuron with EPTC resulted in comparable control of all weeds present (93 to 100%) with the exception of AMARE. Rimsulfuron + EPTC resulted in greater AMARE control than flumioxazin + EPTC (100 vs 78%). Flumioxazin or rimsulfuron + s-metolachlor or pendimethalin, provided similar SOLSA control (85 to 93%) while flumioxazin + ethalfluralin controlled SOLSA better than rimsulfuron + ethalfluralin (92 vs 80%) Otherwise, SOLSA control with 2-way tank mixtures not including flumioxazin or rimsulfuron was <85%.

Rimsulfuron + s-metolachlor, pendimethalin, or ethalfluralin controlled AMARE, KCHSC, and AVESA better than flumioxazin combined with those tank-mix partners (Table 1). Rimsulfuron + s-metolachlor controlled CHEAL better than flumioxazin + s-metolachlor (88 vs 73%) CHEAL control with flumioxazin or rimsulfuron + pendimethalin was similar (93 and 92%). Either herbicide combined with ethalfluralin did not provide acceptable CHEAL control. SETVI control with flumioxazin or rimsulfuron + s-metolachlor or pendimethalin was similar (92 to 97%) while rimsulfuron + ethalfluralin controlled SETVI better than flumioxazin + ethalfluralin (95 vs 80%). Of the 2-way tank mixtures not including flumioxazin or rimsulfuron, metribuzin combinations were the only treatments controlling all weeds other than SOLSA 95% or greater. Otherwise, only EPTC + s-metolachlor controlled all weeds other than SOLSA greater than 80%.

Three-way tank mixtures including flumioxazin and metribuzin controlled AMARE, CHEAL, KCHSC, SOLSA, and AVESA similar to 3-way mixtures including rimsulfuron and metribuzin (Table 1). Of these 3-way mixtures, all controlled SETVI at least 90% except when EPTC was the third tank-mix partner. Similarly, weed control with flumioxazin + s-metolachlor + EPTC was not different than control with rimsulfuron + s-metolachlor + EPTC. However, the other rimsulfuron 3-way combinations not already mentioned usually controlled AMARE and CHEAL better than similar flumioxazin combinations. SOLSA control with 3-way combinations including ethalfluralin was usually better when flumioxazin also was in the tank-mix than when rimsulfuron was included.

Crop injury prior to row-closure was 10% or less (Table 2). Two and three-way tank mixture treatment U.S. No. 1 and total tuber yields were not different than the weed-free control tuber yields.

Table 1. Season-long weed control with preemergence two- and three-way tank mixtures in 2004 at Aberdeen, ID: a comparison of flumioxazin and rimsulfuron.

		Control[1]					
		AMARE	CHEAL	SOLSA	KCHSC	AVESA	SETVI
Treatment	Rate	9/8	9/8	9/8	9/8	9/8	9/8
	lb ai/A	%					
Metribuzin	0.5						
+ flumioxazin	0.047	100	98	95	100	100	95
+ rimsulfuron	0.23	100	100	88	100	96	98
+ EPTC	3.9	100	97	82	100	96	97
+ ethalfluralin	0.94	100	97	50	100	98	96
+ pendimethalin	1.0	98	100	40	100	98	95
+ s-metolachor	1.34	100	100	40	100	98	98
s-metolachlor	1.34						
+ flumioxazin	0.047	85	73	90	90	55	97
+ rimsulfuron	0.023	95	88	85	98	87	96
+ EPTC	3.9	93	83	77	82	93	100
+ ethalfluralin	0.94	72	70	33	63	70	90
+ pendimethalin	1.0	85	87	48	73	58	96
EPTC	3.9						
+ flumioxazin	0.047	78	93	96	98	95	98
+ rimsulfuron	0.023	100	95	98	100	93	98
+ ethalfluralin	0.94	58	72	78	65	85	90
+ pendimethalin	1.0	70	78	72	95	87	91
Pendimethalin	1.0						
+ flumioxazin	0.047	83	93	93	83	40	92
+ rimsulfuron	0.023	95	92	90	95	87	93
+ ethalfluralin	0.94	53	53	27	58	63	87
Ethalfluralin	0.94						
+ flumioxazin	0.047	68	62	92	68	27	80
+ rimsulfuron	0.023	85	75	80	87	87	95
Flumioxazin + metribuzin	0.047 + 0.5						
+ rimsulfuron	0.023	100	98	100	100	98	100
+ EPTC	3.9	97	98	98	97	99	83
+ ethalfluralin	0.94	100	95	90	100	99	97
+ pendimethalin	1.0	100	100	91	100	98	98
+ s-metolachlor	1.34	100	98	97	100	98	92
Flumioxazin + s-metolachlor	0.047 + 1.34						
+ rimsulfuron	0.023	100	98	95	100	83	95
+ EPTC	3.9	100	98	100	87	93	100
+ ethalfluralin	0.94	90	70	95	97	53	93
+ pendimethalin	1.0	83	93	90	98	72	96
Flumioxazin + EPTC	0.047 + 3.9						
+ rimsulfuron	0.023	100	97	100	100	95	95
+ ethalfluralin	0.94	88	98	96	92	95	97
+ pendimethalin	1.0	88	85	97	72	95	95
Flumioxazin + pendimethalin	0.047 + 1.0						
+ rimsulfuron	0.023	100	98	93	100	88	100
+ ethalfluralin	0.94	80	75	90	96	63	88
Flumioxazin + ethalfluralin	0.047 + 0.94						
+ rimsulfuron	0.023	100	97	99	100	90	100
Rimsulfuron + metribuzin	0.023 + 0.5						
+ EPTC	3.9	97	88	95	98	98	88
+ ethalfluralin	0.94	100	92	83	100	99	100
+ pendimethalin	1.0	100	100	88	100	96	100
+ s-metolachlor	1.34	97	90	88	100	93	95

Table 1. continued

Treatment	Rate	Control[1]					
		AMARE 9/8	CHEAL 9/8	SOLSA 9/8	KCHSC 9/8	AVESA 9/8	SETVI 9/8
	lb ai/A	%					
+ EPTC	3.9	100	90	95	100	98	100
+ ethalfluralin	0.94	100	88	83	88	93	98
+ pendimethalin	1.0	98	78	92	100	88	99
Rimsulfuron + EPTC	0.023 + 3.9						
+ ethalfluralin	0.94	100	93	83	98	95	97
+ pendimethalin	1.0	100	98	90	93	96	93
Rimsulfuron + pendimethalin	0.023 + 1.0						
+ ethalfluralin	0.94	98	97	82	100	82	98
LSD (0.05)	-	8.2	9.6	11.1	8.1	9.4	11.0

[1]AMARE redroot pigweed; CHEAL common lambsquarters; KCHSC kochia; SOLSA hairy nightshade; AVESA, tame oat.

Table 2. U.S. No. 1 and total tuber yields with preemergence two- and three-way tank mixtures in 2004 at Aberdeen, ID: a comparison of flumioxazin and rimsulfuron.

Treatment	Rate	Crop injury	Tuber yield[1]	
			U.S. No. 1	Total
	lb ai/A	---%---	-------cwt/A------	
Weedy check	-	0	124	245
Weed-free control	-	0	219	348
Metribuzin	0.5			
+ flumioxazin	0.047	7	256	353
+ rimsulfuron	0.23	0	175	268
+ EPTC	3.9	0	265	363
+ ethalfluralin	0.94	0	216	331
+ pendimethalin	1.0	0	224	321
+ s-metolachor	1.34	0	238	361
s-metolachlor	1.34			
+ flumioxazin	0.047	0	226	322
+ rimsulfuron	0.023	0	271	364
+ EPTC	3.9	0	305	407
+ ethalfluralin	0.94	0	245	359
+ pendimethalin	1.0	0	225	338
EPTC	3.9			
+ flumioxazin	0.047	3	283	373
+ rimsulfuron	0.023	0	244	355
+ ethalfluralin	0.94	0	208	311
+ pendimethalin	1.0	0	232	337
Pendimethalin	1.0			
+ flumioxazin	0.047	2	218	331
+ rimsulfuron	0.023	3	267	391
+ ethalfluralin	0.94	3	217	334
Ethalfluralin	0.94			
+ flumioxazin	0.047	3	177	267
+ rimsulfuron	0.023	2	288	393
Flumioxazin + metribuzin	0.047 + 0.5			
+ rimsulfuron	0.023	0	287	378
+ EPTC	3.9	10	236	335
+ ethalfluralin	0.94	10	220	330
+ pendimethalin	1.0	8	226	337
+ s-metolachlor	1.34	3	226	323

Table 2. continued

Treatment	Rate	Crop injury	Tuber yield[1]	
			U.S. No. 1	Total
	lb ai/A	---%---	-------cwt/A------	
Flumioxazin + s-metolachlor	0.047 + 1.34			
+ rimsulfuron	0.023	7	236	329
+ EPTC	3.9	8	275	380
+ ethalfluralin	0.94	10	250	346
+ pendimethalin	1.0	5	198	297
Flumioxazin + EPTC	0.047 + 3.9			
+ rimsulfuron	0.023	8	256	359
+ ethalfluralin	0.94	5	234	353
+ pendimethalin	1.0	2	201	319
Flumioxazin + pendimethalin	0.047 + 1.0			
+ rimsulfuron	0.023	5	241	353
+ ethalfluralin	0.94	3	227	328
Flumioxazin + ethalfluralin	0.047 + 0.94			
+ rimsulfuron	0.023	5	269	376
Rimsulfuron + metribuzin	0.023 + 0.5			
+ EPTC	3.9	5	202	305
+ ethalfluralin	0.94	0	294	390
+ pendimethalin	1.0	2	216	320
+ s-metolachlor	1.34	0	239	345
Rimsulfuron + s-metolachlor	0.023 + 1.34			
+ EPTC	3.9	3	267	377
+ ethalfluralin	0.94	0	280	370
+ pendimethalin	1.0	0	252	351
Rimsulfuron + EPTC	0.023 + 3.9			
+ ethalfluralin	0.94	0	275	369
+ pendimethalin	1.0	0	232	327
Rimsulfuron + pendimethalin	0.023 + 1.0			
+ ethalfluralin	0.94	2	201	305
LSD (0.05)	-	7	79	89

[1] 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.

Weed control and crop safety with preemergence or postemergence dimethenamid-p and sulfentrazone: ground-applied, sprinkler incorporated compared with chemigated. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objective of this trial was to compare preemergence and postemergence dimethenamid-p and sulfentrazone either ground-applied, sprinkler incorporated or chemigated for weed control and crop safety in a field trial located at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 150 lb N, 140 lb P_2O_5, 73 lb K_2O, 7 lb SO_4, 1 lb Zn/A, and other micronutrients, based on soil tests, before planting 'Russet Burbank' potatoes on April 29, 2004. Potatoes were planted 6 inches deep with 12-inch intervals in rows spaced 36 inches apart in a Declo loam soil with 1.1% organic matter and pH 8.2. The experimental design was a randomized complete block with three replications and 18 by 40 ft plots.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on April 29, 2004, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 25, 2004 and postemergence (POST) treatments June 8, 2004, with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. Ground-applied PRE treatments were sprinkler incorporated with 0.5 in irrigation water immediately after application. Chemigated PRE treatments were applied in 0.25 in irrigation water followed by an additional 0.25 in irrigation water. The untreated checks received 0.5 in irrigation water at the same time as the ground-applied treatments. No potato or weed plants were exposed at time of the PRE application.

Ground-applied POST treatments received 0.5 inches irrigation water 24 h after application. Chemigated POST treatments were applied in 0.25 inches irrigation water followed by an additional 0.25 inches irrigation water. The untreated checks received 0.5 inches irrigation water at the same time as the ground-applied treatments. Potato plant height was 6 inches at the POST application date. Prior to potato row closure, weed species present in the untreated checks were redroot pigweed (AMARE) at 20 and common lambsquarters (CHEAL) at $45/m^2$.

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. Potato vines were desiccated with 0.375 lb/A diquat Sept 7, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Oct 4, 2004, and graded according to USDA standards.

Redroot pigweed control at row closure (7/7/2004) and prior to potato harvest (9/17/2004) was greater than 95% regardless of herbicide, application method, or timing (Table 1). At row-closure, CHEAL control by PRE-applied dimethenamid-p or sulfentrazone was not different regardless of application method and ranged from 87 to 99%. However, PRE-applied dimethenamid-p did not control CHEAL as well as PRE-applied sulfentrazone, regardless of application method, and control was 57 to 60% compared with 96 to 99%, respectively. By the end of the growing season, CHEAL control with PRE ground-applied and sprinkler incorporated dimethenamid-p was reduced to 63% compared to 82, 100, or 98% control with PRE chemigated dimethenamid-p, PRE ground-applied sulfentrazone, or PRE chemigated sulfentrazone, respectively. Season-long CHEAL control with POST treatments was usually less than with PRE treatments. Similar to PRE treatments, POST-applied sulfentrazone provided greater CHEAL control than POST-applied dimethenamid-p.

At approximately 3 wk after the PRE and 1 wk after the POST applications, potato crop injury from all PRE treatments and POST-chemigated dimethenamid-p was 5% or less (Table 2). POST dimethenamid-p or sulfentrazone applied by ground and POST-chemigated sulfentrazone caused 25, 60, or 40% injury 1 wk after treatment (WAT). Injury consisted mainly of stunting and leaf malformation for both POST-applied herbicides and in addition, POST-applied sulfentrazone initially caused interveinal blackening on the leaves. At 4 WAT, on or near potato row closure, POST-ground-applied sulfentrazone was still causing 50% potato crop injury while POST-chemigated sulfentrazone injury was now 15%. POST-applied dimethenamid-p was causing 5% injury at that time regardless of application method. Tuber yields were not reduced as a result of any herbicide treatment compared to the untreated, weed-free control even though some of those treatments resulted in relatively severe crop injury earlier in the season.

Table 1. Season-long weed control and crop safety with dimethenamid-p and sulfentrazone ground-applied and sprinkler incorporated compared with chemigated preemergence and postemergence at Aberdeen, ID in 2004.

			Control[1]			
		Application	AMARE		CHEAL	
Herbicide	Rate	method[2]	7/7	9/15	7/7	9/15
	lb ai/A		----------------------	---------------------%	----------------------	----------------------
Dimethenamid-p	0.64	Ground PRE	99 a	100 a	87 a	63 c
Sulfentrazone	0.094	Ground PRE	99 a	100 a	99 a	100 a
Dimethenamid-p	0.64	Chemigation PRE	99 a	100 a	95 a	82 b
Sulfentrazone	0.094	Chemigation PRE	99 a	100 a	99 a	98 a
Dimethenamid-p	0.64	Ground POST	99 a	100 a	60 b	43 d
Sulfentrazone	0.094	Ground POST	99 a	100 a	99 a	88 ab
Dimethenamid-p	0.64	Chemigation POST	98 a	98 a	57 b	33 d
Sulfentrazone	0.094	Chemigation POST	96 a	98 a	96 a	85 b

[1] AMARE, redroot pigweed; CHEAL, common lambsquarters. Values in the same column followed by the same letter are not significantly different (P = 0.05) according to a Fisher's Protected LSD test performed on arcsine transformed data (non-transformed values shown in the table).

[2] PRE, preemergence; POST, postemergence

Table 2. Potato crop response to dimethenamid-p or sulfentrazone ground-applied and sprinkler incorporated compared with chemigated preemergence or postemergence at Aberdeen, ID in 2004.

			Potato crop response			
			Overall injury		Tuber yield[1]	
Treatment	Rate	Application method[2]	6/17	7/6	U.S. No. 1	Total
	lb ai/A		-------- %	-------	-------- cwt/A	--------
Weedy control			0	0	155	239
Weed-free control			0	0	164	252
Dimethenamid-p	0.64	Ground PRE	2	7	148	243
Sulfentrazone	0.094	Ground PRE	3	7	190	317
Dimethenamid-p	0.64	Chemigation PRE	3	2	195	302
Sulfentrazone	0.094	Chemigation PRE	5	7	182	294
Dimethenamid-p	0.64	Ground POST	25	5	202	296
Sulfentrazone	0.094	Ground POST	60	50	177	275
Dimethenamid-p	0.64	Chemigation POST	2	5	278	355
Sulfentrazone	0.094	Chemigation POST	40	15	209	353
LSD (0.05)	-	-	8	13	169	175

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

[2] PRE, preemergence; POST, postemergence

Comparisons of two dimethenamid-p rates alone or in tank mixtures and sulfentrazone or s-metolachlor tank mixtures for weed control in potatoes. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objectives of this study was to compare weed control with dimethenamid-p at two rates alone or in tank mixtures as well as sulfentrazone or s-metolachlor in tank mixtures in a field trial conducted at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 135 lb N/A, 13 lb P_2O_5/A, and micronutrients, based on soil tests, before planting 'Russet Burbank' potatoes on April 27, 2004. Potatoes were planted 6 inches deep at 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.1% organic matter and pH 7.9. The experimental design was a randomized complete block with three replications and 9 by 25 ft plots.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 21, 2004, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied on May 20, 2004, with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. PRE treatments were incorporated by 0.7 inches sprinkler irrigation immediately after application. No potato or weed plants were exposed at time of the PRE application. Weed densities in the untreated control plots prior to potato row closure were 45 redroot pigweed (AMARE), 20 common lambsquarters (CHEAL), 9 hairy nightshade (SOLSA), and 20 tame oat (AVESA)/m^2.

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. Potato vines were desiccated with 0.375 lb/A diquat Sept 3, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Oct 1, 2004, and graded according to USDA standards.

Season long AMARE control with all herbicide treatments was similar and ranged from 92 to 100% (Table 1). Common lambsquarters control with dimethenamid-p applied alone at 0.64 or 0.84 lb ai/A was similar at 88 or 93%, respectively. CHEAL control with the pendimethalin plus the high rate of dimethenamid-p was greater than pendimethalin combined with the low rate (100 vs 93%), otherwise control by two-way tank mixtures with either rate was similar. Sulfentrazone alone controlled CHEAL better than dimethenamid-p alone at 0.64 or 0.84 lb/A. However, the only sulfentrazone two-way tank mixture with better CHEAL control than a dimethenamid-p two-way mixture with the same tank-mix partner was sulfentrazone + pendimethalin compared with dimethenamid-p at 0.64 lb/A + pendimethalin.

Either dimethenamid-p alone treatment controlled SOLSA similarly at 93 or 98% (Table 1). As with CHEAL, sulfentrazone alone controlled SOLSA better than either dimethenamid-p rate applied alone. However, two-way tank mixtures with either dimethenamid-p rate or with sulfentrazone provided similar SOLSA control and control ranged from 95 to 100%. Tame oat control with either dimethenamid-p alone treatment or with sulfentrazone alone was less than 80% (Table 1). Metribuzin combined with dimethenamid-p at 0.64 or 0.84, or with sulfentrazone provided the best tame oat control by any two-way tank mixture at 100%.

Three-way tank mixture including either dimethenamid-p or s-metolachlor generally provided similar AMARE and CHEAL control (Table 1). Hairy nightshade control, however, was better when dimethenamid-p was included in the three-way mix compared with s-metolachlor combined with the same tank-mix partners. Similarly, dimethenamid-p plus EPTC and metribuzin or pendimethalin controlled tame oat better than s-metolachlor in either of those 3-way mixtures.

U.S. No. 1 and total tuber yields of comparative tank mixtures were generally increased when weed control was improved (Table 2). The highest yielding 3-way tank mixtures were dimethenamid-p + metribuzin + EPTC or pendimethalin and yields with those treatments were greater than yields with s-metolachlor combined with the same tank-mix partners as well as almost every two-way or alone treatment.

Table 1. Season-long weed control with variable rates of dimethenamid-p applied preemergence alone and in tank mixtures compared with sulfentrazone or s-metolachlor tank mixtures at Aberdeen, ID in 2004.

		Control[1]			
		AMARE	CHEAL	SOLSA	AVESA
Treatment	Rate	9/2	9/2	9/2	9/2
	lb ai/A	----------------------------%----------------------------			
Dimethenamid-p	0.64	100	88	93	72
+ EPTC	3.9	100	95	97	90
+ metribuzin	0.5	97	98	97	100
+ pendimethalin	1.0	100	93	95	88
+ flumioxazin	0.047	97	90	95	77
Dimethenamid-p	0.84	98	93	98	80
+ EPTC	3.9	100	100	100	93
+ metribuzin	0.5	100	100	100	100
+ pendimethalin	1.0	100	100	100	92
+ flumioxazin	0.047	100	97	100	92
Sulfentrazone	0.094	95	100	100	53
+ EPTC	3.9	93	98	100	88
+ metribuzin	0.5	100	100	100	100
+ pendimethalin	1.0	100	100	100	70
+ s-metolachlor	1.34	100	100	100	72
Dimethenamid-p	0.64				
+ metribuzin + EPTC	0.5 + 3.9	100	100	100	100
+ pendimethalin + EPTC	1.0 + 3.9	100	98	98	100
+ pendimethalin + metribuzin	1.0 + 0.5	100	98	98	100
s-metolachlor	1.34				
+ metribuzin + EPTC	0.5 + 3.9	92	95	90	88
+ pendimethalin + EPTC	1.0 + 3.9	90	93	87	85
+ pendimethalin + metribuzin	1.0 + 0.5	95	100	83	100
Dimethenamid-p	0.84				
+ pendimethalin + EPTC	1.0 +3.9	100	100	100	93
LSD (0.05)	-	9	7	7	4

[1] AMARE redroot pigweed; CHEAL common lambsquarters; SOLSA hairy nightshade; AVESA, tame oat.

Table 2. Potato crop response to variable rates of dimethenamid-p applied postemergence alone and in tank mixtures compared with sulfentrazone or s-metolachlor tank mixtures at Aberdeen, ID in 2004.

		Potato crop response		
		Overall injury[1]	Tuber yield[2]	
Treatment	Rate	7/3	U.S. No. 1	Total
	lb ai/A	------%------	---- cwt/A ----	
Weedy check	-	0	119	252
Weed-free control	-	0	131	317
Dimethenamid-p	0.64	0	161	306
+ EPTC	3.9	0	152	307
+ metribuzin	0.5	0	172	324
+ pendimethalin	1.0	0	177	333
+ flumioxazin	0.047	0	173	302
Dimethenamid-p	0.84	0	158	328
+ EPTC	3.9	0	170	319
+ metribuzin	0.5	0	194	345
+ pendimethalin	1.0	0	215	351
+ flumioxazin	0.047	0	177	312
Sulfentrazone	0.094	0	173	314
+ EPTC	3.9	0	175	306
+ metribuzin	0.5	0	181	329
+ pendimethalin	1.0	0	180	333
+ s-metolachlor	1.34	0	155	310
Dimethenamid-p	0.64			
+ metribuzin + EPTC	0.5 + 3.9	0	229	393
+ pendimethalin + EPTC	1.0 + 3.9	0	194	342
+ pendimethalin + metribuzin	1.0 + 0.5	0	227	395
s-metolachlor	1.34			
+ metribuzin + EPTC	0.5 + 3.9	0	176	339
+ pendimethalin + metribuzin	1.0 + 3.9	0	203	359
+ pendimethalin + EPTC	1.0 + 0.5	0	168	318
Dimethenamid-p	0.84			
pendimethalin + EPTC	1.0 +3.9	0	221	350
LSD (0.05)	-	ns	50	58

[1] Overall crop injury mainly consisted of stunting with some leaf malformation.

[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.

Adjuvant combinations and a comparison of two spray tips for late-season, rescue treatment weed control in potatoes. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objective of this trial was to compare rimsulfuron + metribuzin + methylated seed oil (MSO) with or without an encapsulating adjuvant (Interlock – Agriliance LLC) applied with an extended range (XR) or an air induction (AI) spray tip for potato crop safety and late-season, rescue weed control in a field trial located at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 135 lb N, 25 lb P_2O_5, 1 lb Zn, 0.08 lb Cu, and 0.3 lb Mn/A based on soil tests, before planting 'Russet Burbank' potatoes on April 27, 2004. Potatoes were planted 6 inches deep with 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.1% organic matter and pH 7.4. The experimental design was a randomized complete block with three replications and 9 by 30 plots.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 17, 2004, just prior to potato emergence. Postemergence (POST) treatments were applied on July 2, 2004 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. Potato plants were 22 inches and redroot pigweed (AMARE), common lambsquarters (CHEAL), hairy nightshade (SOLSA), kochia (KCHSC), and tame oat (AVESA) were present at 70, 45, 180, 9, and $90/m^2$ respectively, at application time. SOLSA height was 9 inches and the other weeds were 16 to 20 inches tall.

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. Potato vines were desiccated with 0.375 lb/A diquat August 31, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Sept 23, 2004 and graded according to USDA standards.

Control of all weeds present except SOLSA was improved when rimsulfuron at 0.023 + metribuzin at 0.5 lb ai/A + MSO was applied with XR compared with AI spray tips (Table 1). SOLSA control with this MSO-only mixture applied with the AI tips was 82% compared with 63% when applied with the XR tips. The AI spray tips produce larger spray droplets than XR tips. Since SOLSA was not as tall as the other weeds at application time, perhaps the herbicides in larger droplets from AI tips reached the SOLSA in the lower portion of the canopy while herbicides in smaller droplets from XR spray tips was intercepted by the taller weeds, staying on the foliage in the upper canopy. Similarly, control of those taller weeds with the MSO-only mixture applied with AI tips was not as good as with XR tips because the larger droplets from AI tips may not have remained on foliage in the upper canopy.

When an encapsulating adjuvant, Interlock, was added to the rimsulfuron + metribuzin + MSO mixture, AMARE, CHEAL, and KCHSC control with AI spray tips was improved compared with the AI-applied mixture without Interlock (Table 1). CHEAL, KCHSC, and SOLSA control with the Interlock mixture applied with AI spray tips was similar to control with the same mixture applied with XR tips although SOLSA control with the AI tip treatment was numerically greater than control with the XR tips. AMARE control with the Interlock mixture applied with AI tips was now greater than the same mixture applied with XR tips, while the opposite was true for AVESA control. Other than AMARE control by the mixture without Interlock sprayed with XR tips or the Interlock mixtures sprayed with either tip, and SOLSA control by either mixture sprayed with AI tips, weed control by these treatments applied at this late POST timing was less than 80% and unacceptable.

Although rimsulfuron + metribuzin was applied with MSO or MSO + Interlock, crop injury was minimal approximately 1 WAT (Table 2). Injury was not evident by 2 WAT (data not shown). U.S. No. 1 tuber yields with the MSO-only mixture sprayed with AI tips was not different than U.S. No. 1 tuber yields in the weedy check plots. Tuber yields with all treatments were similar to yields in the weed-free check.

Table 1. Season-long weed control with herbicides applied late postemergence at Aberdeen, ID in 2004.

				Control[1]				
			Spray	AMARE	CHEAL	KCHSC	SOLSA	AVESA
Treatment	Rate	Adjuvant[2]	Tip[3]	9/8	9/8	9/8	9/8	9/8
	lb ai/A			-----------------------------	-----------------------------	%-	-----------------------------	-----------------------------
Rimsulfuron + metribuzin	0.023 + 0.5	MSO	XR	87	73	77	63	63
Rimsulfuron + metribuzin	0.023 + 0.5	MSO	AI	72	65	67	82	60
Rimsulfuron + metribuzin	0.023 + 0.5	MSO + Interlock	XR	80	70	73	73	67
Rimsulfuron + metribuzin	0.023 + 0.5	MSO + Interlock	AI	87	70	73	80	58
LSD (0.05)	-	-	-	7	5	8	11	4

[1] AMARE redroot pigweed; CHEAL common lambsquarters; KCHSC kochia; SOLSA hairy nightshade; AVESA, tame oat.

[2] MSO, methylated seed oil (Destiny by Agriliance LLC) at 1% (v/v); Interlock, encapsulating adjuvant, (Agriliance LLC) at 1% (v/v).

[3] XR spray tips, extended range (flat fan spray tips – XR8003VS); AI spray tips, air induction (AI11003VS).

Table 2. Potato crop response to herbicides applied late postemergence at Aberdeen, ID in 2004.

				Potato crop response		
			Spray	Overall injury	Tuber yield[1]	
Treatment	Rate	Adjuvant[2]	Tip[3]	7/8	U.S. No. 1	Total
	lb ai/A			---%---	--------cwt/A --------	
Weedy check	-			-	141	230
Weed-free check	-			-	245	360
Rimsulfuron + metribuzin	0.023 + 0.5	MSO	XR	5	230	330
Rimsulfuron + metribuzin	0.023 + 0.5	MSO	AI	3	198	300
Rimsulfuron + metribuzin	0.023 + 0.5	MSO + Interlock	XR	0	217	319
Rimsulfuron + metribuzin	0.023 + 0.5	MSO + Interlock	AI	3	234	335
LSD (0.05)	-			8	71	68

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

[2] MSO, methylated seed oil (Destiny by Agriliance LLC) at 1% (v/v); Interlock, encapsulating adjuvant, (Agriliance LLC) at 1% (v/v).

[3] XR spray tips, extended range (flat fan spray tips – XR8003VS); AI spray tips, air induction (AI11003VS).

Various preemergence, postemergence, postemergence-chemigated, or combination treatments for weed control in potatoes. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objectives of this trial were to determine the efficacy of s-metolachlor compared with metolachlor in preemergence (PRE) or early postemergence (EPOST) tank mixtures, a PRE application followed by (fb) a "rescue" postemergence application, two rates of metribuzin in 3-way mixtures applied PRE, or rimsulfuron with various adjuvants or EPTC applied late postemergence (LPOST)-chemigated in a field trial located at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 135 lb N, 25 lb P_2O_5, 1 lb Zn, 0.08 lb Cu, and 0.3 lb Mn/A based on soil tests, before planting 'Russet Burbank' potatoes on April 27, 2004. Potatoes were planted 6 inches deep with 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.1% organic matter and pH 7.4. The experimental design was a randomized complete block with three replications and 9 by 30 plots.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 17, 2004, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied May 17, 2004 with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. PRE treatments were incorporated by 0.7-inch sprinkler irrigation immediately after application. No potato or weed plants were exposed at time of the PRE application. Postemergence (POST) treatments were applied with the same sprayer June 9, and June 23, 2004. Potato plant heights were 5 and 18 inches on the respective postemergence dates. See Table 1 for weed densities and heights at each POST application.

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. Potato vines were desiccated with 0.375 lb/A diquat August 31, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Sept 23, 2004 and graded according to USDA standards.

Metribuzin + s-metolachlor PRE fb a rescue-type LPOST application of metribuzin + EPTC provided 100% season-long control of AMARE, CHEAL, KCHSC, and AVESA and only 83% SOLSA control (Table 2). Metribuzin + pendimethalin + EPTC EPOST fb metribuzin + rimsulfuron + methylated seed oil (MSO) LPOST-chemigated provided 100% season-long control of all weeds present. The 3-way tank mixture of either 0.5 or 0.625 lb ai/A metribuzin + flumioxazin + flufenacet provided similar control of all weeds and control was 90% or greater. S-metolachlor at 1.34 lb ai/A + metribuzin at 0.5 lb/A PRE controlled all weeds similar to metolachlor at 1.4 lb ai/A + metribuzin t 0.5 lb/A PRE, however, only KCHSC and AVESA were controlled greater than 90%. Weed control generally was improved when either tank mixture was applied EPOST compared with PRE. In contrast to similar weed control by the PRE-applied mixtures, the s-metolachlor mixture applied EPOST controlled CHEAL and SOLSA better than the metolachlor mixture applied EPOST at 98 and 96% compared with 87 and 88%, respectively.

Although AMARE, KCHSC, SOLSA, and AVESA control by rimsulfuron + metribuzin + MSO + ammonium sulfate (AMS) applied LPOST was similar to control by rimsulfuron + MSO LPOST at 90% or greater, the addition of metribuzin and AMS improved CHEAL control to 97% compared with rimsulfuron + MSO-only at 88% (Table 2). When AMS was added to the rimsulfuron at 0.023 lb ai + EPTC at 1.7 lb ai/A + MSO mixture applied LPOST-chemigated, SOLSA control was improved compared with the same LPOST-chemigated mixture without the AMS (87 vs 77%). Neither LPOST-chemigated treatment controlled CHEAL or KCHSC as well as rimsulfuron + metribuzin + MSO + AMS LPOST (not chemigated). The LPOST-chemigated mixture without AMS did not control AMARE or SOLSA as well as the non-chemigated LPOST mixture. AVESA control by both LPOST non-chemigated and LPOST-chemigated treatments was similar and at least 90%.

Although not significant, rimsulfuron + metribuzin + MSO LPOST-chemigated (applied after the 3-way EPOST mixture) and rimsulfuron + EPTC + MSO + AMS LPOST-chemigated caused slight injury at 7% 2 wk after treatment (WAT), while rimsulfuron + EPTC + MSO LPOST-chemigated did not cause any injury (Table 3). In contrast, rimsulfuron + metribuzin + MSO + AMS LPOST caused significant injury at 10% 2 WAT. Injury was not evident 4 WAT (data not shown). All treatments except metolachlor + metribuzin EPOST, resulted in greater U.S. No. 1 tuber yields than the weedy check (Table 3). All treatments had total tuber yields greater than the weedy check and similar U.S. No. 1 and total tuber yields as the weed-free check.

Table 1. Weed density and heights at time of postemergence spray applications at Aberdeen, ID in 2004.

Weed[2]	Application dates and timing codes[1]					
	06/09/04 EPOST		06/23/04 LPOST		07/02/04 VLPOST	
	#/sq ft	Ht (in)	#/sq ft	Ht (in)	#/sq ft	Ht (in)
AMARE	3	1	3	3	8	16
CHEAL	2	2	2	3	5	20
KCHSC	1	1	1	2	1	20
SOLSA	10	1	11	3	20	9
AVESA	3	4	3	5	10	20

[1] EPOST, early postemergence; LPOST, late postemergence; VLPOST, rescue treatment – very late postemergence

[2] AMARE, redroot pigweed; CHEAL, common lambsquarters; KCHSC, kochia; SOLSA, hairy nightshade; AVESA, tame oat

Table 2. Season long weed control with herbicides applied preemergence and postemergence at Aberdeen, ID in 2004.

Treatment[2]	Rate	Application Timing[3]	Control[1] AMARE 9/8	CHEAL 9/8	KCHSC 9/8	SOLSA 9/8	AVESA 9/8
	lb ai/A		%				
Metribuzin + s-metolachlor / metribuzin + EPTC	0.5 + 1.34 / 0.5 + 3.9	PRE / VLPOST	100	100	100	83	100
Metribuzin + pendimethalin + EPTC/ metribuzin + rimsulfuron + MSO	0.5 + 0.75 + 3.9 / 0.5 + 0.016 + 1% v/v	EPOST / LPOST - Chemigated	100	100	100	100	100
Metribuzin + flumioxazin + flufenacet	0.5 + 0.047 + 0.6	PRE	95	97	92	92	92
Metribuzin + flumioxazin + flufenacet	0.625 + 0.047 + 0.6	PRE	98	98	97	90	96
s-metolachlor + metribuzin	1.34 + 0.5	PRE	88	85	95	57	96
Metolachlor + metribuzin	1.4 + 0.5	PRE	88	87	97	53	98
s-metolachlor + rimsulfuron	1.34 + 0.023	EPOST	98	98	98	96	98
Metolachlor + rimsulfuron	1.4 + 0.023	EPOST	98	87	97	88	99
Rimsulfuron + MSO	0.023 + 1%v/v	LPOST	98	88	98	90	95
Rimsulfuron + metribuzin + MSO + AMS Plus	0.023 + 0.5 + 1%v/v + %v/v	LPOST	95	97	95	92	92
Rimsulfuron + EPTC + MSO	0.023 + 1.7 + 1% v/v	LPOST – Chemigated	87	60	78	77	96
Rimsulfuron + EPTC + MSO + AMS Plus	0.023 + 1.7 + 1%v/v + %v/v	LPOST - Chemigated	93	60	83	87	98
LSD (0.05)		-	7	5	8	10	4

[1] AMARE redroot pigweed; CHEAL common lambsquarters; KCHSC kochia; SOLSA hairy nightshade; AVESA, tame oat.

[2] MSO, methylated seed oil (Destiny by Agriliance LLC); AMS Plus, 2.6 lb ammonium sulfate/gal + nonionic surfactant (1% v/v = 0.5 lb AMS/A).

[3] PRE, preemergence; EPOST, early postemergence; LPOST, late postemergence; VLPOST, rescue treatment - very late postemergence.

Table 3. Potato crop response to herbicides applied preemergence and postemergence at Aberdeen, ID in 2004.

			Potato crop response[1]			
		Application	Overall injury		Tuber yield	
Treatment[2]	Rate	Timing[3]	6/12	7/8	U.S. No. 1	Total
	lb ai/A		---------%---------		------ cwt/A ------	
Weedy check	-	-	-	-	141	230
Weed-free check	-	-	-	-	245	360
Metribuzin + s-metolachlor / metribuzin + EPTC	0.5 + 1.34 0.5 + 3.9	PRE VLPOST	0	5	288	388
Metribuzin + pendimethalin +EPTC metribuzin + rimsulfuron + MSO	0.5 + 0.75 + 3.9 0.5 +0.016 + 1%v/v	EPOST LPOST - Chemigated	-	7	289	379
Metribuzin + flumioxazin + flufenacet	0.5 + 0.047 + 0.6	PRE	0	5	286	395
Metribuzin + flumioxazin + flufenacet	0.625 + 0.047 + 0.6	PRE	3	3	284	395
s-metolachlor + metribuzin	1.34 + 0.5	PRE	0	0	290	403
Metolachlor + metribuzin	1.4 + 0.5	PRE	0	0	295	389
s-metolachlor + rimsulfuron	1.34 + 0.023	EPOST	-	8	309	430
Metolachlor + rimsulfuron	1.4 + 0.023	EPOST	-	3	189	429
Rimsulfuron + MSO	0.023 + %v/v	LPOST	-	0	298	396
Rimsulfuron + metribuzin + MSO + AMS Plus	0.023 + 0.5 + 1%v/v + 1%v/v	LPOST	-	10	252	354
Rimsulfuron + EPTC + MSO	0.023 + 1.7 + 1%v/v	LPOST – Chemigated	-	0	266	361
Rimsulfuron + EPTC + MSO + AMS Plus	0.023 + 1.7 + 1%v/v + 1%v/v	LPOST - Chemigated	-	7	244	353
LSD (0.05)	-	-	4	8	66	58

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

[2] MSO, Destiny by Agriliance LLC, methylated seed oil; AMS Plus, 2.6 lb ammonium sulfate/gal + nonionic surfactant (1% v/v = 0.5 lb AMS/A).

[3] PRE, preemergence; EPOST, early postemergence; LPOST, late postemergence; VLPOST, rescue treatment - very late postemergence with two different spray tips.

Weed control and crop safety in potatoes with metribuzin from various manufacturers alone and in tank mixtures. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objectives of this study were to compare metribuzin from various manufacturers applied alone and in tank mixtures for weed control and crop safety in potatoes in a field trial located at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 151 lb N, 140 lb P_2O_5, 20 lb K_2O, 61 lb SO_4, 1 lb Zn/A, and other micronutrients, based on soil tests, before planting 'Russet Burbank' potatoes on April 29, 2004. Potatoes were planted 6 inches deep with 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.1% organic matter and pH 7.4. The experimental design was a randomized complete block with three replications and 9 by 30 ft plots.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 14, 2004, just prior to potato emergence. Preemergence (PRE) herbicide treatments were applied on June 9, 2004. PRE treatments were incorporated by 0.7 inches sprinkler irrigation immediately after application. No potato or weed plants were exposed at time of the PRE application. Prior to potato row closure, weed densities in the untreated checks were 9 redroot pigweed (AMARE) and 90 common lambsquarters (CHEAL)/m^2.

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. Potato vines were desiccated with 0.375 lb/A diquat Sept 7, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Oct 4, 2004, and graded according to USDA standards.

Season-long redroot pigweed control with Bayer CropScience (BC) metribuzin applied PRE at 0.25, 0.5, or 1.0 lb ai/A was 90, 98, or 100%, respectively, and not different when compared with the same rate of Makhteshim-Agan of North America (MANA) metribuzin which controlled AMARE at 85, 96, or 100%, respectively (Table 1). Ag Value (AV) metribuzin applied PRE at 0.5 lb/A provided similar AMARE control at 98%, as the other metribuzin treatments applied PRE at the same rate. Common lambsquarters control by any metribuzin applied PRE also was the similar when comparing the same rate. As rate increased from 0.25 to 0.5 lb/A, AMARE or CHEAL control usually increased significantly. POST-applied BC metribuzin at 0.25 or 0.5 lb/A controlled AMARE and CHEAL similar to MANA metribuzin at the same rate.

Two-way tank mixtures of PRE-applied BC metribuzin at 0.5 lb/A + rimsulfuron, EPTC, pendimethalin, or s-metolachlor also controlled AMARE and CHEAL similar to the same MANA metribuzin combinations, or to any metribuzin at 0.5 lb/A applied PRE alone and control ranged from 92 to 100% (Table 1). AV metribuzin at 0.5 lb/A + rimsulfuron applied PRE controlled AMARE and CHEAL similarly to the other metribuzin + rimsulfuron treatments. BC metribuzin at 0.625 lb/A in 2-way mixtures with flumioxazin or dimethenamid-p did not improve AMARE or CHEAL control compared with the same tank-mix partners combined with BC metribuzin at 0.5 lb/A.

Other than the sulfentrazone tank mixtures, no treatment caused significant injury at the first rating date and MANA metribuzin + s-metolachlor caused 10% visual injury at the second rating date (Table 2). The metribuzin + s-metolachlor injury consisted mainly of leaf crinkling and slight stunting. Sulfentrazone was mistakenly applied at 0.94 lb ai/A which is ten times the lowest labeled rate. The two PRE-applied BC metribuzin tank mixtures including sulfentrazone at this high rate caused significant crop damage visible at both rating dates. This injury consisted of severe stunting, leaf malformation, and some leaf necrosis. The minor injury caused by some of the other treatments only was visible until shortly after row closure while injury from the two sulfentrazone tank-mix treatments was visible most of the growing season.

As would be expected, since weed control was usually similar regardless of the metribuzin used, U.S. No. 1 and total tuber yields of all herbicide treatments also were similar (Table 2). All treatments yielded greater than the weedy check and similar to the weed-free control. Surprisingly, although sulfentrazone had been mistakenly applied at 0.94 lb/A rather than 0.094 lb ai/A in two tank mixtures with BC metribuzin, and significant injury was observed during the growing season, tuber yields in these treatments were not reduced compared with tuber yields of other treatments or the weed-free control.

Table 1. Season-long weed control comparisons with metribuzin made by various manufacturers applied PRE or POST alone and in PRE tank mixes at Aberdeen, ID in 2004.

			Control[1]	
Treatment	Rate	Application Timing[2]	AMARE 9/15	CHEAL 9/15
	lb ai/A		------------------- % -------------------	
Metribuzin[3]	0.25	PRE	90	95
Metribuzin	0.5	PRE	98	100
Metribuzin	1.0	PRE	100	100
Metribuzin	0.25	POST	90	100
Metribuzin	0.5	POST	98	98
MANA-metribuzin[4]	0.25	PRE	85	90
MANA-metribuzin	0.5	PRE	96	100
MANA-metribuzin	1.0	PRE	100	100
MANA-metribuzin	0.25	POST	90	100
MANA-metribuzin	0.5	POST	95	98
AV-metribuzin[5]	0.5	PRE	98	98
Metribuzin[3]	0.5			
+ dimethenamid-p	0.64	PRE	93	98
+ EPTC	3.9	PRE	93	98
+ flumioxazin	0.047	PRE	98	100
+ pendimethalin	1.0	PRE	98	97
+ rimsulfuron	0.023	PRE	92	98
+ s-metolachlor	2.38	PRE	98	100
+ sulfentrazone*	0.94	PRE	100	100
Metribuzin[3]	0.5			
+ dimethenamid-p	0.64	PRE	93	100
+ flumioxazin	0.047	PRE	98	100
+ sulfentrazone*	0.94	PRE	100	100
MANA-metribuzin[4]	0.5			
+ EPTC	3.9	PRE	90	98
+ pendimethalin	1.0	PRE	97	97
+ rimsulfuron	0.023	PRE	93	100
+ s-metolachlor	2.38	PRE	100	100
AV-metribuzin[5]	0.5			
+ rimsulfuron	0.023	PRE	92	100
LSD (0.05)	-	-	7	8

[1] AMARE, redroot pigweed; CHEAL, common lambsquarters.

[2] PRE, preemergence; POST, postemergence.

[3] metribuzin, Sencor 75 DF, Bayer Crop Sciences.

[4] MANA-metribuzin, 75 DF, Makhteshim-Agan of North America.

[5] AV-metribuzin, 75 DF, Ag Value, Inc.

* applied at 0.94 rather than the targeted rate of 0.094 lb ai/A.

Table 2. Potato crop response to metribuzin made by various manufacturers applied PRE or POST alone and in PRE tank mixes at Aberdeen, ID in 2004.

			Potato crop response			
			Overall injury		Tuber yield[1]	
Treatment	Rate	Application timing[2]	6/17	7/6	U.S. No. 1	Total
	lb ai/A		-------% -------		-------- cwt/A --------	
Weedy Check	-	-	-	-	68	125
Weed-free control	-	-	-	-	197	331
Metribuzin[3]	0.25	PRE	0	0	240	360
Metribuzin	0.5	PRE	0	0	216	328
Metribuzin	1.0	PRE	0	7	209	303
Metribuzin	0.25	POST	0	2	180	314
Metribuzin	0.5	POST	0	0	222	302
MANA-metribuzin[4]	0.25	PRE	0	0	182	291
MANA-metribuzin	0.5	PRE	0	2	205	319
MANA-metribuzin	1.0	PRE	0	7	191	293
MANA-metribuzin	0.25	POST	0	0	230	328
MANA-metribuzin	0.5	POST	0	0	193	313
AV-metribuzin[5]	0.5	PRE	0	0	220	347
Metribuzin[3]	0.5					
+ dimethenamid-p	0.64	PRE	0	0	198	289
+ EPTC	3.9	PRE	0	0	242	355
+ flumioxazin	0.047	PRE	3	0	252	340
+ pendimethalin	1.0	PRE	0	0	200	314
+ rimsulfuron	0.023	PRE	0	0	216	319
+ s-metolachlor	2.38	PRE	0	3	227	360
+ sulfentrazone*	0.94	PRE	28	47	230	316
Metribuzin[3]	0.625					
+ dimethenamid-p	0.64	PRE	0	0	230	348
+ flumioxazin	0.047	PRE	7	3	231	309
+ sulfentrazone*	0.94	PRE	27	53	222	321
MANA-metribuzin[4]	0.5					
+ EPTC	3.9	PRE	0	0	195	319
+ pendimethalin	1.0	PRE	0	0	227	328
+ rimsulfuron	0.023	PRE	0	0	228	328
+ s-metolachlor	2.38	PRE	0	10	177	287
AV-metribuzin[5]	0.5					
+ rimsulfuron	0.023	PRE	0	0	223	306
LSD (0.05)	-	-	7	9	46	50

[a] U.S. No tubers are >4oz with no defects; total tuber weight includes U.S. No. 1, U.S. No. 2 (>4 oz with 1 or 2 slight defects), process culls (<4oz), and malformed culls.

[b] PRE, preemergence; POST, postemergence.

[c] metribuzin, Sencor 75 DF, Bayer Crop Sciences.

[d] MANA-metribuzin, 75 DF, Makhteshim-Agan of North America.

[e] AV-metribuzin, 75 DF, Ag Value, Inc.

* applied at 0.94 rather than the targeted rate of 0.094 lb ai/A.

Weed control and potato crop safety with sulfentrazone applied preemergence to wet or dry soil and sprinkler incorporated with various amounts of irrigation water. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objective of this trial was to determine the appropriate sprinkler incorporation amount for sulfentrazone applied preemergence in wet versus dry soil conditions in a field trial located at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 151 lb N, 140 lb P_2O_5, 20 lb K_2O, 61 lb SO_4, 1 lb Zn/A, and other micronutrients, based on soil tests, before planting 'Russet Burbank' potatoes on April 29, 2004. Potatoes were planted 6 inches deep with 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.1% organic matter (O.M.) and pH 8.2. The experimental design was a split block design with three replications and 18 by 40 ft plots. Preemergence (PRE) applied sulfentrazone was the main plot and sub plots were high or low pre-application soil moisture. Treatments consisted of 0.25, 0.5, 1.0, or 2.0 inches sprinkler incorporation amount after sulfentrazone application. An untreated, weedy check was included in each soil moisture sub plot.

Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 14, 2004, just prior to potato emergence. High moisture sub plots were created by applying 0.67 inches irrigation on May 15, 2004, 4 days before sulfentrazone application. Low moisture sub plots did not receive any pre-application moisture other than rainfall. Sulfentrazone was applied at 0.094 lb ai/A preemergence (PRE) on May 19, 2004. PRE treatments were incorporated with the various sprinkler irrigation treatments immediately after application. The weedy check plots with each pre-application moisture received 1 inch irrigation at the time the sulfentrazone treatments were being sprinkler incorporated. No potato or weed plants were exposed at time of the PRE application. Prior to row closure, the main weed present was common lambsquarters (CHEAL) at $45/m^2$.

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. Potato vines were desiccated with 0.375 lb/A diquat Sept 7, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Oct 4, 2004, and graded according to USDA standards.

Common lambsquarters control prior to row closure, approximately 1 month after application was 99% regardless of pre-application soil moisture or sprinkler incorporation amount (Table). However, at the end of the growing season in plots that had high pre-application soil moisture and received 1 or 2 inch sprinkler incorporation, control was reduced to 88 or 68% respectively, compared to 100% control in plots receiving 0.25 or 0.5 inch sprinkler incorporation. When no pre-application irrigation was applied and preemergence-applied sulfentrazone was sprinkler incorporated with 0.25, 0.5, or 1.0 inch irrigation, season-long CHEAL control was greater than 95%. In contrast, control was reduced to 72% when 2.0 inch sprinkler incorporation was used.

Tuber yields reflect season-long control as there was a trend towards reduced yields as sprinkler incorporation amount increased in high pre-application moisture sub plots (Table). Similarly, tuber yields in low pre-application moisture sub plots with 0.25 or 0.5 inch sprinkler incorporation were greater than yields in the weedy control (although numerically less), while yields in that sub plot receiving 1.0 or 2.0 inch sprinkler incorporation were not different than yields in the weedy control. These results indicate that when pre-application soil moisture is high, then sprinkler incorporation amount for preemergence-applied sulfentrazone should not exceed 0.5 inch since greater amounts could move that herbicide below the weed germination zone in coarse-textured, low O.M.%, high pH soils. In drier pre-application soil conditions, sprinkler incorporation amounts up to 1.0 inch may be acceptable depending upon soil type, O.M.%, and pH.

Table . Common lambsquarters control, potato crop injury and tuber yields with sulfentrazone applied preemergence to wet or dry soils and sprinkler incorporated with various irrigation amounts.

Treatment[3]	Pre-application moisture	Sprinkler incorporation Amount[4]	Weed control[1] CHEAL 6/17	Weed control[1] CHEAL 9/15	Crop injury 6/17	Tuber yield[2] U.S. No. 1	Tuber yield[2] Total
		inch	-----------%-----------		---- % ----	----- cwt/A -----	
Weedy check	High	1.0	-	-	0	200	359
Sulfentrazone	High	0.25	99	100	0	200	322
Sulfentrazone	High	0.5	99	100	0	240	345
Sulfentrazone	High	1.0	99	88	0	154	267
Sulfentrazone	High	2.0	99	68	0	164	310
Weedy check	Low	1.0	-	-	0	115	205
Sulfentrazone	Low	0.25	99	95	0	286	395
Sulfentrazone	Low	0.5	99	98	0	195	311
Sulfentrazone	Low	1.0	99	97	0	188	297
Sulfentrazone	Low	2.0	99	72	0	146	264
LSD (0.05)	-	-	ns	7	ns	83	103

[1] CHEAL, common lambsquarters. 6/17 was approximately 1 month after treatment.

[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 (>4 oz with 1 or 2 slight defects), and malformed cull tubers.

[3] Sulfentrazone was applied preemergence at 0.094 lb ai/A.

[4] Treatments were sprinkler incorporated immediately after application. The weedy check in each pre-application moisture received 1 inch irrigation at the same time the sulfentrazone treatments were sprinkler incorporated.

Effects of fall irrigation and tillage on flucarbazone-sodium dissipation and crop response of potatoes planted the following season. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objective of this trial was to determine the effects on potatoes planted the season after flucarbazone-sodium was applied to spring wheat and 1 or 4 in irrigation was applied and the trial area was plowed or ripped post-wheat harvest in a weed-free trial located at the Aberdeen Research and Extension Center.

Flucarbazone-sodium was applied postemergence at 0.42 or 0.84 oz ai/A to spring wheat on July 7, 2003. Application was made with a CO_2-pressurized backpack sprayer that delivered 17.5 gpa at 35 psi. Wheat was harvested September 1, 2003. Plots were plowed or ripped (no soil inversion, deep shanks loosen soil and compaction) and received 1 or 4 inch irrigation water on November 3, 2003. The experimental design was a split block with three replications and 20 by 30 ft sub plots. Main plots were herbicide rate (0, 0.42, or 0.84 oz ai/A) and sub plots were post-wheat harvest tillage (plowed or ripped) and irrigation (1 or 4 inch).

The experimental area was fertilized with 150 lb N, 140 lb P_2O_5, 20 lb K_2O, 60 lb SO_4, 1 lb Zn, 0.15 lb Cu., and 1.8 lb Mn/acre, based on soil tests, before planting 'Russet Burbank' potatoes on April 29, 2004. Potatoes were planted 5 inches deep with 12-inch intervals in rows spaced 36 inches apart with 1.1% organic matter and pH 8.0. Potatoes were hilled and 0.27 lb/A imidacloprid was applied on May 14, 2004, just prior to potato emergence.

The trial area was kept weed-free during the growing season. 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. Potato vines were desiccated with 0.375 lb/A diquat Sep 7, 2004. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Oct 4, 2004 and graded according to USDA standards.

Average leaflet number per potato plant decreased significantly as flucarbazone rate increased from 0 to 0.84 oz/A and fall irrigation and tillage was 1.0 in and plowing (Table). Leaflet number/plant in other treatments were similar regardless of rate, tillage, or irrigation. Potatoes planted in flucarbazone-treated plots that were plowed and received 1.0 or 4.0 inch post-wheat harvest irrigation had significant stunting injury 1 month after emergence (MAE) at 8 to 17% (Table). Potatoes planted in flucarbazone-treated plots that were ripped and received 1.0 inch post-wheat harvest irrigation had 3 to 8% stunting 1 MAE. At 2 MAE, flucarbazone-treated plots that were plowed and received 1.0 inch irrigation were still injured 3 to 7%.

Malformed cull tuber weight usually increased as flucarbazone rate increased from 0 to 0.84 oz/A regardless of fall irrigation or tillage (Table). U.S. No. 1 and total tuber yields decreased numerically as flucarbazone rate increased from 0 to 0.84 oz/A regardless of fall tillage or irrigation, and when plots were treated with flucarbazone at 0.84 lb/A were plowed and received 4.0 inches irrigation, tuber yield decreased significantly compared with yields in the untreated control plots with the same tillage and irrigation amount.

These results seem to indicate that in general, potatoes growing in flucarbazone-treated were affected more detrimentally than potatoes in untreated control plots, and potatoes in plowed plots were often more affected than potatoes in ripped plots. After flucarbazone application to spring wheat in 2003 and before tillage in November 2003, the trial area received approximately 1.0 inch rainfall in addition to scheduled irrigation which was ended in August. When flucarbazone-treated plots were plowed, the herbicide that had moved down in the soil profile after application was possibly moved back near the soil surface when soil was inverted during the plowing operation. The herbicide in these plowed plots was most likely present in great enough amount to affect potatoes planted in 2004. In contrast, when plots were ripped instead of plowed fall 2003, no soil inversion occurred and the herbicide may have remained far enough down in the soil profile as to not affect potatoes planted in 2004.

Table . The effects of post-wheat harvest irrigation and tillage on flucarbazone-sodium carryover to potatoes in Aberdeen, ID.

	Post-wheat harvest remediation[1]		Crop response[2]			Tuber yield[3]		
Flucarbazone Rate	Tillage type	Irrigation amount	Leaflet Count	Stunting 6/23	Stunting 7/20	Malformed culls	U.S. No. 1	Total
oz/A		inches	avg #/plant	-------- % --------		----------- cwt/A -----------		
0	Plow	1.0	35	0	0	62	113	243
0.42	Plow	1.0	23	8	3	61	99	228
0.84	Plow	1.0	22	17	7	79	72	237
0	Rip	1.0	31	0	0	37	190	322
0.42	Rip	1.0	30	3	0	71	176	344
0.84	Rip	1.0	28	8	2	67	160	331
0	Plow	4.0	34	0	0	54	174	328
0.42	Plow	4.0	25	10	0	57	136	282
0.84	Plow	4.0	30	15	2	70	121	281
0	Rip	4.0	35	0	0	44	237	373
0.42	Rip	4.0	31	2	0	71	203	353
0.84	Rip	4.0	34	2	0	50	225	360
LSD (0.05)	-	-	12	3	3	26	49	40

[1] Plots were plowed or ripped and received either 1.0 or 4.0 inches irrigation water November 3, 2003

[2] Russet Burbank potato were planted April, 29, 2004. Leaflet count was taken in the middle two-rows on 10 plants/plot. Injury ratings were conducted on 6/23 and 7/20, 2004 approximately 1 and 2 months after potato emergence.

[3] U.S. No. 1 tubers are >4 oz and have no defects. Malformed culls are >4 oz with an unacceptable number or type of deformities. Total tuber weight includes process culls (< 4oz with no defects), U.S. No. 1, U.S. No. 2 (>4 oz with 1 or 2 slight defects), and malformed cull tubers.

Potato leaf and vine desiccation with various products applied alone or in tank mixtures in single or sequential applications. Pamela J.S. Hutchinson, Daniel M. Hancock, and Brent R. Beutler. (Aberdeen Research and Extension Center, University of Idaho, Aberdeen, ID 83210.) The objectives of this trial were to determine how quickly several products desiccated potato leaves and stems and to compare single and sequential applications of desiccant treatments in a weed-free field trial conducted at the Aberdeen Research and Extension Center.

The experimental area was fertilized with 150 lb N, 140 lb P_2O_5, 20 lb K_2O, 60 lb SO_4, 1 lb Zn, 0.15 lb Cu., and 1.8 lb Mn/acre, based on soil tests, before planting 'Russet Burbank' potatoes on April 29, 2004. Potatoes were planted 6 inches deep with 12-inch intervals in rows spaced 36 inches apart in a Declo Loam soil with 1.1% 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 14, 2004, 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. The trial area was kept weed-free during the season.

Single-application desiccation treatments and the first part of sequential treatments were applied at the start of natural senescence on August 27, 2004. The second application was made 1 wk later on Sept 4, 2004. The non-sulfuric acid treatments were applied with a CO_2-pressurized backpack sprayer that delivered 30 gpa at 32 psi. The sulfuric acid treatments were applied with a tractor-mounted CO_2-pressurized sprayer that delivered 30 gpa at 32 psi. Tubers were harvested from 20 ft of each of the two center rows in each plot using a single-row mechanical harvester on Oct 4, 2004 and graded according to USDA standards.

There were 19 single-application treatments consisting of diquat at 0.375 or 0.5 lb ai/A + 0.25%v/v nonionic surfactant (NIS), commercial sulfuric acid, CT-311 sulfuric acid, CT-311-Soy sulfuric acid, glufosinate ammonium at 0.375 lb ai/A + ammonium sulfate (AMS), glufosinate ammonium at 0.375 lb ai/A + carfentrazone at 0.0083 lb ai/A + ammonium sulfate (AMS), glufosinate ammonium at 0.1875 lb ai/A + endothall at 0.5 lb ai/A + AMS, endothall at 0.5 or 1.0 lb ai/A + AMS + methylated seed oil (MSO), carfentrazone at 0.025, 0.05, 0.075, or 0.09 lb ai/A + MSO, carfentrazone at 0.05 + diquat at 0.25 lb ai/A + MSO, carfentrazone at 0.025 or 0.05 + endothall at 0.5 lb/A + AMS + MSO, commercial sulfuric acid applied at the second application timing, or ET (pyraflufen ethyl) at 0.0089 + AMS applied at the second application timing.

At 1 wk after treatment (WAT) with these single application treatments, CT-311-Soy, glufosinate ammonium + AMS, ET + AMS, both endothall rates, and all carfentrazone rates were providing <90% leaf desiccation while the other single-application treatments resulted in $\geq$90% leaf desiccation (Table). The addition of diquat to 0.05 lb/A carfentrazone or endothall to 0.025 or 0.05 lb/A carfentrazone improved leaf desiccation compared to those rates of carfentrazone applied alone. Glufosinate ammonium + carfentrazone or endothall resulted in greater leaf desiccation 1 WAT than glufosinate ammonium + AMS. CT-311 sulfuric acid was comparable to commercial sulfuric acid. At 1 and 2 WAT, Endothall at 1.0 lb/A provided greater leaf desiccation than at 0.5 lb/A. At 2 WAT, single applications of CT-311-Soy, endothall at 0.5 lb/A, carfentrazone at 0.025 or 0.05 lb /A, or ET still were providing <90% leaf desiccation. By 3 WAT, all single-application treatments provided $\geq$90% leaf desiccation.

There were 10 sequential application treatments consisting of two applications of diquat at 0.25 lb/A + NIS, glufosinate ammonium at 0.1875 + endothall at 0.5 lb/A + AMS + MSO, carfentrazone at 0.025, 0.05, 0.075, or 0.09 lb/A, carfentrazone at 0.025 + endothall at 0.5 lb/A + AMS + MSO, carfentrazone at 0.05 + endothall at 0.5 lb/A +AMS + MSO or diquat at 0.25 lb/A + MSO, or glufosinate ammonium at 0.1875 + AMS followed by (fb) sulfuric acid. Sequential applications of diquat at 0.25 lb/A provided similar leaf desiccation as single applications of diquat at 0.375 or 0.5 lb/A 2 and 3 wks after the first application timing (Table). Sequential applications of carfentrazone at 0.025 or 0.05 lb/A improved, while 0.075 or 0.09 lb/A, did not improve leaf desiccation compared with single-applications of those rates. Sequential applications of carfentrazone + diquat or + endothall did not improve leaf desiccation compared with single applications of those tank mixtures.
At 1 WAT, the only treatments providing >90% stem desiccation were commercial sulfuric acid or CT-311 sulfuric acid (Table). Two wk after the first application and 1 wk after the second application timing, the only treatments providing <80% stem desiccation were single or sequential applications of carfentrazone at 0.025 lb/A or single application at 0.05 lb/A. By 3 WAT (first application timing), the only treatment resulting in <90% stem desiccation was the single application of carfentrazone at 0.025 lb/A.

Desiccation treatment tuber yields were similar to yields from the untreated control (Table). Glufosinate ammonium at 0.1875 + AMS applied the first application timing fb sulfuric acid the second application timing resulted in similar tuber yields compared with a single application of sulfuric acid applied the first or the second application timing, or compared with a single application of glufosinate ammonium at 0.375 lb/A + AMS applied at the first application timing. However, one of the treatments providing numerically slow leaf and stem desiccation had tuber yields slightly greater than treatments providing faster desiccation in the same time period.

Table. Potato leaf and stem desiccation 7, 14, and 21 days after single or sequential desiccation treatments were applied and tuber yields at Aberdeen, ID in 2004.

Treatment[2]	Rate	Application Timing[3]	Desiccation						Tuber yield[1]	
			Leaf			Stem			U.S. No. 1	Total
			9/02	9/09	9/15	9/02	9/09	9/15		
	lb ai/A		------------------- % -------------------						---- cwt/A ----	
Untreated control	-	-	23	27	40	8	23	40	280	385
Diquat	0.375	A	92	95	97	78	87	95	266	393
Diquat	0.5	A	96	95	98	85	93	97	264	371
Diquat	0.25	A								
Diquat	0.25	B	82	93	100	73	88	98	252	369
Sulfuric Acid										
(CT-311 Soy)	100% at 30 GPA	A	63	88	97	40	83	93	255	382
Sulfuric Acid										
(CT-311)	100% at 30 GPA	A	97	100	100	90	97	100	267	385
Sulfuric Acid	100% at 30 GPA	A	97	100	100	93	97	98	268	379
Sulfuric Acid	100% at 30 GPA	B	-	95	100	-	93	98	256	382
Glufosinate	0.375									
+AMS Plus	+ 4.0	A	82	93	97	65	80	90	267	374
Glufosinate	0.1875									
+ AMS Plus/	+ 4.0	A								
Sulfuric acid	100%	B	70	100	100	47	97	100	251	357
Glufosinate	0.375									
+ carfentrazone	+ 0.0083									
+ AMS Plus	+ 4.0	A	90	97	98	82	92	95	267	365
Glufosinate	0.1875									
+ endothall + AMS Plus	+ 0.5 + 4.0	A	90	97	100	75	88	96	285	378
Glufosinate	0.1875									
+ endothall + AMS Plus /	+ 0.5 + 4.0	A								
Glufosinate	0.1875									
+ endothall + AMS Plus	+ 0.5 + 4.0	B	85	98	100	67	95	98	256	361
Endothall	0.5									
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A	77	85	95	53	75	90	259	365
Endothall	1.0									
+ AMS Plus + MSO	+ 4.0 + 1 qt/A	A	88	93	97	77	87	92	253	380
Carfentrazone + MSO	0.025 + 1 qt/A	A	70	82	90	53	77	87	302	403
Carfentrazone + MSO /	0.025 + 1 qt/A	A								
Carfentrazone + MSO	0.025 + 1 qt/A	B	67	87	95	53	73	90	226	349
Carfentrazone + MSO	0.05 + 1 qt/A	A	73	82	97	53	67	93	251	366
Carfentrazone + MSO /	0.05 + 1 qt/A	A								
Carfentrazone + MSO	0.05 + 1 qt/A	B	70	92	100	57	85	97	248	349
Carfentrazone + MSO	0.075 + 1 qt/A	A	87	93	98	78	83	97	266	358
Carfentrazone + MSO /	0.075 + 1 qt/A	A								
Carfentrazone + MSO	0.075 + 1 qt/A	B	85	95	100	68	88	98	266	376
Carfentrazone + MSO	0.09 + 1 qt/A	A	83	93	97	72	82	93	262	366
Carfentrazone + MSO /	0.09 + 1 qt/A	A								
Carfentrazone+ MSO	0.09 + 1 qt/A	B	83	98	100	73	95	100	250	358
Carfentrazone + MSO	0.05 + 1 qt/A									
+ diquat	+ 0.25	A	90	97	100	82	90	95	280	383
Carfentrazone + MSO	0.05 + 1 qt/A									
+ diquat /	+ 0.25	A								
Carfentrazone + MSO	0.05 + 1 qt/A									
+ diquat	+ 0.25	B	92	97	100	83	95	98	256	363
Carfentrazone + MSO	0.025 + 1 qt/A									
+ endothall + AMS Plus	+ 0.5 + 4.0	A	90	97	100	80	88	97	273	394
Carfentrazone + MSO	0.025 + 1 qt/A									
+ endothall + AMS Plus /	+ 0.5 + 4.0	A								
Carfentrazone + MSO	0.025 + 1 qt/A									
+ Endothall + AMS Plus	+ 0.5 + 4.0	B	90	97	100	77	92	100	265	382

Table continued		Appli-	Desiccation						Tuber yield[1]	
		cation	Leaf			Stem			U.S	
Treatment[2]	Rate	Timing[3]	9/02	9/09	9/15	9/02	9/09	9/15	No. 1	Total
	lb ai/A		------------------			%		------------------	---- cwt/A ----	
Carfentrazone + MSO	0.05 + 1 qt/A									
+ endothall + AMS Plus	+ 0.5 + 4.0	A	87	93	99	78	88	95	304	420
Carfentrazone + MSO	0.05 + 1 qt/A									
+ endothall + AMS Plus /	+ 0.5 + 4.0	A								
Carfentrazone + MSO	0.05 + 1 qt/A									
+ endothall + AMS Plus	+ 0.5 + 4.0	B	93	100	100	83	93	100	296	417
ET + AMS Plus	0.0089 + 4.0	B*	78	88	98	70	83	95	-	-
LSD (0.05)	-	-	8	6	3	16	9	6	70	72

[1] U.S. No. 1 tubers are >4 oz with no defects, Total tuber yield weight included U.S. No. 1, U.S. No. 2 (>4oz with 1 to 2 slight defects), process culls (<4oz), and malformed culls.

[2] Diquat single or sequential treatments included a non-ionic surfactant at 0.25% v/v; CT-311 is an experimental formulation of sulfuric acid and CT-311 Soy is an experimental sulfuric acid formulated with soy oil, Cheltec, Inc.; all treatments including carfentrazone also included methylated seed oil at 1 qt/A; ET, pyraflufen ethyl, Nichino America, Inc.; MSO, methylated seed oil; AMS Plus, ammonium sulfate (2.6 lb ai/gal) + nonionic surfactant, Agriliance LLC.

[3] A, application on August 27; B, application on September 4, 2004.

* ET + AMS Plus was applied September 4 and was rated 1, 2, and 3 weeks after treatment.

Evaluation of herbicides applied to dormant rhubarb for two growing seasons, 2004 and 2005. 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 two year period to 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. Untreated weedy and hand-weeded plots, and the currently registered combination of pronamide + napropamide, 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. 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 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). 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 was 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 was collected April 27, 2005 in the same manner as in 2004 and was also analyzed to compare the effects of the herbicides on yield.

Only oxyfluorfen and dimethenamid-p applied the second year reduced yield compared to untreated weedy controls. Oxyfluorfen was the only product to reduce yield compared to the hand-weeded control in the same year. Yield results with all the other herbicides were comparable for both years. Phytotoxicity ratings for all the herbicides were generally low. The highest ratings for both years occurred with oxyfluorfen and clomazone, but were still relatively low and were not correlated to yield reductions either year.

Though not significant, yield for the halosulfuron+sulfentrazone treatment was higher than the hand-weeded treatment and all other treatments for both years. 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 the individual treatments will be incorporated into the continuing field study conducted at NWREC.

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

		Yield		Phytotoxicity[1]		Efficacy[2]	
Treatments	Rate	2004	2005	2004	2005	2004	2005
	(lbs ai/A)	kg/plant		-------- 0-10 ------		-------- 1-10-------	
Dimethenamid-p	0.75	2.84	5.50	0.3	0.0	8.1	8.6
Oxyfluorfen	2.00	2.69	5.13	2.1	3.7	9.1	9.0
Clomazone	1.50	3.50	6.52	2.1	3.9	8.7	9.2
Linuron	3.00	3.44	7.09	0.1	0.4	8.9	8.9
Metolachlor	2.00	1.97	6.28	1.4	1.0	8.7	8.4
Pronamide + napropamide	2.00 + 2.00	2.70	7.72	0.2	0.2	8.4	7.9
Prometryn	2.00	3.07	6.79	0.6	0.0	8.3	8.6
Pendamethalin	1.59	3.42	7.27	0.2	0.0	8.2	8.6
Halosulfuron-methyl+sulfentrazone	0.94 + 0.25	4.12	8.54	0.6	0.1	8.2	9.3
Dichlobenil	2.00	3.12	5.94	1.0	1.6	7.8	9.4
Hand-weeded		2.71	7.26	0.0	0.0	10.0	10.0
Untreated weedy control		3.44	7.79	0.0	0.0	0.0	0.0
LSD ($P \leq 0.05$)		NS	1.89	0.5	0.7	1.0	1.1

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

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

Comparing and determining effective rates of herbicides for purple nutsedge control in turfgrass. Kai Umeda and Gabriel Towers. (University of Arizona Cooperative Extension, 4341 E. Broadway Rd., Phoenix, AZ 85040) A small plot field experiment was conducted on a driving range tee area at the Riverview Golf Course in Sun City, AZ. The tee area was established common bermudagrass maintained at a cutting height of 0.5 inch and mowed regularly. The experiment was established with plots measuring 5 ft by 10 ft and treatments replicated three times in a randomized complete block design. Herbicide applications were made with a backpack CO_2 sprayer pressurized to 25 psi and equipped with a hand-held boom with three flat fan nozzles spaced 20 inches apart. All treatments were applied in 39 gpa water and a non-ionic surfactant CS-7 at 0.25 % v/v was added to all treatments. The first application date for all treatments was 12 July 2005. Sequential applications of halosulfuron, flazasulfuron, penoxulam, trifloxysulfuron, and sulfentrazone treatments were made four weeks later on 09 August. Sequential applications of sulfosulfuron alone or tank-mixed with MSMA were sprayed six weeks apart with the second application on 23 August. Sulfosulfuron was also applied as a sequential treatment on 27 July and 23 August that followed an initial application of MSMA alone on 12 July. All applications were made in the early morning when temperatures ranged from 76 to 80F with variable cloudiness and no winds. The turfgrass and nutsedge were mowed prior to each spray application.

Sulfosulfuron consistently showed the highest degree of nutsedge control among all of the treatments. Halosulfuron, trifloxysulfuron, and penoxulam showed good nutsedge control after a second application was made. Halosulfuron and flazasulfuron were more effective at higher rates of application when a series of rates were compared.

Table. Evaluation of rates of herbicides for nutsedge control in turfgrass

			CYPRO control					
Treatment	Rate	Application*	9-Aug	23-Aug	6-Sep	20-Sep	27-Sep	4-Oct
	lb ai/A				%			
untreated check			0	0	0	0	0	0
halosulfuron	0.031	12-Jul, 9-Aug	32	95	48	73	65	78
halosulfuron	0.047	12-Jul, 9-Aug	73	93	75	78	80	86
halosulfuron	0.062	12-Jul, 9-Aug	77	95	83	88	75	88
sulfosulfuron	0.06	12-Jul	95	77	66	78	77	82
sulfosulfuron	0.094	12-Jul	95	73	73	77	75	85
sulfosulfuron	0.06	12-Jul, 23-Aug	93	82	99	96	90	97
sulfosulfuron + MSMA	0.06 + 2.0	12-Jul, 23-Aug	92	95	99	96	99	99
MSMA + sulfosulfuron	2.0 + 0.06	12-Jul, 27-Jul, 23-Aug	95	95	99	97	98	99
flazasulfuron	0.0039	12-Jul, 9-Aug	58	72	45	60	73	75
flazasulfuron	0.0078	12-Jul, 9-Aug	50	90	67	77	72	88
flazasulfuron	0.0156	12-Jul, 9-Aug	47	90	78	85	85	91
flazasulfuron	0.023	12-Jul, 9-Aug	80	87	87	92	83	96
flazasulfuron	0.047	12-Jul, 9-Aug	83	95	88	93	87	93
penoxulam	0.125	12-Jul, 9-Aug	68	95	93	87	78	92
trifloxysulfuron	0.026	12-Jul, 9-Aug	67	95	98	89	83	90
sulfentrazone	0.024	12-Jul, 9-Aug	60	77	67	75	70	82
LSD (p=0.05)			22.6	12.2	37.3	15.0	23.0	10.5

* Application dates of single and sequential treatments.

Sequential treatments of halosulfuron, flazasulfuron, penoxulam, trifloxysulfuron, and sulfentrazone applied at 4-week intervals on 12-Jul and 9-Aug 2005.

Sulfosulfuron sequential treatments applied at 6-week intervals. Sulfosulfuron + MSMA applied as a tank-mix treatment. MSMA + sulfosulfuron was MSMA alone on 12-Jul before sulfosulfuron sequential treatment. Sulfentrazone applied as pre-mix product including 2,4-D, mecoprop, and dicamba.

Evaluation of postemergence herbicides for broadleaved weed control in dormant bermudagrass turf. Kai Umeda and Gabriel Towers. (University of Arizona Cooperative Extension, 4341 E. Broadway Rd. Phoenix, AZ 85040) A small plot field experiment was conducted adjacent to a softball field in Tempe, AZ where plots measured 5 ft by 10 ft and arranged in a randomized block design with three replicates. Herbicides were applied with a backpack CO_2 sprayer pressurized to 30 psi and delivered 39 gpa water through a hand-held boom equipped with three 8002 flat fan nozzles spaced 20 inches apart. The treatments were applied on 25 March 2005 when the air temperature was 54°F, calm, and partly cloudy.

The treatments that included 2,4-D, mecoprop, and dicamba effectively controlled burclover and malva in the dormant bermudagrass turf.

Table. Winter broadleaved weed control in dormant bermudagrass

		Weed Control			
		medpo		malpa	
Treatment	Rate	8-Apr	22-Apr	8-Apr	22-Apr
	lb ai/A			%	
untreated check		0	0	0	0
carfentrazone +	0.025 +	96	98	87	87
2,4-D ester +	0.675 +				
mecoprop +	0.24 +				
dicamba	0.07				
2,4-D +	1.0 +	98	98	77	87
mecoprop +	0.27 +				
dicamba	0.11				
fluroxypyr	0.56	50	17	77	60
sulfentrazone +	0.03 +	87	98	76	95
2,4-D ester +	0.70 +				
mecoprop +	0.25 +				
dicamba	0.11				
LSD p=0.05		9.3	24.3	8.7	42.5

Applications on 25 March 2005

Evaluation of bispyribac-sodium for *Poa annua* control in turfgrass. Kai Umeda and Gabriel Towers. (University of Arizona Cooperative Extension, 4341 E. Broadway Rd., Phoenix, AZ 85040) Two small plot field experiments were conducted at the Toka Sticks Golf Course in Mesa, AZ and at the Cave Creek Golf Course in Phoenix, AZ to evaluate POANN control in perennial ryegrass overseeded in common bermudagrass turf. Postemergence applications were made for all treatments in both experiments using a backpack CO_2 sprayer pressurized to 30 psi and delivering 25 gpa water through a hand-held boom equipped with three 8002 flat fan nozzles spaced 20 inches apart. At Toka Sticks GC, plots were 5 ft wide by 10 ft in length and arranged in a randomized complete block design with four replicates. All treatments were applied on 04 February 2005 with air temperature at 55°F, cloudy and calm. The sequential applications were planned for 1, 2, or 3 weeks after the initial application. A second application was made on 14 February at 10 days after treatment of the first application (DAT-1) when the air temperature was 52°F. The planned 2 week application was applied on 21 February at 17 DAT-1 with temperature at 52°F and high overcast sky with no wind. The 3 week application was sprayed on 03 March at 27 DAT-1 with temperature at 50°F, overcast and calm. At Cave Creek GC, plots measured 5ft by 5ft and replicated three times in a randomized complete block design. Sequential treatments were initiated on 08 February 2005 when it was 40°F, clear, and calm. One week later on 15 February, it was 56°F, overcast and calm. The 2 week sequential application was made on 22 February when it was 50°F, partly cloudy, and no wind. On 01 March, the 3 week sequential application was sprayed when it was clear, calm, and 60°F. POANN seedhead suppression was rated at intervals and turf quality ratings included color and overall health and vigor of the ryegrass.

Bispyribac-sodium was variable in providing POANN suppression with sequential applications. Ryegrass injury was pronounced after the first application as a yellowing of the turfgrass that recovered as the spring season progressed.

Table. Turf safety and *Poa annua* seedhead suppression

			Toka Sticks Golf Course						Cave Creek Golf Course					
			Turf quality*			POANN suppression			Turf quality*			POANN suppression		
Treatment	Rate	Timing	21-Feb	22-Mar	1-Apr	21-Feb	22-Mar	1-Apr	22-Feb	14-Mar	28-Mar	22-Feb	14-Mar	28-Mar
	gm ai/A						%						%	
untreated check			7.5	6.0	4.5	0	0	0	8.0	6.7	5.3	0	0	0
bispyribac	30 + 30	1 week	5.0	7.0	6.8	99	73	38	5.7	6.7	5.7	96	96	86
bispyribac	45 + 45	1 week	5.3	7.3	6.8	97	63	60	5.0	6.3	6.0	99	99	85
bispyribac	60 + 30	1 week	5.0	7.5	7.3	99	85	56	5.0	7.0	6.0	99	98	77
bispyribac	30 + 30	2 weeks	6.0	6.0	6.3	90	55	30	5.7	6.3	5.3	96	83	75
bispyribac	45 + 45	2 weeks	5.8	6.5	7.0	97	65	64	5.7	5.7	6.0	92	87	77
bispyribac	60 + 30	2 weeks	5.5	6.8	6.5	99	69	58	5.3	6.3	5.3	96	83	67
bispyribac	30 + 30	3 weeks	6.3	6.0	6.8	90	60	71	5.3	6.0	5.3	96	87	70
bispyribac	45 + 45	3 weeks	6.0	6.0	7.0	98	71	68	5.7	6.0	5.3	95	90	78
bispyribac	60 + 30	3 weeks	5.3	6.8	6.5	99	65	54	5.7	6.3	5.7	93	87	68
prohexadione	108		8.0	6.8	6.5	97	63	55	-	-	-	-	-	-
prohexadione	108 + 108	3 weeks	7.8	7.0	6.8	97	61	64	-	-	-	-	-	-
LSD (p=0.05)			0.59	0.82	1.42	2.7	21.8	23.1	0.58	1.13	1.03	2.9	9.5	20.5

Applications made at Toka Sticks GC on 02 February 2005, 14 (1 week), 21 (2 week) February, and 03 March (3 week).

Applications made at Cave Creek GC on 08 February 2005, 15, 22 February, and 01 March.

*Turf quality rating scale 1 to 9, 9 = best quality

Spring initiated application of herbicides for nutsedge control and effects on overseeded ryegrass. Kai Umeda and Gabriel Towers. (University of Arizona Cooperative Extension, 4341 E. Broadway Rd., Phoenix, AZ 85040) A small plot field experiment was conducted at the Palo Verde Golf Club in Sun Lakes, AZ on perennial ryegrass turf that was overseeded into common bermudagrass during the fall of 2004. CYPRO emerged in April and herbicides were applied beginning on 05 May 2005 then following on 02 June, 06 July, and 03 August. MSMA and halosulfuron treatments were applied on all four application dates and imazaquin and sulfosulfuron were applied only three times in May, July, and August. All treatments included a nonionic surfactant Latron CS-7 at 0.25% v/v. Treatments were initiated when the CYPRO was 0.5 to 0.75 inch above the ryegrass that was regularly mowed at approximately 1.0 inch height of cut. On 05 May, the air temperature was 74°F, sky clear, and there was a very slight breeze with soil temperature at the 1 to 2 inch depth at 64°F. On 02 June, the temperature was 79°F, overcast, and a breeze with soil temperature at 68°F. On 06 July, the temperature was 96°F, clear, and calm. The final application date was 03 August when monsoon rains occurred during the night before and temperature was only 70°F, cloudy, calm, and very humid. All applications were made with a backpack CO_2 sprayer pressurized to 30 psi and delivered 30 gpa water through a hand-held boom equipped with three 8003 flat fan nozzles spaced 20 inches apart. The experimental plots measured 5 ft wide by 10 ft long and each treatment was replicated four times in a randomized complete block design.

Halosulfuron, imazaquin, and sulfosulfuron gave short-term CYPRO control early and then gave effective control after three or four applications. Halosulfuron was safest on the ryegrass while imazaquin and sulfosulfuron removed the ryegrass completely. Sulfosulfuron delayed bermudagrass transition during the spring.

Table 1. Spring initiated application of herbicides for purple nutsedge control and effects on overseeded ryegrass.

		Turfgrass quality*				CYPRO control								
Treatment	Rate	13-May	2-Jun	15-Jun	30-Jun	13-May	2-Jun	15-Jun	30-Jun	18-Jul	3-Aug	17-Aug	31-Aug	29-Sep
	lb a.i./A									%				
untreated check		7.3	6.8	7.0	7.0	0	0	0	0	0	0	0	0	0
MSMA	3.0	4.8	5.8	3.8	6.0	29	0	40	0	50	48	58	74	83
halosulfuron	0.062	4.3	5.3	4.8	5.5	83	73	91	68	89	91	98	95	93
imazaquin	0.5	4.0	2.3	2.0	5.3	80	83	70	70	78	91	96	94	94
sulfosulfuron	0.094	3.8	1.0	1.0	3.0	83	95	90	73	78	93	98	94	97
LSD (p=0.05)		0.60	1.03	0.86	1.82	6.2	6.6	15.4	15.4	7.6	14.2	26.9	12.1	5.1

*Quality rating scale of 1-9, 9 is best

4 application dates on 05 May, 02 June, 06 July, and 03 August, 2005 for MSMA and halosulfuron treatments and imazaquin and sulfosulfuron applied 3 times on May, July, August dates.

Postemergence herbicides and tank mix combinations for weed control in seedling alfalfa. Mick Canevari, Donald Colbert, Randall Wittie and Scott Whiteley. (Cooperative Extension, University of California, 95205) A field study was conducted to evaluate postemergence herbicides and tank mixtures for weed control in seedling alfalfa. Plots were 10 by 15 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 20 gpa on December 2, 2004. No adjuvant added to the acetic acid treatment. A non ionic surfactant, Unifilm 707 was added to the paraquat treatment at 0.125% V/V. Unifilm 707 0.25% V/V and UN32 1.25% V/V were added to all remaining herbicide treatments.

Table 1. Application information.

Application date	December 2, 2004
Crop stage	3-5 trifoliate
Weed stage	STEME 15-30, 3-4 inch; URTUR 8-12 lf, 1-2 inch; SENVU 8-12 lf, 1-2 inch RANMU 4-6 lf, 4-6 inch; MALPA 10-20 lf, 4-6inch; POAAN 4 lf-2 tiller, 1-2 inch, SONOL 4-6 lf, 2-4 inch; RUMCR 2-4 lf, 1-2 inch; LACSE 4-6 lf, 2-12 inch and POLAV 3-6 lf, 1 inch.
Air temperature (F)	54
Relative humidity (%)	45
Wind (mph)	3
Cloud cover (%)	0
Texture	clay loam

All herbicide treatments showed good alfalfa tolerance except for paraquat which resulted in some severe necrosis 47 DAT with complete recovery prior to the 1st cutting April 14, 2005 (Table 2). Bromoxynil alfalfa plant stand counts 5/sqft and acetic acid 3 plants/sqft reduced stand counts similar to the untreated check of two plants/sqft. These low stand counts were due to severe weed competition. All other treatment stand counts ranged from 8 to 13 alfalfa plants/sqft. In general, the best herbicide treatments for overall weed control were tank mixtures of; (1) Imazamox + bromoxynil + pendimethalin, (2) Imazamox + bromoxynil, (3) Imazamox + 2,4-DB amine, (4) Imazamox + 2,4-DB amine + pendimethalin, (5) Imazethapyr + bromoxynil, (6) Imazethapyr + 2,4-DB amine and (7) Paraquat (Table 3). Acetic acid, paraquat and bromoxynil alfalfa and weed yields on the first cutting were similar to the untreated check (Table 4). Treatments with the highest alfalfa yields were imazamox + imazethapyr + pendimethalin (0.032 + 0.032 + 1.0 lb ai/A), imazethapyr + 2,4-DB amine, imazamox + imazethapyr (0.032 + 0.032 lb ai/A), imazamox + 2,4-DB amine and imazamox + bromoxynil. On the second cutting, May 4, 2005 all herbicide treatments with imazethapyr or imazamox resulted in the highest alfalfa yields. Acetic acid, paraquat and bromoxynil treatments gave weed yields similar to the untreated check.

Table 2. Seedling alfalfa crop injury and stand counts.

		Alfalfa Injury				
		Necrosis		Stunting		Stand Count
Treatment[1]	Rate	12 DAT[2]	47 DAT	68 DAT	96 DAT	151 DAT
	lb ai/A	---------------	---------------	%---------------	---------------	Plants/sqFt
Acetic acid[3]	20 gpa	8	0	0	0	3.0
Imazethapyr + bromoxynil	0.094 + 0.375	4	7	0	0	9.0
Imazethapyr + 2,4-DB	0.094 + 0.750	0	8	8	7	13.0
Imazethapyr + pendimethalin	0.094 + 1.0	0	0	0	0	10.0
Imazamox	0.047	0	0	0	0	10.0
Imazamox + imazethapyr	0.024 + 0.024	0	3	0	0	10.0
Imazamox + imazethapyr	0.032 + 0.032	0	10	5	2	11.0
Imazamox + Imazethapyr + pendimethalin	0.032 + 0.032 + 1.0	0	3	0	0	12.0
Imazamox + bromoxynil	0.047 + 0.375	0	5	0	0	10.0
Imazamox + bromoxynil + pendimethalin	0.047 + 0.375 + 1.0	0	8	5	0	12.0
Imazamox + 2,4-DB	0.047 + 1.0	0	10	0	0	10.0
Imazamox + 2,4-DB + pendimethalin	0.047 + 1.0 + 1.0	0	8	7	0	11.0
Imazamox + pendimethalin	0.047 + 1.0	0	0	0	0	11.0
Imazethapyr	0.094	0	0	0	0	9.0
Bromoxynil	0.375	4	0	0	0	5.0
Paraquat	0.188	57	48	30	0	10.0
2,4-DB	1.0	5	13	0	0	8.0
Untreated check	-	0	0	0	0	2.0
LSD (0.05)		4.6	6.4	6.3	2.5	1.9

[1] Unifilm 707 (NIS) added to paraquat at 0.125% V/V. All other treatments Unifilm 707 0.25% V/V + UN32 1.25% V/V.

[2] DAT = days after treatment.

[3] Applied at 20 gallons of product/acre; no adjuvant added.

Table 3. Postemergence herbicides and tank mixtures for weed control in seedling alfalfa.

		Weed control[1] – Days after treatment (DAT)									
		68 DAT			98 DAT						
Treatment[2]	Rate	RANMU	RUMCR	POLAV	STEME	URTUR	SENVU	MALPA	POAAN	SONOL	LACSE
	LB ai/A					--%--					
Acetic acid[3]	20 gpa	0	0	0	0	0	0	0	0	0	0
Imazethapyr + bromoxynil	0.094 + 0.375	92	82	92	77	82	95	83	10	90	93
Imazethapyr + 2,4-DB	0.094 + 1.0	90	93	89	65	92	48	87	13	92	93
Imazethapyr + pendimethalin	0.094 + 1.0	95	92	90	87	95	28	83	37	12	7
Imazamox	0.047	92	93	91	98	87	12	93	42	25	13
Imazamox + imazethapyr +	0.024 + 0.024	91	95	92	92	80	13	96	30	24	10
Imazamox + imazethapyr +	0.032 + 0.032	90	94	92	95	97	23	94	60	30	12
Imazamox + imazethapyr + pendimethalin	0.032 + 0.032 + 1.0	94	93	92	99	92	20	93	58	47	17
Imazamox + bromoxynil	0.047 + 0.375	94	93	92	96	82	96	93	42	99	97
Imazamox + bromoxynil pendimethalin	0.047 + 0.375 + 1.0	94	92	94	97	86	97	92	67	98	97
Imazamox + 2,4-DB	0.047 + 1.0	94	94	95	95	89	18	94	50	93	96
Imazamox + 2,4-DB + pendimethalin	0.047 + 1.0 + 1.0	94	95	97	97	95	40	95	67	99	100
Imazamox + pendimethalin	0.047 + 1.0	96	92	97	99	93	10	93	85	33	43
Imazethapyr	0.094	92	93	93	78	88	35	88	23	18	10
Bromoxynil	0.375	27	23	57	0	0	100	0	0	90	73
Paraquat	0.188	83	100	27	70	25	86	18	100	95	97
2,4-DB	1.0	57	96	72	0	83	38	72	17	100	100
Untreated ck	-	0	0	0	0	0	0	0	0	0	0
LSD (P=0.05)		9.6	7.9	10.1	9.8	16.1	8.6	3.8	19.8	7.3	9.5

[1] Weeds evaluated were; roughseeded buttercup (RANMU), curly dock (RUMCR), prostrate knotweed (POLAV), common chickweed (STEME), burning nettle (URTUR), common groundsel (SENVU) , little mallow (MALPA), annual bluegrass (POAAN), annual sowthistle (SONOL) and prickly lettuce (LACSE).

[2] Unifilm 707 (NIS) added to paraquat at 0.125% V/V, all other treatments Unifilm 707 0.25% V/V + UN32 1.25% V/V.

[3] Applied at 20 gallons of product/acre; no adjuvant added.

Table 4. Alfalfa and weed yield with various postemergence herbicides and tank mixtures in seedling alfalfa.

		Alfalfa and weed yield			
		First cutting		Second cutting	
Treatment[1]	Rate	Alfalfa	Weeds	Alfalfa	Weeds
	LB ai/A	--Tons/A--			
Acetic acid[2]	20 gpa	0.03	3.33	0.10	0.35
Imazethapyr + bromoxynil	0.094 + 0.375	1.55	0.52	1.11	0.06
Imazethapyr + 2,4-DB	0.094 + 1.0	1.86	0.35	1.32	0.02
Imazethapyr + pendimethalin	0.094 + 1.0	0.90	1.19	1.27	0.07
Imazamox	0.047	1.69	1.06	1.24	0.00
Imazamox + imazethapyr	0.024 + 0.024	1.59	1.00	1.32	0.00
Imazamox + imazethapyr	0.032 + 0.032	1.83	0.48	1.35	0.01
Imazamox + imazethapyr + pendimethalin	0.032 + 0.032 + 1.0	1.89	0.26	1.49	0.01
Imazamox + bromoxynil	0.047 + 0.375	1.77	0.10	1.61	0.00
Imazamox + bromoxynil + pendimethalin	0.047 + 0.375 + 1.0	1.62	0.05	1.67	0.02
Imazamox + 2,4-DB	0.047 + 1.0	1.80	0.06	1.27	0.00
Imazamox + 2,4-DB + Pendimethalin	0.047 + 1.0 + 1.0	1.64	0.07	1.50	0.00
Imazamox + Pendimethalin	0.047 + 1.0	1.31	0.22	1.37	0.00
Imazethapyr	0.094	1.29	1.40	1.14	0.02
Bromoxynil	0.375	0.17	2.40	0.26	0.20
Paraquat	0.188	0.09	2.63	0.62	0.21
2,4-DB	1.0	0.80	1.32	1.20	0.01
Untreated check	-	0.09	2.56	0.19	0.44
LSD (0.05)		0.30	0.47	0.21	0.14

[1] Unifilm 707 (NIS) added to paraquat at 0.125% V/V. All other treatments Unifilm 707 0.25% V/V + UN32 1.25% V/V.

[2] Applied at 20 gallons of product/acre; no adjuvant added.

Weed control and cover crops in spring seeded alfalfa. Dennis A. Merrick and Ralph E. Whitesides. (Department of Plants, Soils, and Biometeorology, Utah State University, Logan, Utah 84322-4820). This 2-year study compared various seeding rates of an oat cover crop with herbicides used for weed control in spring seeded alfalfa. Conventional use of cover crops in newly seeded alfalfa often results in adequate weed control at first cutting through crop competition but can damage alfalfa. Conventional cover crop methods can reduce alfalfa yield for the life of the stand and allow weed regrowth which can reduce hay quality. This study examined the ability of a cover crop to provide adequate weed control without causing a stand reduction in seedling alfalfa. Each oat seeding rate was compared to an untreated control and to herbicide treatments.

Treatments were randomized with four replications. Treatments included: control, oats cv. 'Powell' seeded at the standard rate of 40 lbs/A, half rate of 20 lbs/A, and a light rate of 10 lbs/A, and a herbicide treatment of 2,4-DB 2 qts/A and clethodim 7 oz/A. Herbicide treatments were applied using a CO_2 backpack sprayer when alfalfa was between 4 and 8 inches tall. Alfalfa was seeded at 18 lbs/A on top of the already seeded oats. Weeds present included: green foxtail (SETVI), common lambsquarters (CHEAL), redroot pigweed (AMARE), kochia (KOCSC), prickly lettuce (LACSE), field bindweed (CONAR), and velvetleaf (ABUTH).

Table 1. Total biomass yield lbs/A.

Treatment	Total biomass 04	Total biomass 05
Control	10078	7170
2,4DB&clethodim	9615	6697
10 lbs/A oats	11011	7409
20 lbs/A oats	10369	7078
40 lbs/A oats	10486	6733

Table 2. Sub-sample dry matter yield lbs/A.

Treatment	Oats 04	Oats 05	Alfalfa 04	Alfalfa 05	Weeds 04	Weeds 05
Control	0	0	7971	8882	1905	1019
2,4DB&clethodim	0	0	8797	8553	0	53
10 lbs/A oats	3716	3075	6351	7361	537	230
20 lbs/A oats	5024	2984	5703	7015	201	244
40 lbs/A oats	5820	4281	4863	6023	315	139

At first cutting, the traditional 40 lbs of oats/A surpassed all other treatments in total yield (Table 1) but had a small percentage of alfalfa as part of the total (Table 2). In subsequent cuttings, the 10 lbs of oats/A produced total yields similar to the control and herbicide treatments. The herbicide treated plots had the highest percentage weed control in 2004 (100%) and 2005 (99%). At first cutting, the herbicide treated plots had reduced yield due to crop injury from the herbicides. However, this treatment supplied the highest pure alfalfa yield for the season. The highest seasonal total dry matter yield was achieved by the light rate (10 lbs/A oats) for both years. Weed content in 2004 was 5% and 2% in 2005 of the total. The 10 lb/A oat treatment provided 72% weed control during the first year and 69% weed control for the second when compared to the untreated check plot. Both the 40 and 20 lbs/A oat treatments supplied similar weed control and season yield totals, however, the higher yields were due to the high oat content of the first cutting. Estimated cost of herbicide/A was $31.00 and oats at the 10 lb/A was $3.00.

Wild oat control with triallate plus GWN 3041. Joan Campbell and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, Idaho 83844-2339) Two experiments were established near Moscow, Idaho to determine wild oat control in 'Wawawai' spring wheat and 'Marana' spring barley with triallate and triallate plus GWN 3041. Treatments were applied with a CO_2 pressurized backpack sprayer delivering 10 gpa at 3 mph and 32 psi on April 28, 2005. Relative humidity, air and soil temperatures were 40%, 60 F, and 54 F at 3 inches, respectively. Soil type, pH, organic matter, and CEC were silty clay, 4.3, 5.7%, and 49 cmol/kg, respectively. The herbicide was incorporated 1.5 inches deep with a field cultivator/harrow twice immediately after application. Wild oat was seeded to obtain a uniform population of 11 plants/ft^2 on April 28 after herbicide incorporation. Wheat and barley were seeded 2.5 inches deep on May 2. The experimental design was a randomized complete block with four replications and 8 by 30 ft experimental units. Weed control was evaluated visually and wheat grain was harvested at maturity.

GWN 3041 is a broadleaf herbicide. The goal was to achieve broadleaf and wild oat control in one preplant application. Broadleaf weed density was low and not uniform so data was collected on wild oat control only. Wild oat control with triallate treatments ranged from 89 to 91% in wheat and 68 to 86% in barley on May 11, 2005 (Tables 1 and 2). By July 13, wild oat control with triallate treatments was 35 to 61% in wheat and 49 to 75% in barley. Wild oat control did not differ among treatments containing triallate. GWN 3041 did not control wild oat.

Wheat and barley were stunted severely due to supersaturated soil conditions after crop emergence. Barley grain was not harvested due to this injury. Wheat and barley were not injured visibly from any herbicide treatments. Wheat grain yield was higher with triallate+GWN 3041 at 1+0.035 lb ai/A (1700 lb/A) and 1+0.047 lb ai/A (1581 lb/A) than the untreated control (1000 lb/A).

Table 1. Wild oat control with triallate and spring wheat grain yield.

		Wild oat control			Spring wheat	
Treatment	Rate	May 11	June 14	July 13	Grain yield	Test weight
	lb ai/a		%		lb/a	lb/bu
Untreated	-	-	-	-	1000 c	57 a
Triallate	1	91 a[1]	62 a	61 a	1264 bc	58 a
GWN 3041	0.031	2 b	5 b	0 b	1008 c	57 a
GWN 3041	0.035	0 b	5 b	0 b	1047 c	56 a
GWN 3041	0.047	2 b	5 b	0 b	1060 c	57 a
Triallate+GWN 3041	1+0.031	89 a	58 a	38 ab	1418 abc	58 a
Triallate+GWN 3041	1+0.035	90 a	75 a	36 ab	1700 a	59 a
Triallate+GWN 3041	1+0.047	89 a	69 a	35 ab	1581 ab	58 a

[1] Means followed by the same letter within a column are not significantly different according to LSD (0.05).

Table 2. Wild oat control in spring barley.

		Wild oat control		
Treatment	Rate	May 11	June 14	July 13
	lb ai/a		%	
Untreated	-	-	-	-
Triallate	1	86 a[1]	49 a	66 a
GWN 3041	0.031	0 b	0 b	5 b
GWN 3041	0.035	0 b	0 b	0 b
GWN 3041	0.047	6 b	10 b	8 b
Triallate + GWN 3041	1+0.031	68 a	62 a	74 a
Triallate + GWN 3041	1+0.035	86 a	75 a	72 a
Triallate + GWN 3041	1+0.047	86 a	60 a	71 a

[1] Means followed by the same letter within a column are not significantly different according to LSD (0.05).

Crop tolerance to GWN-3041. Joan Campbell and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, Idaho 83844-2339) An experiment was established near Moscow, Idaho to determine crop tolerance to soil incorporated GWN-3041. The prior crop was spring barley and the soil was field cultivated several times before application. GWN-3041 alone and in combination with triallate were applied on April 30, 2005 with a tractor mounted sprayer delivering 10 gpa at 3 mph and 35 psi. Relative humidity, air and soil temperatures were 60%, 62 and 62 F, respectively. Soil pH, organic matter, CEC and texture were 4.8, 2.6%, 14 cmol/kg, and loam, respectively. Herbicide was incorporated in half the plots with a field cultivator/harrow immediately after application. Herbicide was not incorporated in the other plots. 'Joel' spring pea, 'Red Chief' lentil, 'Sierra' garbanzo bean, 'Idagold' mustard, and 'Sunrise' canola were seeded on May 25. After the June 25 crop injury rating, the crops were sprayed with glyphosate at 0.5 lb ai/a. The same crops were seeded again on July 6. The rotation was pea, lentil, garbanzo bean, mustard, and canola following mustard, canola, pea, lentil, and garbanzo bean, respectively. The experimental design was a randomized complete block split block with four replications and 8 by 30 ft experimental units. Crop injury as percent of the untreated control was rated visually on June 25 and August 1. Canola and mustard will be seeded again in spring 2005.

Crop injury is a combination of stand and vigor. Data presented are averaged over tillage and herbicide treatments because there was no tillage by herbicide treatment interaction. Triallate alone did not injure any of the crops (Tables 1 and 2). Crop injury averaged over tillage and GWN-3041 rate was 16 and 21% for pea, 7 and 9% for lentil, 12 and 17% for garbanzo bean, 61 and 68% for mustard, and 63 and 77% for canola with GWN-3041 at 0.047 and 0.094 lb ai/A, respectively in the May 25 seeding. Pea, lentil, and garbanzo bean injury was 22 and 15%, 10 and 7%, 20 and 11% for tilled versus not-tilled treatments, respectively (Table 2). Pea, lentil, and garbanzo bean were not injured in the July 6 seeding. Mustard injury was 74 and 55% in the May planting and 50 and 33% in the July planting, and canola injury was 76 and 64% in the May planting and 48 and 41% in the July planting for the tilled versus not-tilled plots, respectively. However, only canola in the May planting was affected by tillage statistically.

Table 1. Crop injury from GWN-3041 averaged over tillage in 2005.

		Pea		Lentil		Garbanzo bean		Mustard		Canola	
Herbicide	Rate	6-25[1]	8-01[2]	6-25	8-01	6-25	8-01	6-25	8-01	6-25	8-01
	lb ai/A	%									
Untreated	-	-	-	-	-	-	-	-	-	-	-
Triallate	1	0	0	0	0	0	0	0	0	0	0
Triallate	2	0	0	0	0	0	0	0	0	0	0
GWN-3041	0.047	16	0	8	0	12	0	56	33	58	38
GWN-3041	0.094	19	0	10	0	19	0	66	33	70	38
Triallate + GWN-3041	1 0.047	18	0	8	0	10	0	64	42	64	47
Triallate + GWN-3041	1 0.094	21	0	9	0	14	0	66	47	78	45
Triallate + GWN-3041	2 0.047	15	0	6	0	14	0	63	43	67	48
Triallate + GWN-3041	2 0.094	23	0	11	0	17	0	72	52	83	52
LSD (0.05)		9	-	4	-	6	-	12	10	10	9

[1] The 6-25 evaluation is for the May 25 seeding and the 8-01 evaluation is for the July 6 seeding.

Table 2. Crop injury from GWN-3041 averaged over GWN-3041 treatments in 2005.

	Pea		Lentil		Garbanzo bean		Mustard		Canola	
Tillage	6-25[1]	8-01[2]	6-25	8-01	6-25	8-01	6-25	8-01	6-25	8-01
					%					
Tilled	22	0	10	0	20	0	74	50	76	48
Not-tilled	15	0	7	0	11	0	55	33	64	41
LSD (0.05)	NS	-	NS	-	NS	-	NS	NS	8	NS

[1] The 6-25 evaluation is for the May 25 seeding and the 8-01 evaluation is for the July 6 seeding.

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 26, 2005 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 26. Preemergence treatments were applied on May 27 and immediately incorporated with 0.75 in of sprinkler-applied water. Postemergence treatments were applied on June 30 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 July 29.

Common lambsquarters, black nightshade redroot and prostrate pigweed control were excellent with all treatments except the check. Dimethenamid-p alone 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 3689 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.

		Crop	Weed control					
Treatments[1]	Rate	injury	CHEAL	SOLNI	AMARE	AMABL	SASKR	Yield
	lb ai/A	—%—			—%—			lb/A
Flumioxazin	0.05	0	99	98	96	98	98	4534
Dimethenamid-p	0.56	0	96	88	91	98	28	2881
Flumioxazin + pendimethalin	0.05+0.8	0	100	96	97	99	99	4303
Dimethenamid-p + pendimethalin	0.56+0.8	0	98	92	93	96	34	3304
Flumioxazin/imazamox + bentazon	0.05/0.032+0.25	0	99	99	99	100	99	4303
Dimethenamid-p/imazamox + bentazon	0.56/0.032+0.25	0	99	99	99	99	91	4611
Dimethenamid-p + pendimethalin/imazamox + bentazon	0.56+0.8/ 0.032+0.25	0	98	99	100	98	95	4265
Flumioxazin + pendimethalin/imazamox + bentazon	0.05+0.8/ 0.032 + 0.25	0	99	99	99	99	100	4265
Weedy check		0	0	0	0	0	0	576
LSD (0.05)			2	3	3	2	4	922

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

Carryover potential of ethofumesate in sugar beet (second year). Don W. Morishita, Michael P. Quinn, and Robyn C. Walton. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). Ethofumesate is applied preplant, preemergence, or postemergence for weed control in sugar beet. Wheat and barley are important rotational crops, but cannot be planted for 12 months following an ethofumesate application. The second year of a three year field experiment was initiated at the University of Idaho Research and Extension Center near Kimberly, Idaho to: 1) evaluate several ethofumesate rates applied preemergence and postemergence for weed control in sugar beet and 2) determine potential carryover from ethofumesate applications in sugar beet to wheat and barley. This report presents results from the first objective. 'Owyhee' sugar beet was planted May 2, 2005, in 22-inch rows at a rate of 57,024 seed/A. Experimental design was a randomized complete block with four replications. Individual plots were six rows 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. Common lambsquarters (CHEAL), barnyardgrass (ECHCG), green foxtail (SETVI), redroot pigweed (AMARE), and hairy nightshade (SONOL) were the major weed species present. Herbicides were applied in an 11-inch band or broadcast with a CO_2-pressurized bicycle-wheel sprayer. All band applications were applied at 20 gpa using 8001 even fan nozzles and broadcast applications were applied at 15 gpa using 8001 flat fan nozzles. Additional environmental and application information is given in Table 1. Crop injury was evaluated on June 6, 31 days after the first herbicide application. Crop injury and weed control were evaluated visually 18 and 38 days after the last herbicide treatment (DALT) on June 28 and July 18, respectively. The two center rows of each plot were harvested mechanically October 5.

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

Application date	May 6	May 20	May 25	May 31	June 10
Application timing	pre	cotyledon	2 leaf	4 leaf	6 leaf
Air temperature (F)	63	68	56	62	68
Relative humidity (%)	43	57	45	59	30
Wind velocity (mph)	6	2	8	2	1
Soil temperature (F)	52	61	55	48	54
Cloud cover (%)	50	70	0	25	15
Weed species (plant/ft^2)					
lambsquarters, common		1	<1	1	1
pigweed, redroot		0	<1	<1	<1
nightshade, hairy		0	<1	1	1
foxtail, green		1	1	1	1
barnyardgrass		0	<1	<1	<1

Precipitation from May 7 to May 31 totaled 3.12 inches at this site. Consequently, crop injury on June 6 ranged from 31 to 73% (Table 2). There was no difference in crop injury between band and broadcast applications with the exception of ethofumesate applied postemergence followed by ethofumesate & desmedipham & phenmedipham (efs&dmp&pmp), triflusulfuron, and clopyralid applied postemergence three times. With this treatment, sugar beet was injured 66% with the band application compared to 40% with the broadcast application. It is not known why this happened. At 18 DALT, crop injury with most treatments was still very obvious and ranged from 15 to 33%. By 38 DALT, crop injury was minimal and ranged from 3 to 9%, with no differences among herbicide treatments. Weed control with all herbicide treatments was excellent (99 to 100%) for all weed species. Even though crop injury was as high as 73% at the first evaluation, sugar beet root yield averaged 32 ton/A for all herbicide treatments and no differences were observed among the treatments.

Table 2. Crop injury, weed control, root, and extractable sugar yield in sugar beet treated with ethofumesate tank mixtures near Kimberly, Idaho.[1]

						Weed control[2]										
	Application		Crop injury			CHEAL		ECHCG		SETVI		AMARE	SOLSA	Root	Extractable
Treatment[3]	Rate	Dates	6/6	6/28	7/18	6/28	7/18	6/28	7/18	6/28	7/18	7/18	6/28	yield	sugar
	lb ai/A		%											ton/A	lb/A
Check	-		-	-	-	-	-	-	-	-	-	-	-	26a	6,964a
Broadcast															
Ethofumesate /	1.5 /	5/6,	39cd	21bc	5a	100a	99a	100a	100a	100a	100a	100a	100a	28a	7,544a
Efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31 &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.125 /	5/25													
ethofumesate	0.25	5/31 & 6/10													
11-inch band															
Ethofumesate /	1.5/	5/6	43cd	23bc	8a	100a	100a	100a	99a	100a	100a	100a	100a	36a	9,809a
efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.125 /	5/25													
ethofumesate	0.25	5/31 & 6/10													
Broadcast															
Ethofumesate /	2.25 /	5/6	46bcd	23bc	4a	100a	100a	100a	100a	100a	100a	100a	100a	33a	9,070a
efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.125 /	5/25													
ethofumesate	0.25	5/31 & 6/10													
11-inch band															
Ethofumesate /	2.25 /	5/6,	54abc	29ab	6a	100a	99a	100a	100a	100a	100a	100a	100a	32a	8,857a
efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.125 /	5/25													
ethofumesate	0.25	5/31 & 6/10													
Broadcast															
Ethofumesate /	3.0 /	5/6,	58abc	29ab	3a	99a	100a	100a	100a	100a	100a	100a	100a	31a	8,479a
efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.125 /	5/25													
ethofumesate	0.25	5/31 & 6/10													

Table 2. Continued

						Weed control[2]									
	Application		Crop injury			CHEAL		ECHCG		SETVI		AMARE	SOLSA	Root yield	Extractable sugar
Treatment[3]	Rate	Dates	6/6	6/28	7/18	6/28	7/18	6/28	7/18	6/28	7/18	7/18	6/28		
	lb ai/A		%											ton/A	lb/A
11-inch band															
Ethofumesate /	3.0 /	5/6,	73a	33a	9a	100a	100a	100a	100a	100a	100a	100a	100a	32a	8,575a
efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.125 /	5/25													
ethofumesate	0.25	5/31 & 6/10													
Broadcast															
efs&dmp&pmp +	0.25 +	5/20,	40cd	16c	3a	100a	100a	100a	100a	100a	100a	100a	100a	31a	8,346a
triflusulfuron /	0.0312 /														
efs&dmp&pmp +	0.25 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.75 /	5/25													
ethofumesate	1.375	5/31 & 6/10													
11-inch band															
efs&dmp&pmp +	0.25 +	5/20,	66ab	24abc	4a	100a	98a	100a	100a	100a	99a	100a	100a	31a	8,386a
triflusulfuron /	0.0312 /														
Efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid +	0.094 +	6/10													
ethofumesate /	0.75 /	5/25													
ethofumesate	1.375	5/31 & 6/10													
Broadcast															
Efs&dmp&pmp +	0.25 +	5/20,	31d	15c	3a	99a	99a	100a	100a	100a	99a	100a	100a	31a	8,496a
triflusulfuron /	0.0312 /														
Efs&dmp&pmp +	0.33 +	5/25,													
triflusulfuron +	0.0312 +	5/31, &													
clopyralid	0.094	6/10													

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

[2] Weeds evaluated for control were common lambsquarters (CHEAL), green foxtail (SETVI), barnyardgrass (ECHCG), redroot pigweed (AMARE), and hairy nightshade (SOLSA).

[3] Broadcast applications were made with 11001 flat fan nozzles and band applications were made with 8002 even fan nozzles. Efs&dmp&pmp is a commercial formulation of a 1:1:1 mixture of ethofumesate, desmedipham, and phenmedipham.

Comparison of ethofumesate, desmedipham, and phenmedipham formulations for weed control in sugar beet. Michael P. Quinn, Don W. Morishita, and Robyn C. Walton. (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 new and old ethofumesate & desmedipham & phenmedipham (efs&dmp&pmp) and desmedipham & phenmedipham (dmp&pmp) formulations for weed control and crop safety. These herbicides were applied at the standard rates (0.25 to 0.33 lb ai/A) and micro rates (<0.25 lb ai/A). 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 (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. 'Owyhee' sugar beet was planted May 22, 2005, in 22-inch rows at a rate of 57,024 seed/A. Kochia (KCHSC), redroot pigweed (AMARE), and common lambsquarters (CHEAL) were the major weed species present. 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. Crop injury was evaluated visually 17 days after the first herbicide treatment (DAFT) on June 6. Crop injury and weed control were evaluated visually 13 and 31 days after the last herbicide treatment (DALT) on June 29, and July 18. The two center rows of each plot were harvested mechanically October 6.

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

Application date	May 20	May 25	May 31	June 10	June 16
Application timing	cotyledon	2 leaf	4 leaf	6 leaf	8 leaf
Air temperature (F)	69	70	68	66	84
Soil temperature (F)	64	53	56	53	64
Relative humidity (%)	60	56	48	31	20
Wind speed (mph)	2	5	4	5	2
Cloud cover (%)	25	0	25	15	95
Weed species/ft^2					
kochia	-	-	<1	<1	<1
pigweed, redroot	-	-	1	<1	<1
lambsquarters, common	-	-	1	1	1
foxtail, green	-	-	1	1	1
barnyardgrass	-	-	1	<1	<1
nightshade, hairy	-	-	2	1	2

Crop injury at 17 DAFT ranged from 18 to 38%. Among those treatments with the greatest injury was efs&dmp&pmp-1 (commercial formulation), efs&dmp&pmp-2 (experimental formulation), dmp&pmp-1 (commercial formulation), and dmp&pmp-2 (experimental formulation) applied in combination with triflusulfuron + clopyralid at the standard rates or the micro rates (Table 2). The second crop injury evaluation (13 DALT) ranged from 5 to 14% with the efs&dmp&pmp-2 applied alone sequentially at 0.25 and 0.33 lb ai/A exhibiting the least injury. No difference in crop injury was observed at the third injury evaluation (31 DALT). Redroot pigweed control ranged from 94 to 100% at the first evaluation, and 73 to 100% at the second evaluation. Control was poorer with the experimental formulations alone than the commercial formulation alone or either formulation with the tank mix partners. Common lambsquarters control ranged from 91 to 100% in the first evaluation, and 63 to 100% control in the second evaluation, and followed a pattern similar to redroot pigweed control, although common lambsquarters control appeared to decline in more treatments than redroot pigweed control. Green foxtail control ranged from 91 to 100% at the first evaluation, and 58 to 97% at the second evaluation, and followed a pattern similar to redroot pigweed control. There were no differences among herbicide treatments for barnyardgrass, hairy nightshade, or kochia control at any of the evaluation dates and all herbicide treatments controlled these species $\geq$92%. The only exception to this was efs&pmp&dmp-2 applied alone. In this treatment, green foxtail control was 80% at the second evaluation. Root yield ranged from 28 to 39 tons/A. Among the highest yielding treatments was efs&dmp&pmp-1 at 0.12 lb ai/A + triflusulfuron + clopyralid + MSO at 0.004 + 0.03 lb ai/A + 1.5% v/v, respectively, followed by efs&dmp&pmp-1 plus the same herbicide combination. Extractable sugar yield followed nearly the same order as root yield.

ed control, root

	Applicatio	
Table 2. Cro	Rate	Dat
	b ai/A	
	-	
Treatmen³		
	).25 /	5/20
	).33	5/3
Check	).25 /	5/2
Efs&dmp&p	).33	5/3
Efs&dmp&p	).25 +	5/2
Efs&dmp&p	).0156 /	
Efs&dmp&p	).33 +	5/31
Efs&dmp&p	.0156 +	6/1
triflusulfur	.094	
Efs&dmp&p	.25 +	5/20
triflusulfur	.0156 /	
clopyralid	.33 +	5/31
Efs&dmp&p	.0156 +	6/16
triflusulfur	.094	
Efs&dmp&p	.12 +	5/25
triflusulfur	.004 +	6/10
clopyralid	.03 +	
Efs&dmp&p	5 % v/v	
triflusulfur	12 +	5/20
clopyralid +	.004 +	6/10
MSO	.03 +	
Efs&dmp&p	5% v/v	
triflusulfur	12 +	5/25
clopyralid +	.004 +	
MSO	.03 +	
Efs&dmp&p	5% v/v	
triflusulfur	2 +	
clopyralid +	)04 +	
MSO	)3 +	
Efs&dmp&p	5% v/v	
triflusulfur	12 +	5/20,
clopyralid +	)04 +	
MSO	)3 +	
Efs&dmp&p	% v/v	
triflusulfur	+	6/10
clopyralid +	)04 +	
MSO /	3 +	
Efs&dmp&p	% v/v	
triflusulfur	5 /	5/25
clopyralid +	3	5/31.
MSO		
Dmp&pmp-2		
Dmp&pmp-2		

yield, and extractable sugar yield with different formulations of ethofumesate, desmedipham, and phenmedipham.¹

				Weed control²											
)	Crop injury			AMARE		CHEAL		SETVI		ECHCG		SOLSA	KCHSC	Root yield	Extractable yield
es	6/6	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18		
	---------------					%-------							---------------	ton/A	lb/A
	-	-	-	-	-	-	-	-	-	-	-	-	-	28e	8243e
) , 6/10	24bc	10abc	8a	99bcd	94cde	99ab	86de	96de	68cd	99a	92bc	100a	99a	37ab	10899ab
5 , 6/16	18f	5d	1a	94e	84ef	92c	63f	91f	58d	99a	80cd	100a	100a	32cde	9394cde
5 , 6/10, 5	30bc	14a	6a	100ab	100ab	100a	99ab	98a-d	96a	100a	100a	100a	100a	33b-e	9722b-e
) , 6/10, 5	30bc	10abc	8a	100a	99abc	99ab	100a	99ab	96a	100a	100a	100a	100a	36a-d	10575a-d
, 5/31,)	26cde	8cd	4a	99bcd	96cd	93c	73ef	97cde	86ab	100a	100a	99a	100a	35a-d	10173a-d
), 5/31,)	28bcd	11abc	1a	100ab	100ab	95bc	69f	96de	86ab	100a	98ab	100a	100a	35a-d	10239a-d
, 5/31	28bcd	9bcd	3a	99bcd	99bcd	99ab	100ab	97b-e	91a	100a	100a	100a	99a	37a-d	10671a-d
).5/31)	28bcd	8cd	4a	100abc	99a-d	96bc	96bcd	98a-d	97a	100a	100a	100a	100a	39a	11205ab
5 , 6/10	21ef	8cd	5a	97de	73f	91c	59f	94ef	58d	97a	81d	99a	98a	38ab	11231a

Table 2. Crop injury, weed control, root yield, and extractable sugar yield with different formulations of ethofumesate, desmedipham, and phenmedipham.[1]

						Weed control[2]											
	Application		Crop injury			AMARE		CHEAL		SETVI		ECHCG		SOLSA	KCHSC	Root	Extractable
Treatment[3]	Rate	Dates	6/6	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	yield	yield
	lb ai/A		%													ton/A	lb/A
Check	-		-	-	-	-	-	-	-	-	-	-	-	-	-	28e	8243e
Efs&dmp&pmp-1 /	0.25 /	5/20	24bc	10abc	8a	99bcd	94cde	99ab	86de	96de	68cd	99a	92bc	100a	99a	37ab	10899ab
Efs&dmp&pmp-1	0.33	5/31, 6/10															
Efs&dmp&pmp-2 /	0.25 /	5/25	18f	5d	1a	94e	84ef	92c	63f	91f	58d	99a	80cd	100a	100a	32cde	9394cde
Efs&dmp&pmp-2 +	0.33	5/31, 6/16															
Efs&dmp&pmp-2 +	0.25 +	5/25	30bc	14a	6a	100ab	100ab	100a	99ab	98a-d	96a	100a	100a	100a	100a	33b-e	9722b-e
triflusulfuron /	0.0156 /																
Efs&dmp&pmp-2 /	0.33 +	5/31, 6/10,															
triflusulfuron +	0.0156 +	6/16															
clopyralid	0.094																
Efs&dmp&pmp-1 +	0.25 +	5/20	30bc	10abc	8a	100a	99abc	99ab	100a	99ab	96a	100a	100a	100a	100a	36a-d	10575a-d
triflusulfuron /	0.0156 /																
Efs&dmp&pmp-1 +	0.33 +	5/31, 6/10,															
triflusulfuron +	0.0156 +	6/16															
clopyralid	0.094																
Efs&dmp&pmp-2 +	0.12 +	5/25, 5/31,	26cde	8cd	4a	99bcd	96cd	93c	73ef	97cde	86ab	100a	100a	99a	100a	35a-d	10173a-d
triflusulfuron +	0.004 +	6/10															
clopyralid +	0.03 +																
MSO	1.5 % v/v																
Efs&dmp&pmp-1 +	0.12 +	5/20, 5/31,	28bcd	11abc	1a	100ab	100ab	95bc	69f	96de	86ab	100a	98ab	100a	100a	35a-d	10239a-d
triflusulfuron +	0.004 +	6/10															
clopyralid +	0.03 +																
MSO	1.5% v/v																
Efs&dmp&pmp-2 +	0.12 +	5/25, 5/31	28bcd	9bcd	3a	99bcd	99bcd	99ab	100ab	97b-e	91a	100a	100a	100a	99a	37a-d	10671a-d
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO	1.5% v/v																
Efs&dmp&pmp-2 +	0.2 +																
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO	1.5% v/v																
Efs&dmp&pmp-1+	0.12 +	5/20, 5/31	28bcd	8cd	4a	100abc	99a-d	96bc	96bcd	98a-d	97a	100a	100a	100a	100a	39a	11205ab
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO /	1.5% v/v																
Efs&dmp&pmp-1 +	0.2 +	6/10															
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO	1.5% v/v																
Dmp&pmp-2 /	0.25 /	5/25	21ef	8cd	5a	97de	73f	91c	59f	94ef	58d	97a	81d	99a	98a	38ab	11231a
Dmp&pmp-2	0.33	5/31, 6/10															

Table 2. Continued[1]

						Weed control[2]											
	Application		Crop injury			AMARE		CHEAL		SETVI		ECHCG		SOLSA	KCHSC	Root	Extractable
Treatment[3]	Rate	Dates	6/6	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	6/29	7/18	yield	yield
	lb ai/A		%													ton/A	lb/A
Dmp&pmp-1 /	0.25 /	5/20	23def	9bcd	5a	99bcd	97a-d	98ab	90cd	97b-e	75bc	99a	94bc	100a	100a	37abc	10835abc
Dmp&pmp-1	0.33	5/31, 6/10															
Dmp&pmp-2 +	0.25 +	5/25	30bc	11abc	11a	100abc	99abc	100a	98abc	100a	96a	100a	100a	100a	98a	37a-d	10806abc
triflusulfuron /	0.0156 /																
Dmp&pmp-2 +	0.33 +	5/31, 6/10,															
triflusulfuron +	0.0156 +	6/16															
clopyralid +	0.094 +																
Dmp&pmp-1 +	0.25 +	5/20	23def	11abc	5a	100ab	100a	100a	100ab	99ab	97a	99a	100a	100a	98a	38ab	10936ab
triflusulfuron /	0.0156 /																
Dmp&pmp-1 +	0.33 +	5/31, 6/10,															
triflusulfuron +	0.0156 +	6/16															
clopyralid	0.094																
Dmp&pmp-2 +	0.12 +	5/25, 5/31,	33ab	13ab	4a	98cd	94cde	96bc	96bc	99a-d	91a	100a	100a	100a	96a	32de	9203de
triflusulfuron +	0.004 +	6/10															
clopyralid +	0.03 +																
MSO	1.5% v/v																
Dmp&pmp-1 +	0.12 +	5/20,	38a	11abc	8a	99bcd	99abc	98ab	97abc	97b-e	92a	99a	100a	100a	98a	32cde	9375cde
triflusulfuron +	0.004 +	5/31, 6/10															
clopyralid +	0.03 +																
MSO /	1.5% v/v																
Dmp&pmp-2 +	0.12 +	5/25, 5/31,	33ab	14a	4a	100abc	91de	98ab	95bcd	99a-d	93a	99a	100a	100a	100a	36a-d	10486a-d
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO /	1.5% v/v																
Dmp&pmp-2 +	0.2 +	6/10															
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO	1.5% v/v																
Dmp&pmp-1 +	0.12 +	5/20, 5/31,	28bcd	8cd	3a	100ab	100a	98ab	96bcd	99a-d	96a	99a	100a	100a	100a	38ab	10982ab
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO /	1.5% v/v																
Dmp&pmp-1 +	0.2 +	6/10															
triflusulfuron +	0.004 +																
clopyralid +	0.03 +																
MSO	1.5% v/v																

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

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

[3] Efs&dmp&pmp-1 is the commercial formulation of a 1:1:1 mixture of ethofumesate, desmedipham, and phenmedipham. Efs&dmp&pmp-2 is an experimental formulation of ethofumesate, desmedipham, and phenmedipham. Dmp&pmp-1 is a commercial formulation of a 1:1 mixture of desmedipham and phenmedipham. Dmp&pmp-2 is an experimental formulation of desmedipham and phenmedipham. MSO is methylated seed oil.

Comparison of ethofumesate, desmedipham, and phenmedipham to triflusulfuron alone and in combination. Michael P. Quinn, Don W. Morishita, and Robyn C. Walton. (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 weed control and crop injury of ethofumesate & desmedipham & phenmedipham (efs&dmp&pmp) and triflusulfuron herbicide treatments applied alone and in combination. 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 (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/100g soil. 'Owhyee' sugar beet was planted May 22, 2005, in 22-inch rows at a rate of 57,024 seed/A. Kochia (KCHSC), common lambsquarters (CHEAL), redroot pigweed (AMARE), hairy nightshade (SOLSA), 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 was evaluated visually 17 days after the first herbicide treatment (DAFT) on June 6. Crop injury and weed control were evaluated visually 19 days after the last herbicide treatment (DALT) on June 29. The two center rows of each plot were harvested mechanically October 6.

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

Application date	May 6	May 20	May 25	May 31	June 10
Application timing	pre	cotyledon	2 leaf	4 leaf	6 leaf
Air temperature (F)	62	68	70	68	68
Soil temperature (F)	51	61	65	56	54
Relative humidity (%)	44	57	29	48	30
Wind speed (mph)	7	2	3	4	1
Cloud cover (%)	60	70	0	25	15
Weed species/ft^2					
kochia		2	2	3	3
lambsquarters, common		1	2	1	1
pigweed, redroot		0	<1	<1	<1
nightshade, hairy		1	<1	1	1
foxtail, green		3	4	6	4
barnyardgrass		0	<1	<1	<1

Crop injury 17 DAFT ranged from 4 to 58% (Table 2). At the second evaluation, which was 19 DALT, crop injury ranged from 3 to 26%. The greatest injury at both evaluation dates was with efs&dmp&pmp applied alone at 0.337 lb ai/A followed by sequential applications at 0.42, and 0.73 lb ai/A. Kochia control ranged from 15 to 91% and was poorest in the triflusulfuron alone treatment. Kochia control was best (85 to 90%) with conventional efs&dmp&pmp (0.25, 0.337, and 0.42 lb ai/A) + triflusulfuron (0.0156, 0.0234, and 0.0312 lb ai/A) rates applied sequentially. In addition, preemergence ethofumesate followed by postemergence efs&dmp&pmp + triflusulfuron controlled kochia 85 to 91%. Common lambsquarters control ranged from 92 to 100% and was best in tank mix combination treatments. Hairy nightshade, redroot pigweed, green foxtail, and barnyardgrass control was excellent for all treatments ranging from 98 to 100%. Root yields in this study ranged from 11 to 30 ton/A. Among the highest yielding postemergence treatments were the conventional efs&dmp&pmp + triflusulfuron rates and efs&dmp&pmp applied alone. Treatments containing ethofumesate at 1.5 lb ai/A followed by efs&dmp&pmp + triflusulfuron + clopyralid applied at 0.25 and 0.33 + 0.0156 + 0.094 lb ai/A with or without Wet Sol also were among those treatments with the highest root yields. Extractable sugar yield ranged from 2796 to 8351 lb/A and followed the same order as root yield. Results from this study show that kochia control is better with conventional rates compared to micro rates and that efs&dmp&pmp used at higher than conventional rates will control kochia and other weeds present, but also increases crop injury potential compared to lower rates. However, the higher injury did not cause lower root or extractable sugar yield.

Table 2. Crop injury, weed control, and yield comparing ethofumesate & desmedipham & phenmedipham, and triflusulfuron alone and in combination, near Kimberly, ID.[1]

Treatment[3]	Rate	Application dates	Crop injury		Weed control[2]						Root yield	Extractable yield
			6/6	6/29	KCHSC	CHEAL	SOLSA	SETVI	ECHCG	AMARE		
	lb ai /A		%								ton/A	lb/A
Check	-		-	-	-	-	-	-	-	-	11e	2971e
Efs&dmp&pmp+	0.25+	5/20	44b	16ab	90a	99a	100a	100a	100a	100a	28ab	7540ab
triflusulfuron/	0.0156/											
Efs&dmp&pmp+	0.337+	5/25										
triflusulfuron/	0.0234/											
Efs&dmp&pmp+	0.42+	5/31, 6/10										
triflusulfuron	0.0312											
Triflusulfuron/	0.0156/	5/20	11d	3c	15d	92cb	99a	98c	99a	100a	10e	2796e
Triflusulfuron/	0.0234/	5/25										
Triflusulfuron/	0.0312/	5/31, 6/10										
Efs&dmp&pmp/	0.25/	5/20	39bc	14d	80b	97b	100a	99abc	100a	100a	25abc	6693abc
Efs&dmp&pmp/	0.337/	5/25										
Efs&dmp&pmp/+	0.42/	5/31, 6/10										
Efs&dmp&pmp/	0.337/	5/20	58a	26a	91a	100a	100a	99abc	100a	100a	27ab	7309ab
Efs&dmp&pmp/	0.42/	5/25										
Efs&dmp&pmp/	0.73/	5/31, 6/10										
Efs&dmp&pmp+	0.14+	5/20	38bc	9bc	65c	99a	100a	98bc	100a	100a	22bcd	5912bcd
triflusulfuron+	0.0234+											
clopyralid+	0.0313+											
MSO/	0.5% V/V/											
Efs&dmp&pmp+	0.169+	5/25										
triflusulfuron+	0.0234+											
clopyralid+	0.0313+											
MSO/	0.5% V/V/											
Efs&dmp&pmp+	0.197	5/31										
triflusulfuron+	0.0234											
clopyralid+	0.0313+											
MSO	0.5% V/V											
Efs&dmp&pmp+	0.14+	5/20	40bc	13bc	64c	100a	100a	100ab	100a	100a	15de	4046de
triflusulfuron+	0.0156+											
clopyralid+	0.0313+											
MSO/	0.5% V/V/											
Efs&dmp&pmp+	0.169+	5/25										
triflusulfuron+	0.0188+											
clopyralid+	0.0313+											
MSO/	0.5% V/V/											
Efs&dmp&pmp+	0.197+	5/31										
triflusulfuron+	0.0219+											
clopyralid+	0.0313+											
MSO/	0.5% V/V/											
Efs&dmp&pmp+	0.225+	6/10										
triflusulfuron+	0.0219+											
clopyralid+	0.0313+											
MSO	0.5% V/V											
Efs&dmp&pmp+	0.14+	5/20	39bc	14b	68c	99a	100a	100abc	100a	100a	24abc	6488abc
triflusulfuron+	0.0156+											
clopyralid+	0.0313+											
MSO/	1.5% V/V/											
Efs&dmp&pmp+	0.169+	5/25										
triflusulfuron+	0.0188+											
clopyralid+	0.0313+											
MSO/	1.5% V/V/											
Efs&dmp&pmp+	0.197+	5/31										
triflusulfuron+	0.0219+											
clopyralid+	0.0313+											
MSO/	1.5% V/V/											
Efs&dmp&pmp+	0.225+	6/10										
triflusulfuron+	0.0219+											
clopyralid+	0.0313+											
MSO	1.5% V/V											

Table 2. Continued[1]

Treatment[3]	Rate	Application dates	Crop injury		Weed control[2]						Root yield	Extractable yield
			6/6	6/29	KCHSC	CHEAL	SOLSA	SETVI	ECHCG	AMARE		
	lb ai /A		---%							---%	ton/A	lb/A
Efs&dmp&pmp+	0.125+	5/20	39bc	11bc	66c	100a	100a	100a	100a	100a	19cd	5089cd
triflusulfuron+	0.0104+											
clopyralid+	0.0313+											
MSO/	1.5% V/V/											
Efs&dmp&pmp+	0.25+	5/25, 5/31,										
triflusulfuron+	0.0104+	6/10										
clopyralid+	0.0313+											
MSO	1.5% V/V											
Ethofumesate/	1.5/	5/6	33c	11bc	91a	100a	100a	100a	100a	100a	30a	8239a
Efs&dmp&pmp+	0.25+	5/25										
triflusulfuron+	0.0156+											
clopyralid/	0.094/											
Efs&dmp&pmp+	0.33+	5/31, 6/10										
triflusulfuron+	0.0156+											
clopyralid	0.094											
Ethofumesate+	1.5+	5/6	36bc	15b	85ab	100a	100a	100ab	100a	100a	29a	7945a
Wet Sol/	4 qt/A/											
Efs&dmp&pmp+	0.25+	5/25										
triflusulfuron+	0.0156+											
clopyralid/	0.094											
Efs&dmp&pmp+	0.33+	5/31, 6/10										
triflusulfuron+	0.0156+											
clopyralid	0.094											
Ethofumesate+	1.5+	5/6	36bc	18ab	90a	100a	100a	100a	100a	100a	31a	8351a
Wet Sol/	4 qt/A/											
Efs&dmp&pmp+	0.25+	5/25										
triflusulfuron+	0.0156+											
clopyralid/	0.094											
Efs&dmp&pmp+	0.33+	5/31, 6/10										
triflusulfuron+	0.0156+											
clopyralid	0.094											

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

[2] Weeds evaluated for control on June 29 were kochia (KCHSC), common lambsquarters (CHEAL), hairy nightshade (SOLSA), green foxtail (SETVI), barnyard grass (ECHCG), and redroot pigweed (AMARE).

[3] Efs&pmp&dmp is the commercial formulation of a 1:1:1 mixture of ethofumesate, desmedipham, and phenmedipham sold as Progress. MSO is methylated seed oil. Wet Sol is a proprietary soil conditioning agent.

Comparison of adjuvants used with sugar beet herbicide micro rates. Robyn C. Walton, Don W. Morishita, and Michael P. Quinn. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). Micro herbicide rates have been used in Idaho for the past five years with mixed success. Inconsistency with these lower rates is not clearly understood. Drier conditions, including lower relative humidity than the Red River Valley of North Dakota and Minnesota are thought to be a factor. A field experiment was conducted for the second year at the University of Idaho Research and Extension Center near Kimberly, Idaho to evaluate different adjuvants used with the micro rate in Idaho's drier climate. All micro rate treatments included ethofumesate & desmedipham & phenmedipham (efs&dmp&pmp) + triflusulfuron + clopyralid + an adjuvant or a combination of two adjuvants. 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 (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. 'Owyhee' sugar beet was planted May 2, 2005, in 22-inch rows at a rate of 57,024 seed/A. Kochia (KCHSC), redroot pigweed (AMARE), common lambsquarters (CHEAL), barnyardgrass (ECHCG), green foxtail (SETVI), and hairy nightshade (SOLSA) 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 was visually evaluated June 6, 6 days after last herbicide treatment was applied (DALT). Crop injury and weed control were evaluated visually 19 DALT on June 29. The two center rows of each plot were harvested mechanically October 6.

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

Application date	May 20	May 26	May 31	June 10
Application timing	cotyledon	2 leaf	4 leaf	6 leaf
Air temperature (F)	69	56	68	72
Relative humidity (%)	60	50	48	27
Wind velocity (mph)	2	7	4	5
Soil temperature (F)	64	48	56	61
Cloud cover (%)	25	0	25	30
Weed species (plants/ft^2)				
kochia	1	1	1	1
pigweed, redroot	0	1	<1	1
lambsquarters, common	1	1	1	1
foxtail, green	1	2	2	1
barnyardgrass	0	1	<1	<1
nightshade, hairy	4	<1	<1	<1

Crop injury ranged from 15 to 30% 6 DALT (Table 2). Efs&dmp&pmp applied at the conventional rate (0.25 lb ai/A) + triflusulfuron at the cotyledon stage followed by efs&dmp&pmp + triflusulfuron + clopyralid at 0.33 + 0.0312 + 0.094 lb ai/A at the 2, 4, and 6 leaf stage had the highest injury at 30%. Treatments containing MSO, sucrose, AG 05006, and WE 5040 as the spray adjuvants had the least injury ranging from 15 to 17%. Crop injury decreased to $\leq$10% on June 29 with no differences among herbicide treatments. Kochia control ranged from 57 to 78% control. The conventional rate efs&dmp&pmp + triflusulfuron + clopyralid treatment showed the best kochia control at 78%. All other treatments had unacceptable control (<70%). Micro rate treatments that used only WE 5061 or Rivet® + Interlock® as adjuvants were among those with the poorest kochia control. All treatments controlled redroot pigweed, common lambsquarters, hairy nightshade, green foxtail, and barnyardgrass 97% or better with no difference among any herbicide treatments. Root yield ranged from 8 to 23 ton/A. All herbicide treatments had higher root and extractable sugar yield than the untreated check. The conventional efs&dmp&pmp + triflusulfuron + clopyralid treatment had the highest root and extractable sugar yield at 23 tons/A and 6770 lb/A, respectively. Micro rate treatments that included sucrose or WE 5060 adjuvants were among the other highest yielding treatments at 21 and 22 ton/A, respectively. Extractable sugar yield of the same two treatments were 5926 and 6427 lb/A. Based on this study and previous studies, weed control and crop yield with the micro rates tend to lag behind weed control and yield with the conventional herbicide rates when kochia is present. However, addition of sucrose to MSO and WE5060 adjuvant show some promise for use in micro rate applications in Southern Idaho.

Table 2. Crop injury, weed control, root and extractable sugar yield with micro rates applied with different adjuvants in sugar beet near Kimberly, Idaho.[1]

	Application		Crop injury		Weed control[2]						Root	Extractable
Treatment[3]	rate	dates	6/6	6/29	KCHSC	AMARE	CHEAL	SOLSA	SETVI	ECHCG	yield	sugar
	lb ai/A		----------	----------	----------	----------	%	----------	----------	----------	ton/A	lb/A
Check			-	-	-	-	-	-	-	-	8e	2318e
Efs&dmp&pmp +	0.0833 +	5/20	17c	5a	67b	99a	98a	100a	94a	100a	14d	4316cd
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
MSO /	1.5% v/v /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
MSO	1.5% v/v											
Efs&dmp&pmp +	0.0833 +	5/20	15c	7a	63bc	100a	97a	100a	98a	100a	22ab	6427ab
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
MSO +	1.5% v/v +											
Sucrose /	0.5 /											
Efs&dmp&pmp +	0.125 +											
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
MSO +	1.5% v/v /											
Sucrose	0.5											
Efs&dmp&pmp +	0.0833 +	5/20	19bc	6a	65b	99a	97a	100a	97a	100a	17bcd	4752bcd
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
Destiny +	1.5% v/v +											
Interlock /	4 fl oz/A /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
Destiny +	1.5% v/v +											
Interlock	4 fl oz/A											

Table 2. Continued[1]

	Application		Crop injury		Weed control[2]						Root	Extractable
Treatment[3]	rate	dates	6/6	6/29	KCHSC	AMARE	CHEAL	SOLSA	SETVI	ECHCG	yield	sugar
	lb ai/A		-------------------	-------------------	-------------------	-------------------	%-------------------	-------------------	-------------------	-------------------	ton/A	lb/A
Efs&dmp&pmp +	0.0833 +	5/20	15c	5a	63bc	100a	98a	100a	99a	100a	19a-d	5440a-d
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
AG 05006 +	1.5% v/v +											
Interlock /	4 fl oz/A /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
AG 05006 +	1.5% v/v +											
Interlock	4 fl oz/A											
Efs&dmp&pmp +	0.0833 +	5/20	23abc	9a	58c	99a	97a	99a	100a	100a	17bcd	4889bcd
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
Rivet +	1.5% v/v +											
Interlock /	4 fl oz/A /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
Rivet +	1.5% v/v +											
Interlock	4 fl oz/A											
Efs&dmp&pmp +	0.0833 +	5/20	21abc	5a	63bc	99a	98a	100a	99a	100a	15d	4245cd
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
Rivet +	1.75% v/v +											
Interlock /	4 fl oz/a /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
Rivet +	1.75% v/v +											
Interlock	4 fl oz/A											

Table 2. Continued[1]

	Application		Crop injury		Weed control[2]						Root	Extractable
Treatment[3]	rate	dates	6/6	6/29	KCHSC	AMARE	CHEAL	SOLSA	SETVI	ECHCG	yield	sugar
	lb ai/A		%								ton/A	lb/A
Efs&dmp&pmp +	0.0833 +	5/20	15c	6a	60bc	100a	99a	100a	99a	100a	14de	3990de
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
WE 5040 +	0.5% v/v +											
UAN 28% /	0.0875 /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
WE 5040 +	0.5% v/v +											
UAN 28%	0.0875											
Efs&dmp&pmp +	0.0833 +	5/20	20bc	8a	66b	100a	99a	100a	98a	100a	21abc	5926abc
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
WE 5060 /	0.219 /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
WE 5060	0.219											
Efs&dmp&pmp +	0.0833 +	5/20	27ab	10a	57c	99a	98a	100a	97a	100a	14de	4119d
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
WE 5061 /	0.25 /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
WE 5061	0.25											

Table 2. Continued[1]

	Application		Crop injury		Weed control[2]						Root	Extractable
Treatment[3]	rate	dates	6/6	6/29	KCHSC	AMARE	CHEAL	SOLSA	SETVI	ECHCG	yield	sugar
	lb ai/A		--				%			--	ton/A	lb/A
Efs&dmp&pmp +	0.0833 +	5/20	19bc	5a	60bc	100a	98a	100a	99a	100a	14de	4079d
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
WE 5033 +	0.5 +											
UAN 28% /	0.0875 /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
WE 5033 +	0.5 +											
UAN 28%	0.0875											
Efs&dmp&pmp +	0.0833 +	5/20	20bc	4a	61bc	100a	98a	100a	98a	100a	15cd	4380cd
triflusulfuron +	0.0104 +											
clopyralid +	0.0313 +											
WE 5061 +	0.25 +											
WE 5050 /	0.0156 /											
Efs&dmp&pmp +	0.125 +	5/26, 5/31										
triflusulfuron +	0.0104 +	& 6/10										
clopyralid +	0.0313 +											
WE 5061 +	0.25 +											
WE 5050	0.0156											
Efs&dmp&pmp +	0.25 +	5/20	30a	10a	78a	100a	99a	100a	100a	100a	23a	6770a
triflusulfuron /	0.0312 /											
Efs&dmp&pmp +	0.33 +	5/26, 5/31										
triflusulfuron +	0.0312 +	& 6/10										
clopyralid	0.094											

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

[2] Weeds evaluated for control were kochia (KCHSC), redroot pigweed (AMARE), common lambsquarters (CHEAL), hairy nightshade (SONOL), green foxtail (SETVI), and barnyard grass (ECHCG). Weed control was evaluated on June 29.

[3] Efs&dmp&pmp is a 1:1:1 commercial formulation of ethofumesate, desmedipham, and phenmedipham. MSO is methylated seed oil. Sucrose is granulated table sugar. Destiny is methylated soybean oil. Interlock is a deposition and drift reducing agent. Rivet is methylated soybean oil. UAN 28% is a 28% solution of urea ammonium nitrate. AG 5006, WE 5040, WE 5060, WE 5061, WE 5033, and WE 5050 are all experimental proprietary adjuvants.

Late season weed control in sugar beet. Don W. Morishita, Michael P. Quinn, and Robyn C. Walton. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). Weed control near or after row closure using glyphosate in wiper or wick applicators is becoming more widespread in Idaho. However, some growers have experienced some crop injury and some weeds have escaped control with glyphosate. Thus, other herbicide combinations would be helpful to control some of the weeds glyphosate does not effectively control. A field experiment was conducted at the University of Idaho Research and Extension Center near Kimberly, Idaho to compare late season control methods on crop injury, weed control, and sugar beet yield. Experimental design was a randomized complete block with four replications. Individual plots were four rows by 50 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. 'Owyhee' sugar beet was planted May 2, 2005, in 22-inch rows at a rate of 57,024 seed/A. Kochia (KCHSC), common lambsquarters (CHEAL), redroot pigweed (AMARE), barnyardgrass (ECHCG), and green foxtail (SETVI) were the major weed species present. Herbicides were applied as broadcast applications or using a wiper applicator. Broadcast herbicides were applied with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa using 8001 flat fan nozzles. The wiper applicator, manufactured by Agriweld, Inc. is a tractor-pulled implement equipped with a hydraulic-driven rotating 4-inch tube, covered with carpet. A concentrated herbicide solution is sprayed onto the carpet surface with flat fan nozzles positioned above the carpet. The carpeted tube rotates against a carpeted backboard, providing friction necessary to create a thick foam. The foam on the carpet-covered tube is pulled over the top of the beets contacting only those plants above the crop canopy. Additional environmental and application information is given in Table 1. Crop injury was evaluated visually on June 6, July 22, and August 15. The two center rows of each plot were harvested mechanically October 4.

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

Application date	May 6	May 24	May 31	June 2	July 13	August 4
Application timing	pre	post	4 leaf	4 leaf	late season	late season
Air temperature (F)	62	62	68	51	83	69
Relative humidity (%)	44	47	48	61	45	54
Wind velocity (mph)	7	9	4	3	3	4
Soil temperature (F)	51	56	56	44	73	59
Cloud cover (%)	60	0	25	10	0	0
Weed species (plants/ft^2)						
kochia		1	1	1	<1	<1
pigweed, redroot		0	1	<1	<1	<1
lambsquarters, common		1	1	1	<1	<1
foxtail, green		1	1	1	<1	<1
barnyardgrass		0	<1	<1	<1	<1

Crop injury on June 6, which was before any of the late season weed control applications were made, ranged from 16 to 26% among herbicide treatments. This injury was higher than the hand weeded control treatment, which averaged 3% injury (Table 2). Crop injury ratings on July 22, which was 9 days after the first late weed control treatments were applied, ranged from 0 to 13% among the treatments receiving glyphosate or glyphosate + fluroxypyr or mesotrione. Crop injury rating on August 15, which was 11 days after the second late weed control applications, ranged from 0 to 31%. Glyphosate + mesotrione, each applied at 12.5% v/v had the highest (31%) injury. Using a 50% v/v glyphosate concentration compared to 25 and 37.5% did not injure the crop more in this experiment. In 2004, the 50% v/v injured sugar beet more than the lower concentrations. Overall, the hand weeded check had the best weed control. Ethofumesate applied preemergence followed by two ethofumesate &desmedipham &phenmedipham (efs&dmp&pmp) + triflusulfuron + clopyralid applications was among the herbicide treatments with the best overall weed control, although kochia control averaged only 63 and 56% at each evaluation. Kochia control with efs&dmp&pmp + triflusulfuron + clopyralid applied two times followed by a late season weed control treatment including mowing once or twice was better than efs&dmp&pmp + triflusulfuron + clopyralid applied two times without a late season weed control treatment. This shows that a late season glyphosate wiper application can improve kochia control. All weed control treatments had yields greater than the untreated check, which averaged 18 ton/A root yield and 5,195 lb/A sugar yield. Among the highest yielding treatments were the hand weeded control, glyphosate at 25 and 50% v/v, mowing one or two times, and late season hand weeding.

Table 2. Crop injury, weed control, root, and extractable sugar yield using a wiper applicator for late season weed control in sugar beet near Kimberly, Idaho.[1]

							Weed control[2]											
	Application		Crop injury[3]				KCHSC		CHEAL		AMARE		SETVI		ECHCG		Root	Sugar
Treatment[4]	Rate	Dates	6/6	7/22	8/15	10/4	7/22	8/15	7/22	8/15	7/22	8/15	7/22	8/15	7/22	8/15	yield	yield
	lb ai/A		%														ton/A	lb/A
Check	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	18d	5195d
Hand weeded	-	-	3b	1cd	5cde	0b	96a	99a	84e	99abc	86a	98a	83bcd	97a	98ab	98a	32a	9150a
Ethofumesate / Efs&dmp&pmp + triflusulfuron + clopyralid / Efs&dmp&pmp + triflusulfuron + clopyralid	1.25 / 0.25 + 0.0156 + 0.094 / 0.33 + 0.0156 + 0.094	5/6 5/25 5/31	16a	0d	0e	0b	63cd	56ef	100a	99ab	100a	100a	98a	89ab	99a	84bc	26bc	7565abc
Efs&dmp&pmp + triflusulfuron + clopyralid	0.25 + 0.0156 + 0.094	5/24 & 6/2	26a	0d	0e	0b	43e	35g	99ab	96a-d	99a	98a	75cde	71c	94abc	80b-e	25bc	7195bc
Efs&dmp&pmp + triflusulfuron + clopyralid / Glyphosate	0.25 + 0.0156 + 0.094 / 25% v/v	5/24 & 6/2 7/13 & 8/4	24a	4bcd	8b-e	1ab	71bc	70de	100a	100a	100a	99a	74de	73c	91bc	81b-e	28ab	8013ab
Efs&dmp&pmp + triflusulfuron + clopyralid / Glyphosate	0.25 + 0.0156 + 0.094 / 37.5% v/v	5/24 & 6/2 7/13 & 8/4	21a	9ab	10bc	2a	76b	69def	91b-e	79e	96a	93a	74de	68c	90cd	83bcd	26bc	7497bc
Efs&dmp&pmp + triflusulfuron + clopyralid / Glyphosate	0.25 + 0.0156 + 0.094 / 50% v/v	5/24 & 6/2 7/13 & 8/4	18a	5bcd	14b	2a	79b	84bc	89de	87de	96a	93a	70e	68c	89cd	74c-f	29ab	8307ab
Efs&dmp&pmp + triflusulfuron + clopyralid / Glyphosate + fluroxypyr	0.25 + 0.0156 + 0.094 / 12.5% v/v+ 12.5% v/v	5/24 & 6/2 7/13 & 8/4	26a	13a	14b	2a	75b	59def	97a-d	90cde	97a	97a	77cde	67c	83cd	70ef	21cd	6008cd
Efs&dmp&pmp + triflusulfuron + clopyralid / Glyphosate + mesotrione	0.25 + 0.0156 + 0.094 / 12.5% v/v+ 12.5% v/v	5/24 & 6/2 7/13 & 8/4	23a	8ab	31a	1ab	64cd	71cde	95a-e	87de	97a	92a	83bc	70c	86cd	73c-f	21cd	6032cd

Table 2. Continued.[1]

							Weed control[2]											
	Application		Crop injury[3]				KCHSC		CHEAL		AMARE		SETVI		ECHCG			
Treatment[4]	Rate	Dates	6/6	7/22	8/15	10/4	7/22	8/15	7/22	8/15	7/22	8/15	7/22	8/15	7/22	8/15	Root yield	Sugar yield
	lb ai/A		%														ton/A	lb/A
Efs&dmp&pmp + triflusulfuron + clopyralid / Mow one time	0.25 + 0.0156 + 0.094 /	5/24 & 6/2 7/13	21a	0d	1de	0b	59d	54f	89cde	86de	92a	88a	73de	68c	78d	64f	28ab	8043ab
Efs&dmp&pmp + triflusulfuron + clopyralid / Efs&dmp&pmp + triflusulfuron / Mow two times	0.25 + 0.0156 + 0.094 / 0.25 + 0.0156 / -	5/24 5/31 7/13 & 8/4	21a	0d	5cde	0b	69bcd	74cd	99abc	93b-e	99a	99a	81cd	73c	90cd	71def	30ab	8360ab
Efs&dmp&pmp + triflusulfuron + clopyralid / Hand weed (late)	0.25 + 0.0156 + 0.094 / -	5/24 & 6/2 7/13	18a	6bc	9bcd	0b	96a	92b	97a-d	97a-d	98a	97a	91ab	86b	99a	86ab	29ab	8137ab

[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), redroot pigweed (AMARE), green foxtail (SETVI), and barnyardgrass (ECHCG).

[3] Crop injury rating on October 4 was based on a visual evaluation of the harvested roots from each plot and was rated on a scale of 0 to 10 where 0 = no injury and 10 = completely dead root.

[4] Hand weeded treatment was hand weeded several times during the season as needed. Efs&dmp&pmp is a 1:1:1 commercial formulation of ethofumesate, desmedipham, and phenmedipham. Glyphosate used was Honcho.

<u>Volunteer potato interference in sugar beet</u>. Don W. Morishita, Michael P. Quinn, and Robyn C. Walton. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). Sugar beet often follows potato in southern Idaho crop rotations. Depending on the number of tubers left in the field, tillage practices following harvest, and subsequent environmental conditions, volunteer potatoes can be a significant plant pest in sugar beet production. A field experiment was initiated 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 (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. 'Owyhee' sugar beet was planted May 2, 2005, 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. Herbicides were broadcast-applied with a CO_2-pressurized bicycle-wheel sprayer calibrated to deliver 15 gpa using 8001 flat fan nozzles. Hand weeding was used to control other weeds not controlled by the herbicides. Additional environmental and application information is given in Table 1. Eight potato plants from the two center rows in each plot were harvested by hand on September 28. Harvested tubers were weighed individually, counted, and sorted by size. The two center rows of sugar beet in each plot were harvested mechanically October 5.

Table 1. Environmental condition at application.

Application date	May 20	May 24	May 31
Application timing	cotyledon	2 leaf	4 leaf
Air temperature (F)	77	62	68
Relative humidity (%)	49	47	48
Wind velocity (mph)	1	9	4
Soil temperature (F)	60	56	56
Cloud cover (%)	30	0	25

Volunteer potato yield increased with increasing plant density for all tuber sizes measured (Table 2). At the highest volunteer potato plant density, total tuber yield was 21,153 lb/A, which equated to 91,811 tubers/A. 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 -0.74 and -0.76, respectively. With no volunteer potato, sugar beet root and extractable sugar yield averaged 36 ton and 10,388 pounds per acre, respectively. At the lowest potato density (2,728 plants/A), sugar beet root yield was reduced 25% and at the highest density (16,335 plants/A), root yield was reduced 61%. Further analysis of the data will be conducted following the second year of this experiment in 2006.

Table 2. Tuber weight and tuber number in volunteer potato density competition in sugar beets near Kimberly, Idaho.[1]

	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------					ton/A	lb/A
No potato	0d	0e	0g	0d	0e	0d	0f	0f	0e	0f	36a	10,388a
2,728 plants/A	161cd	1,327d	1216f	2,588cd	5,346d	3,921c	9,091e	4,068e	4,420de	22,251e	27b	7,218bc
4,084 plants/A	169cd	2,421c	1644ef	4,297bc	8,611cd	4,416c	15,674d	5,342e	6,953cd	32,631d	29b	8,362b
5,445 plants/A	250bc	2,543c	2641cd	5,372abc	10,911bc	6,441bc	16,318cd	8,464cd	9,746a-d	41,242c	26bc	7,102bc
6,806 plants/A	267bc	2,894c	2227de	4,934abc	10,363bc	7,822abc	20,636bc	7,424d	9,093bcd	45,940bc	27b	7,469bc
8,168 plants/A	180cd	3,974b	3094bc	6,145ad	13,417b	5,064c	26,046b	10,418bc	11,276abc	53,255b	21cd	5,924cd
10,890 plants/A	562a	5,163b	3882ab	7,654ab	17,576a	15,628a	36,987a	12,878ab	13,936ab	80,866a	19d	5,281de
16,335 plants/A	437ab	6,990a	5168a	8,268a	21,153a	12,309ab	46,334a	17,283a	15,288a	91,811a	14e	3,757e

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

[2] Volunteer potato was 'Russet Burbank'.

Sugar beet tolerance to glyphosate formulations and rates. 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 evaluate glyphosate formulations and rates for crop tolerance and weed control in glyphosate resistant 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 (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. '3h010ARR' sugar beet was planted May 2, 2005, in 22-inch rows at a rate of 57,024 seed/A. Green foxtail (SETVI), redroot pigweed (AMARE), common lambsquarters (CHEAL), and hairy nightshade (SONOL) 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 was evaluated visually 17, 39, 59, and 66 day after first treatment (DAFT) on June 6, June 28, July 18 and July 25, respectively. Weed control was evaluated visually 39 days after the first herbicide treatment (DAFT) on June 28. The two center rows of each plot were harvested mechanically October 3.

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

Application date	May 20	May 25	May 31	June 10	June 23	July 11
Application timing	cotyledon	2 leaf	4 leaf	6 leaf	10 leaf	row close
Air temperature (F)	68	56	61	66	66	68
Relative humidity (%)	57	45	61	31	50	57
Wind velocity (mph)	2	8	2	5	3	3
Soil temperature (F)	61	55	50	53	62	62
Cloud cover (%)	70	0	30	15	0	0
Weed species (plants/ft^2)						
pigweed, redroot	0	1	1	1	1	
lambsquarters, common	1	1	1	1	1	
foxtail, green	1	2	1	1	1	
nightshade, hairy	5	4	1	3	1	

Crop injury with the glyphosate treatments ranged from 3 to 6% on June 6 and from 0 to 4% on June 28 (Table 2). Ethofumesate & desmedipham & phenmedipham (efs&dmp&pmp) + triflusulfuron at 0.25 + 0.0156 lb ai/A applied at the at the cotyledon stage followed by efs&dmp&pmp + triflusulfuron + clopyralid at 0.33 + 0.0156 + 0.094 lb ai/A applied at the 2, 4, and 6 leaf stage had the most injury (20 and 15%) at each evaluation date. By July 18, little or no injury was observed in any herbicide treatment. Crop injury ranged from 0 to 6% with no differences among herbicide treatments for either July evaluation. All herbicide treatments controlled green foxtail, redroot pigweed, common lambsquarters, and hairy nightshade ≥95% with no difference among herbicide treatments. Root yield for all herbicide treatments ranged from 34 to 40 ton/A and were all greater than the untreated check, which yielded 28 ton/A. Glyphosate applied at 2 lb ae/A (the highest rate) had a 40 ton/A root yield and 13,307 lb/A extractable sugar yield, both of which were among the highest yielding treatments. There was no apparent difference in crop response or weed control to any of the glyphosate formulations.

Table 2. Crop injury, weed control, root and extractable sugar yield in glyphosate resistant sugar beet near Kimberly, Idaho.[1]

Treatment[3]	Application rate[4]	Application dates	Crop injury				Weed control[2]				Root yield	Extractable sugar
			6/6	6/28	7/18	7/25	SETVI	AMARE	CHEAL	SOLSA		
	lb ae/A		%								ton/A	lb/A
Check			-	-	-	-	-	-	-	-	28c	9695c
Glyphosate + ammonium sulfate	0.75 + 5% v/v	5/20, 5/31, 6/23 & 7/11	3b	0b	1a	1a	100a	100a	99a	98a	34b	11763b
Glyphosate + ammonium sulfate	1.5 + 5% v/v	5/20, 5/31, 6/23 & 7/11	5b	1b	4a	4a	99a	100a	100a	99a	38ab	13276a
Glyphosate + ammonium sulfate	2 + 5% v/v	5/20, 5/31, 6/23 & 7/11	3b	1b	0a	1a	99a	100a	100a	99a	40a	13307a
Glyphosate-1 + ammonium sulfate	1.5 + 5% v/v	5/20, 5/31, 6/23 & 7/11	6b	3b	4a	4a	99a	100a	100a	97a	36ab	12301ab
Glyphosate-2 + ammonium sulfate	1.5 + 5% v/v	5/20, 5/31, 6/23 & 7/11	5b	1b	6a	5a	99a	100a	99a	99a	36ab	11982ab
Glyphosate-3 + ammonium sulfate	1.5 + 5% v/v	5/20, 5/31, 6/23 & 7/11	4b	1b	5a	5a	99a	100a	100a	98a	34b	11434b
Glyphosate + ammonium sulfate/	0.75 + 5% v/v/	5/25 & 6/10	6b	4b	4a	5a	99a	98a	95b	99a	35ab	11862ab
Glyphosate + ammonium sulfate + pyraclostrobin	0.75 + 5% v/v + 0.196	7/11										
Efs&dmp&pmp + triflusulfuron/	0.25 0.0156	5/20	20a	15a	3a	1a	99a	99a	100a	99a	34b	11603b
Efs&dmp&pmp + triflusulfuron + clopyralid	0.33 0.0156 0.094	5/25, 5/31 & 6/10										

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

[2] Weeds evaluated for control were green foxtail (SETVI), redroot pigweed (AMARE), common lambsquarters (CHEAL), and hairy nightshade (SOLSA). Weed control was evaluated on June 28.

[3] Efs&dmp&pmp is a commercial formulation of a 1:1:1 mixture of ethofumesate, desmedipham, and phenmedipham. Glyphosate is Roundup Ultra Max II,. Glyphosate-1 is MON 79670 and glyphosate-2 isMON 79710, and glyphosate-3 is Roundup Original Max.

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

Application timing and herbicide tank mixtures with glyphosate formulations applied to glyphosate resistant sugar beet. Michael P. Quinn, Don W. Morishita, and Robyn C. Walton. (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 evaluate glyphosate application timing and soil-active herbicide tank mixtures with glyphosate for crop injury and weed control in glyphosate resistant 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 (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. '3H010ARR' sugar beet was planted May 2, 2005, in 22-inch rows at a rate of 57,024 seed/A. Kochia (KCHSC), common lambsquarters (CHEAL), redroot pigweed (AMARE), green foxtail (SETVI) 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 was evaluated visually 31, 42, and 49 days after the first herbicide treatments (DAFT) were applied. Crop injury and weed control were evaluated visually 53 and 144 DAFT on June 28 and September 28. The two center rows of each plot were harvested mechanically October 3.

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

Application date	May 6	May 20	May 25	May 31	June 10	June 16	June 23	July 11
Application timing	PRE	cotyledon	2 leaf	4 leaf	6 leaf	8 leaf	10 leaf	row close
Air temperature (F)	62	68	56	62	66	84	66	68
Soil temperature (F)	60	61	55	48	53	64	62	62
Relative humidity (%)	44	57	45	59	31	20	50	57
Wind speed (mph)	7	2	8	2	5	2	3	1
Cloud cover (%)	60	70	0	25	15	95	0	0
Weed species/ft^2								
pigweed, redroot	1	<1	<1	<1	<1	<1	<1	<1
lambsquarters, common	0	1	<1	<1	<1	<1	<1	<1
foxtail, green	1	1	1	1	1	1	1	<1
nightshade, hairy	2	1	2	2	2	1	1	<1

Crop injury at 31 DAFT ranged from 3 to 20% and was greatest with ethofumesate applied preemergence followed by ethofumesate & desmedipham & phenmedipham (efs&dmp&pmp) + triflusulfuron + clopyralid applied postemergence. The other non-glyphosate treatment consisting of efs&dmp&pmp + triflusulfuron + clopyralid applied postemergence also had 14% injury at 31 DAFT (Table 2). By the second evaluation (42 DAFT) crop injury had declined to 0 to 8% and only differed between the ethofumesate + efs&dmp&pmp + triflusulfuron + clopyralid treatment and the rest of the treatments. Further injury evaluations revealed no differences among herbicide treatments. Common lambsquarters, redroot pigweed, green foxtail, and hairy nightshade control were generally excellent ranging from 97 to 100%, and did not differ among herbicide treatments at either evaluation date. Root yield ranged from 25 to 38 ton/A with all treatments. All glyphosate treatments except glyphosate + s-metolachlor had higher root and extractable sugar yields than the check. Extractable sugar yield followed the same order as root yield.

Table 2. Crop injury, weed control, root and extractable sugar yield in glyphosate tolerant sugar beet near Kimberly, Idaho[1]

								Weed control[2]								
	Application		Crop injury					CHEAL		AMARE		SETVI		SOLSA	Root	Extractable
Treatment[3]	Rate[4]	Dates	6/6	6/28	7/18	7/25	9/28	6/28	9/28	6/28	9/28	6/28	9/28	6/28	yield	sugar
	lb ai/ A		%												ton/A	lb/A
Check	-		-	-	-	-	-	-	-	-	-	-	-	-	25c	8569c
Glyphosate+ AMS	0.75 lb ae/A+ 5% v/v	5/25, 6/23	3c	0b	3a	3a	3a	99a	99a	100a	100a	99a	100a	100a	38a	13207a
Ethofumesate/ glyphosate	1.0/ 0.75	5/6 5/25, 6/23	4bc	0b	3a	3a	1a	100a	100a	100a	100a	100a	100a	100a	35ab	12359ab
Glyphosate+ AMS	0.75 lb ae/A+ 5% v/v	5/25, 6/10, 7/11	3c	0b	4a	4a	3a	98a	100a	97a	100a	99a	100a	100a	36ab	11656ab
Efs&dmp&pmp+ triflusulfuron+ MSO	0.08+ 0.004 + 1.5% v/v	5/20, 5/25, 5/31,6/10	14ab	3b	0a	0a	3a	97a	98a	100a	100a	100a	99a	100a	31abc	10950abc
Ethofumesate/ Efs&dmp&pmp+ triflusulfuron+ clopyralid+ MSO	1.0/ 0.08 + 0.004 + 0.03 + 1.5% v/v	5/6 5/20, 5/25, 5/31, 6/10, 6/16	20a	8a	4a	3a	1a	100a	100a	100a	100a	100a	99a	100a	30bc	10021bc
Glyphosate+ AMS+ dimenthamid-P Glyphosate+ AMS	0.75 lb ae/A+ 5% v/v+ 0.843 0.75 lb ae/A+ 5% v/v	5/25 6/10	9bc	0b	1a	3a	0a	99a	100a	100a	100a	100a	100a	99a	37ab	12349ab
Glyphosate+ AMS/ S-metolachlor	0.75 lb ae/A+ 5% v/v/ 0.95	5/25, 6/16 7/11	3c	1b	4a	6a	1a	99a	99a	99a	100a	100a	100a	99a	31abc	10310bc
Glyphosate+ AMS+ clopyralid/ Glyphosate+ AMS	0.75 lb ae/A+ 5% v/v+ 0.1875 / 0.75 lb ae/A+ 5% v/v	5/25 6/16	8bc	1b	1a	0a	1a	100a	99a	100a	98a	100a	99a	100a	37ab	12688ab

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

[2] Weeds evaluated for control were common lambsquarters (CHEAL), redroot pigweed (AMARE), green foxtail (SETVI), hairy nightshade (SOLSA), barnyard grass (ECHCG).

[3] Efs&dmp&pmp is a the commercial formulation of a 1:1:1 mixture of ethofumesate, desmedipham, and phenmedipham sold as Progress. AMS is ammonium sulfate.

[4] All glyphosate rates are expressed as pounds acid equivalent per acre (lb ae/A).

Ethofumesate carry over injury potential in spring wheat and barley. Don W. Morishita, Michael P. Quinn, and Robyn C. Walton. (Twin Falls Research and Extension Center, University of Idaho, Twin Falls, ID 83303-1827). 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 in if they plan to grow wheat or barley the following year or plant a different crop. A study was initiated in April 2004 at the University of Idaho Research and Extension Center near Kimberly, Idaho to determine crop injury potential of small grain cereals to various ethofumesate rates and timing of application made on sugar beet planted in 2004. Spring wheat ('Alpowa') and spring barley ('Moravian 69') were planted April 7, 2005, at 100 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 Rad 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. Sugar beet herbicide treatments applied in 2004 were 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 fenoxaprop at 0.08 lb ai/A + thifensulfuron & tribenuron at 0.014 lb ai/A + fluroxypyr at 0.125 lb ai/A + nonionic surfactant at 0.25% v/v was applied May 20, 2005, for wild oat and broadleaf weed control. This herbicide treatment was applied with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 19 psi. Additional environmental and application information from 2004 and 2005 is given in Table 1. Crop injury was evaluated visually 361 and 479 days after last herbicide treatment (DALT) on June 3 and June 29, respectively. Barley and wheat was harvested separately on August 9 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	4/26/04	5/4/04	5/13/04	5/24/04	6/7/04	5/20/05
Application timing	pre	cotyledon	2 leaf	post	post	post
Air temperature (F)	80	72	55	53	67	78
Relative humidity (%)	18	32	60	62	31	49
Wind velocity (mph)	1	4	5	6	2	2
Soil temperature (F)	62	58	51	50	59	62
Cloud cover (%)	0	0	50	80	5	30

None of the herbicide treatments injured wheat or barley greater than 9% (Table 2). Differences in wheat and barley injury was observed among herbicide treatments in both wheat evaluations and the first barley evaluation. However, none of the injury affected grain yield. Interestingly, treatments with a 0% injury rating were among the highest ethofumesate rates applied. Variation in crop injury among all treatments was likely due more to environmental and edaphic variability in the study site. No difference in grain yield was observed among the treatments. Grain yield ranged from 63 to 87 bu/A in wheat and 57 to 93 bu/A in barley. Similar to the variability in crop injury, yield variability also was attributed to factors not associated with the herbicide treatments. Based on one year of data, it appears that ethofumesate does not carryover to affect planting wheat or barley the following year, regardless of whether it 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). A second year of planting sugar beet and applying ethofumesate has been completed and wheat and barley will be planted in 2006 to determine if any ethofumesate persists to injure these small grain cereals.

Table 2. Carryover potential of ethofumesate in wheat and barley.[1]

			Crop injury					
		Application	TRZAS		HORVS		Grain yield	
Treatment[3]	Rate	dates (2004)	6/3/05	6/29/05	6/3/05	6/29/05	TRZAS	HORVS
	lb ai/A		---------------------%----------------------				---------bu/A----------	
Check	-		-	-	-	-	87a	77a
Ethofumesate (11-inch band)/	1.5/	4/26	5a	1cd	8a	4a	77a	76a
efs&dmp&pmp (11-inch band)	0.33	5/13, 5/24, 6/7						
Ethofumesate (11-inch band)/	1.5/	4/26	1a	3bcd	0c	3a	82a	83a
efs&dmp&pmp (broadcast)	0.33	5/13, 5/24, 6/7						
Ethofumesate (11-inch band)/	2.25/	4/26	0a	1cd	0c	1a	79a	73a
efs&dmp&pmp (11-inch band)	0.33	5/13, 5/24, 6/7						
Ethofumesate (11-inch band)/	2.25/	4/26	0a	3bcd	1bc	1a	73a	74a
efs&dmp&pmp (broadcast)	0.33	5/13, 5/24, 6/7						
Ethofumesate/ (11-inch band)/	3.0/	4/26	3a	0d	5ab	0a	84a	93a
efs&dmp&pmp (11-inch band)	0.33	5/13, 5/24, 6/7						
Ethofumesate/ (11-inch band)/	3.0/	4/26	4a	3bcd	0c	5a	77a	79a
efs&dmp&pmp (broadcast)	0.33	5/13, 5/24, 6/7						
Efs&dmp&pmp (11-inch band)/	0.25/	5/4	1a	5abc	4abc	8a	67a	74a
efs&dmp&pmp (11-inch band)/	0.25/	5/13, 5/24, 6/7						
ethofumesate (11-inch band)/	0.75/	5/13						
ethofumesate (11-inch band)	1.375	5/24, 6/7						
Efs&dmp&pmp (broadcast)/	0.25/	5/4	5a	6ab	3bc	4a	63a	57a
efs&dmp&pmp (broadcast)/	0.33/	5/13, 5/24, 6/7						
ethofumesate (broadcast)/	0.75/	5/13						
ethofumesate (broadcast)	1.375	5/24, 6/7						
Efs&dmp&pmp (broadcast)/	0.25/	5/4	5a	9a	5ab	5a	64a	67a
efs&dmp&pmp (broadcast)	0.33	5/13, 5/24, 6/7						

[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.

Downy brome control in established Kentucky bluegrass. Janice Reed, John Holman, and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was conducted near Colton, WA to determine the effect of several pre and post-emergence herbicides on downy brome control in established Kentucky bluegrass. The experiment was conducted in a three year old stand of 'South Dakota' bluegrass. 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). Downy brome control and Kentucky bluegrass injury were evaluated visually. Plots were not harvested due to poor downy brome control in all treatments.

Table 1. Application data.

Application date	9/10/04	9/23/04	10/27/04	3/3/05	4/7/05
Application timing	Early fall	Fall	Late fall	Early spring	Spring
Downy brome growth stage	1 to 2 leaf	2 to 3 leaf	4 leaf	6 to 8 inch	8 to 10 inch
Bluegrass growth stage	2 to 4 inch	3 to 4 inch	6 inch	8 to 10 inch	10 to14 inch
Air temp (F)	78	68	52	53	57
Relative humidity (%)	44	50	79	59	56
Wind (mph, direction)	3, S	3, SW	5, NE	4, NE	4, SE
Cloud cover (%)	25	30	40	10	100
Soil temp at 2 in (F)	60	58	45	37	41
Soil moisture	low	low	med	med	high

Substantial precipitation occurred from the middle of July through the middle of August, causing earlier than normal germination of downy brome. Thus, the proposed pre-emergence treatments were applied after a large portion of the downy brome plants had emerged (1-2 leaf stage). Appreciable precipitation did not occur until one month after the early fall application, which likely resulted in poor herbicide incorporation into the soil and root zone.

In the fall of 2004, imazapic controlled downy brome 100%, but also suppressed bluegrass growth 100% (data not shown). No other treatment controlled downy brome in the fall. At the time of all fall applications, downy brome was large (4 inches) and vigorous. No other treatment injured bluegrass. By April 2005, plots treated with imazapic had some downy brome regrowth, but control was still 78% (Table 2). Kentucky bluegrass regrowth was 70% in plots treated with imazapic, but plants did not produce seed. Primsulfuron applied alone or in combination with diuron suppressed downy brome height 15 and 20%, respectively, and reduced bluegrass height 5 and 10%, respectively. Metribuzin applied alone or in a split application with flufenacet/metribuzin or metolachlor suppressed downy brome height 6 to 15%.

The study is being repeated at two locations near Rockford, WA during the 2005-2006 growing season.

Table 2. Kentucky bluegrass injury and downy brome control in Colton, WA on April 27, 2005.

Treatment[1]	Rate	Application timing[2]	Downy brome control	Bluegrass injury
	lb ai/A		--------------%--------------	
Flufenacet/metribuzin	0.55	Efall (pre)	0 e	0 d
Flufenacet	0.32	Efall (pre)	0 e	0 d
Flufenacet/metribuzin +	0.55 +	Efall (pre) +		
metribuzin	0.187	Lfall	6 de	0 d
Flufenacet/metribuzin +	0.55 +	Efall (pre) +		
pendimethalin	3	Efall (pre)	0 e	0 d
Pendimethalin	3	Efall (pre)	0 e	0 d
Metolachlor	1.1	Efall (pre)	0 e	0 d
Metolachlor + metribuzin	1.1 + 0.187	Efall (pre) + Lfall	15 bc	0 d
Metolachlor +	1.1 +	Efall (pre) +		
diuron	0.75	Espring	0 e	0 d
Metsulfuron/chlorsulfuron	0.0234	Efall (pre)	0 e	0 d
Dimethanamid	1.13	Efall (pre)	0 e	0 d
Terbacil	0.8	Fall	10 cd	0 d
Oxyflourfen	0.375	Fall	6 de	0 d
Oxyflourfen + diuron	0.375 + 0.75	Fall + Espring	5 de	0 d
Sulfosulfuron	0.031	Efall	0 e	0 d
Imazapic	0.125	Efall	78 a	30 a
Proproxycarbazone	0.04	Efall	0 e	0 d
Dicamba + flucarbazone	1 + 0.027	Efall + spring	5 de	0 d
Metribuzin	0.187	Lfall	11 cd	0 d
Primsulfuron	0.0356	Spring	15 bc	5 c
Primsulfuron + diruon	0.0234 + 0.56	Spring + spring	20 b	13 b
Untreated check			--	--
Downy brome density (plants/ft$^{2)}$			96	

[1] Sulfosulfuron, proproxycarbazone, and flucarbazone applied with non-ionic surfactant (R-11) at 6.4 oz/A. Imazapic applied with modified seed oil (MSO) at 1 pt/A. Primsulfuron applied with crop oil concentrate (Moract) at 1 qt/100 gal.

[2] Pre = preemergence to downy brome; pre treatments were applied post-emergence (9/10/04). Efall = early fall, post-emergence (9/10/04); Fall = fall, post-emergence (9/23/04). Lfall = late fall, post-emergence (10/27/04). Espring = early spring (3/3/05). Spring treatments applied on 4/7/05.

The effect of adjuvants on weed control with flucarbazone in Kentucky bluegrass. Janice Reed and Donn Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was conducted to determine the effect of adjuvants on the efficacy of flucarbazone for grass weed control in Kentucky bluegrass. The experiment was conducted in a four year old stand of 'Kenblue' bluegrass near Tekoa, WA and in a three year old stand of 'Alene' near Plummer, ID. Plots were 8 by 25 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). Quackgrass and hairy chess control and Kentucky bluegrass injury were evaluated visually. Plots were not harvested.

Table 1. Application data.

Location	Tekoa, WA	Plummer, ID
Target weed	Quackgrass	Hairy chess
Weed growth stage	6 to 10 in	2 to 6 in
Bluegrass growth stage	4 to 8 in	6 in
Application date	April 8, 2005	April 29, 2005
Air temp (F)	52	59
Relative humidity (%)	65	54
Wind (mph, direction)	3, SE	3, W
Cloud cover (%)	70	50
Soil temp at 2 in (F)	45	49
Soil moisture	high	med

Quackgrass suppression (height reduction) in Tekoa on both evaluation dates, was highest with 0.027 lb ai/A flucarbazone + R-11, compared to the 0.0175 lb ai/A rate of flucarbazone with all other adjuvants (Table 2). Bluegrass injury (height reduction and maturity delay) on May 2 was highest with 0.027 lb ai/A flucarbazone + R-11, and 0.0175 lb ai/A flucarbazone + R-11 + Bronc Max. On June 8, 0.027 lb ai/A of flucarbazone + R-11 injured bluegrass more than the other treatments.

All plots at the Plummer site were treated with the 0.027 lb ai/A rate of flucarbazone due to high weed density. Hairy chess height reduction was 25 to 33 % on May 17 and 45 to 53 % on June 21, and did not differ among treatments at either evaluation date (Table 3). No treatment injured bluegrass on May 17. By June 21, bluegrass height reduction and delay in maturity was 18 to 28 % and did not differ among treatments.

Table 2. Quackgrass control and bluegrass injury with flucarbazone plus adjuvants near Tekoa, WA in 2005.

Treatment[1]	Rate	Quackgrass control		Bluegrass injury	
		May 2	June 8	May 2	June 8
	lb ai/A	----------------------------	%	----------------------------	
Flucarbazone + R-11	0.0175 + 1 qt/100 gal	3	28	3	13
Flucarbazone + R-11 + Bronc Max	0.0175 + 1 qt/100 gal + 2 qt/ 100 gal	15	35	10	15
Flucarbazone + Renegade	0.175 + 1.75 pt/A	5	28	3	13
Flucarbazone + Renegade + In-Place	0.175 + 1.75 pt/A + 2 oz/A	8	33	3	13
Flucarbazone + R-11	0.027 +1 qt/100 gal	21	48	10	20
Untreated control	----	--	--	--	--
LSD (P = 0.05)		6	9	5	5

[1] R-11 is 90% nonionic surfactant (NIS); Bronc Max is ammonium sulfate/citric acid; Renegade is a modified seed oil/nonionic surfactant/ammonia/buffer blend; In Place is a deposition aid/drift management agent.

Table 3. Hairy chess control and bluegrass injury with flucarbazone plus adjuvants near Plummer, ID in 2005.

Treatment[1]	Rate	Hairy chess control		Bluegrass injury	
		May 17	June 21	May 17	June 21
	lb ai/A	----------------------------	%	----------------------------	
Flucarbazone + R-11	0.0175 + 1 qt/100 gal	25	45	0	20
Flucarbazone + R-11 + Bronc Max	0.0175 + 1 qt/100 gal + 2 qt/100 gal	33	53	0	28
Flucarbazone + Renegade	0.175 + 1.75 pt/A	28	45	0	24
Flucarbazone + Renegade + In-Place	0.175 + 1.75 pt/A + 2 oz/A	30	50	0	18
Flucarbazone + R-11	0.027 +1 qt/100 gal	30	48	0	20
Untreated control	----	--	--	--	--
LSD (P = 0.05)		NS	NS	NS	NS

[1] R-11 is 90% nonionic surfactant (NIS); Bronc Max is ammonium sulfate/citric acid; Renegade is a modified seed oil/nonionic surfactant/ammonia/buffer blend; In Place is a deposition aid/drift management agent.

Grass weed control with flucarbazone-sodium in seedling Kentucky bluegrass seed production. Larry H. Bennett, Sandra M. Frost and Daniel A. Ball (Oregon State University - CBARC, Pendleton, OR 97801). A study was conducted in a commercial seed production field near Hermiston, OR to evaluate flucarbazone-sodium herbicide for control of rattail fescue (*Vulpia myuros*) and crop tolerance on seedling Kentucky bluegrass (var. 'Blue Ridge', 'Monte Carlo', and 'Mallard') grown for seed. Kentucky bluegrass (KBG) varieties were planted separately in this trial. Early postemergence (EPOST) treatments were applied November 4, 2004 to KBG in the 2 inch stage (Table 1). Late postemergence (LPOST) treatments were applied February 8, 2005 to KBG in the 1 to 2.5 inch stage. All treatments were applied with a hand-held CO_2 sprayer delivering 16 gpa at 30 psi. Plots were 9 ft by 30 ft in size, in an RCB arrangement, with 3 replications. Soil at the site was a loamy sand (84.6% sand, 7.9% silt, 7.5% clay, 0.9% organic matter, pH 5.2, CEC of 12.5 meq/100g). Evaluations of crop injury and rattail fescue control were made on January 31, March 29 and April 19, 2005 (Table 2).

Table 1. Application conditions.

	Nov 4, 2004	Feb 8, 2005
Kentucky bluegrass (in)	2	1-2.5
Timing	EPOST	LPOST
Air temp (F)	37	50
Relative humidity (%)	82	54
Wind velocity (mph)	0	3
Soil temp 1 inch (F)	32	48

EPOST applications of either primisulfuron or flucarbazone-sodium caused very little crop injury to the KBG when rated in late January (Table 2). The LPOST application of primisulfuron, which was a sequential application to the EPOST treatment, caused significant crop injury (47%), when rated 49 days after application. The LPOST application of flucarbazone-sodium, following an EPOST treatment of flucarbazone-sodium, did not cause any appreciable crop injury. Rattail fescue control was fair to good with both compounds applied EPOST. Control with flucarbazone-sodium was not different when mixed with MSO + either ammonium sulfate (AMS) or Solution 32 compared with a non-ionic surfactant (NIS). The split applications of flucarbazone-sodium gave similar results as a single application. On March 29, 2005 the split application of flucarbazone-sodium gave better rattail fescue control than the split application of primisulfuron in this trial. The trial was terminated in late April in order to clean up the remaining rattail fescue before it produced seed. No yields were taken on the plots.

Table 2. Rattail fescue control in seedling Kentucky bluegrass.

			Crop injury			Rattail fescue control		
Treatment[1]	Rate	Timing	1/31	3/29	4/5	1/31	3/29	4/19
	--lb ai/a--		------------------------%--------------------------					
Untreated control			0	0	0	0	0	0
Flucarbazone-sodium + NIS	0.026	EPOST	0	2	0	75	82	75
Flucarbazone-sodium + MSO + AMS	0.026	EPOST	2	0	0	72	87	80
Flucarbazone-sodium + MSO + UAN	0.026	EPOST	0	3	0	70	88	77
Flucarbazone-sodium + MSO + UAN / flucarbazone-sodium + MSO + AMS	0.013 / 0.013	EPOST/ LPOST	0	2	2	62	90	79
Primisulfuron + MSO / primisulfuron + MSO	0.018 / 0.018	EPOST/ LPOST	3	47	33	62	77	73
LSD (0.05)			NS	6	8	18	11	15

[1] MSO = methylated seed oil at 1% v/v; NIS = non-ionic surfactant at 0.25% v/v; UAN = Solution 32 at 50% v/v; AMS = ammonium sulfate at 1.5 lb/a.

Seedling emergence of roundup ready field corn following preemergence 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, 2005 at the Agricultural Science Center, Farmington, New Mexico to evaluate the emergence of field corn (Dekalb 60-19RR) following preemergence 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. Field corn was planted with flexi-planters equipped with disk openers on May 16. Treatments were applied on May 17 and immediately incorporated with 0.75 in of sprinkler-applied water. Treatments were evaluated for seedling emergence on May 23, 25 and 27 by counting individual seedlings per 10 ft of the center two rows.

Atrazine plus dimethenamid-p at 1.9 lb ai/A and the check had significantly more seedlings emerged by May 23 than did any other treatments. By May 27 and 29, there were no significant differences in seedling emergence from any of the treatments.

Table. Seedling emergence of roundup ready field corn following preemergence herbicides.

			Seedling emergence	
Treatments[1]	Rate	5-23-04	5-25-04	5-27-04
	lb ai/a		no	
Atrazine + s-metolachlor + mesotrione (pm)	2.47	9.0	35.2	43.3
Atrazine + s-metolachlor (pm)	1.65	10.5	36.5	44.8
Atrazine + acetochlor (pm)	2.7	5.8	33.0	41.2
Atrazine + acetochlor (pm)	1.35	3.0	32.0	43.2
Atrazine + dimethenamid-p (pm)	1.9	14.3	33.5	42.3
Check		14.5	34.8	42.0
LSD 0.05		4.1	ns	ns

[1] pm equal packaged mix.

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, 2005 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. Pioneer 34N42) 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 11.

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 55 percent. Common lambsquarters, redroot and prostrate pigweed and black nightshade control was greater than 90% in all treatments as compared to the weedy check.

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

		Crop	Weed control				
Treatments[1]	Rate	injury	CHEAL	SOLNI	AMARE	AMABL	SASKR
	lb ai/A	—%—			%		
Dimethenamid-p + atrazine (pm)	0.85	0	99	92	92	92	93
Dimethenamid-p + atrazine (pm)	1.9	0	100	98	98	99	99
S-metolachlor + atrazine (pm)	0.83	0	99	96	95	96	91
S-metolachlor + atrazine (pm)	1.65	0	100	99	99	100	99
Dimethenamid-p	0.75	0	99	94	93	94	55
S-metolachlor	1.25	0	99	94	97	92	55
Dimethenamid-p/diflufenzopyr + dicamba (pm)	0.75/0.25	0	100	99	100	100	100
S-metolachlor/diflufenzopyr + dicamba (pm)	1.25/0.25	0	100	100	100	100	100
Weedy check			0	0	0	0	0
LSD (0.05)			1.2	2	3	2	4

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

Broadleaf weed control in roundup ready 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, 2005 at the Agricultural Science Center, Farmington, New Mexico to evaluate the response of field corn (var. Pioneer 34N44) and annual broadleaf weeds to preemergence followed by sequential postemergence herbicides. Soil type was a Wall sandy loam with a pH of 7.8 and an organic matter content of less than 1%. The experimental design was a randomized complete block with three replications. Individual plots were 4, 34 in rows 30 ft long. Field corn was planted with flexi-planters equipped with disk openers on May 16. Preemergence treatments were applied 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. All postemergence treatments had sprayable ammonium sulfate (AMS) added to the spray mixture at 2.0 lbs/A. 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 11.

Rimsulfuron plus thifensulfuron-methyl applied preemergence alone at 0.0469 lb ai/A or in combination with atrazine at 1.0 lb ai/A had the highest crop injury ratings of 19 and 20, respectively. All treatments gave good to excellent control of redroot and prostrate pigweed, black nightshade and common lambsquarters. Russian thistle control was excellent with all treatments except glyphosate applied postemergence at 0.94 lb ai/A and the weedy check.

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

Treatments[1]	Rate	Crop injury[2]	Weed control[3]				
			AMARE	AMABL	CHEAL	SOLNI	SASKR
	lb ai/A		%				
Rimsulfuron + thifensulfuron-methyl (pm)/glyphosate	0.0156/0.94	1.0	100	100	100	100	100
Rimsulfuron + thifensulfuron-methyl (pm)/glyphosate	0.0469/0.94	19.0	100	100	100	100	100
Rimsulfuron + thifensulfuron-methyl (pm) + atrazine/ glyphosate	0.0156+1.0/0.94	2.0	100	100	100	100	100
Rimsulfuron + thifensulfuron-methyl (pm) + atrazine/ glyphosate	0.0469+1.0/0.94	20.0	100	100	100	100	100
Glyphosate + DPX E9636 + atrazine + DPX 4145	0.94+0.0156+0.5+0.0156	0	100	100	100	100	100
Glyphosate	0.94	0	91	94	94	94	66
Nicosulfuron + rimsulfuron (pm) + mesotrione + atrazine	0.035+0.0469+0.75	0	100	100	100	100	100
Weedy check		0	0	0	0	0	0

[1] First treatment applied preemergence followed by a sequential postemergence treatment and pm equal packaged mix. All postemergence treatments were applied with sprayable ammonium sulfate at 2.0 lb/A.

[2] Crop injury was rated on June 9.

[3] Weed control was rated on July 11.

Rattail fescue control in chemical fallow. Larry H. Bennett, Sandra M. Frost, and Daniel A. Ball (Oregon State University – CBARC, Pendleton, OR 97801). A study was established in winter wheat stubble to be chemical fallowed to evaluate control of rattail fescue (*Vulpia myuros*). Treatments consisted of different glyphosate or Surefire® application rates and timings. The study was conducted at the Columbia Basin Agricultural Research Center, Pendleton, OR. Plots were 9 by 25 ft arranged in a randomized complete block design with 4 replications. Rattail fescue seed was surface broadcast to the plot area on September 27, 2004. Soil at the site was a Walla Walla silt loam (26% sand, 57.5% silt, 16.5% clay, 1.6% organic matter, 5.9 pH, and CEC of 14.9 meq/100g). Herbicide treatments were applied using a 9 ft hand-held boom, CO_2 pressured sprayer delivering 10 gpa at 30 psi. Early postemergence (EPOST) treatments were applied March 21, 2005 when rattail fescue was at the 3 to 5 leaf stage (1 to 2 inch height) (Table 1). Late postemergence (LPOST) treatments were applied on April 20, 2005, when rattail fescue was at the 5 to 6 leaf stage of growth. Control of rattail fescue was visually evaluated on April 4, April 20, and May 23, 2005. Panicles were collected from three 0.062 m^2 areas per plot and counted on June 20, 2005. Seed from panicles will be germinated in the greenhouse during winter 2005-06. Mention of products used in this trial should not be considered to be a product endorsement or recommendation for commercial use.

Table 1. Application conditions.

	Mar 21, 2005	Apr 20, 2005
Timing	EPOST	LPOST
Rattail fescue (inches)	1-1.5	2-4
Air temperature (F)	53	65
Relative humidity (%)	64	38
Wind speed (mph)	2	3
Soil temperature (F at 1 inch)	58	66
Cloud cover (%)	65	80

Glyphosate or paraquat + diuron applied EPOST gave 53 to 60% control of rattail fescue on May 23, 2005 (Table 2). Glyphosate applied LPOST gave 58 to 71% control of rattail fescue and, with the exception of the high rate, did not result in significantly better control than the same rates applied EPOST. Paraquat + diuron applied EPOST gave significantly better control than the LPOST application (56 and 44%, respectively) when rated on May 23, 2005. An EPOST glyphosate application at 0.56 lb ae/a followed by a LPOST application at 0.75 lb ae/a gave significantly better control of rattail than a LPOST application of glyphosate at 0.75 lb ae/a. Split treatments gave the highest control and EPOST treatments gave the lowest control. By May 23, 2005 control of rattail fescue was 44 to 79% over all treatments. Glyphosate applied in split treatment (0.56 / 0.56 lb ae/a) resulted in significantly fewer rattail fescue panicles than any single application of glyphosate.

Table 2. Rattail fescue control in chemical fallow at Pendleton, OR.

			Rattail fescue control			Rattail fescue panicle counts
Treatment[1]	Rate[2]	Timing	4/4/05	4/20/05	5/23/05	6/20/05
	--lb ae/a--		-------------------	-------%-------	-------------------	--#/m^2--
Untreated check	--	--	0	0	0	1331
Glyphosate	.375	EPOST	66	73	53	1768
Glyphosate	.562	EPOST	71	84	60	1973
Glyphosate	.75	EPOST	73	86	59	1780
Glyphosate	.937	EPOST	71	91	59	1668
Paraquat + diuron	.75	EPOST	84	90	56	1871
Glyphosate	.375	LPOST	--	--	58	2320
Glyphosate	.562	LPOST	--	--	65	1768
Glyphosate	.75	LPOST	--	--	66	2312
Glyphosate	.937	LPOST	--	--	71	1820
Paraquat + diuron	0.5 + 0.25	LPOST	--	--	44	1228
Glyphosate / glyphosate	.375 / .375	EPOST/LPOST	64	76	69	1547
Glyphosate / glyphosate	.562 / .375	EPOST/LPOST	73	85	73	1257
Glyphosate / glyphosate	.375 / .562	EPOST/LPOST	64	73	71	1504
Glyphosate / glyphosate	.562 / .562	EPOST/LPOST	74	84	76	868
Glyphosate / glyphosate	.562 / .75	EPOST/LPOST	66	83	79	1272
Glyphosate / paraquat + diuron	.375 / 0.5 + 0.25	EPOST/LPOST	61	74	73	1325
Paraquat + diuron / glyphosate	0.5 + 0.25 / .375	EPOST/LPOST	84	89	70	1741
LSD (0.05)			7	4	12	570

[1] Glyphosate treatments received AMS at 0.85 lb/A. Paraquat + diuron treatments received R-11 at 0.25% v/v. EPOST= 3-5 leaf rattail fescue; LPOST= 5-6 leaf rattail fescue. Glyphosate = Roundup UltraMax, paraquat + diuron = Surefire®.

[2] Paraquat and diuron rates are in lb ai/a.

Rattail fescue control with glyphosate in chemical fallow. Eric D. Jemmett, Traci Rauch, and Donald C. Thill (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). Studies were established in chemical fallow to investigate the response of rattail fescue (VLPMY) to different timings and herbicide combinations with glyphosate at Genesee and Moscow, ID. Plots were 8 by 30 ft arranged in a randomized complete block design with four replications. Rattail fescue seed was seeded at 16 lb/A using a double disk cone seeder and was broadcast seeded at 16 lb/A using a drop spreader. Herbicide treatments were applied using a backpack sprayer delivering 10 gpa at 34 psi and 3 mph (Table 1). Control of rattail fescue was visually evaluated May 12 and June 22, 2005. Rattail fescue panicles were counted on July 8 and 11, 2005 at Genesee and Moscow, respectively.

Table 1. Application conditions.

	Genesee, Idaho		Moscow, Idaho	
Application date	3/03/05	4/18/05	3/03/05	4/15/05
Timing	EPOST	LPOST	EPOST	LPOST
Rattail fescue growth stage	2 to 5 tiller	7 to 10 tiller	1 to 3 tiller	6 to 8 tiller
Air temperature (F)	54	45	57	60
Relative humidity (%)	52	70	55	52
Wind (mph)	2	5	3	4
Cloud cover (%)	20	60	20	30
Soil temperature (F)	50	40	48	48
pH	5.4		5.6	
OM%	3.6		2.8	
CEC (meg/100g)	25		16	
Texture	silt loam		silt loam	

At Genesee on May 12, glyphosate or paraquat/diuron applied EPOST, EPOST + LPOST, and LPOST controlled rattail fescue 76 to 90%, 88 to 99%, and 35 to 55% respectively (Table 2). On June 22, glyphosate or paraquat/diuron applied EPOST, EPOST + LPOST, and LPOST controlled rattail fescue 24 to 73%, 65 to 95%, and 18 to 60%, respectively. All treatments reduced rattail fescue panicle density compared to the untreated control except paraquat/diuron applied EPOST. Panicle density was reduced most (89 to 99%) by glyphosate treatments applied EPOST + LPOST at 0.375 + 0.562, 0.562 + 0.562, and 0.562 + 0.75 lb ae/A but was not different from other combination treatments, except paraquat/diuron + glyphosate (EPOST + LPOST).

At Moscow on May 12, glyphosate or paraquat/diuron applied EPOST and EPOST + LPOST controlled rattail fescue 88 to 97%, while LPOST applications of glyphosate or paraquat/diuron only controlled rattail fescue 31 to 75% (Table 2). On June 22, glyphosate or paraquat/diuron applied EPOST + LPOST and the two highest rates of glyphosate applied EPOST controlled rattail fescue 75 to 90%. Rattail fescue control was 61 to 70% with the two lowest rates of glyphosate applied EPOST and paraquat/diuron applied EPOST and LPOST, while LPOST treatments of glyphosate controlled rattail fescue 21 to 30%. All treatments reduced rattail fescue panicle density compared to the untreated control except treatments applied LPOST. Panicle density was reduced most (78 to 85%) by the highest rate of glyphosate applied EPOST, glyphosate (EPOST) + paraquat/diuron (LPOST), and glyphosate applied EPOST + LPOST at 0.562 + 0.375 and 0.562 + 0.75 lb ae/A, but was not different from glyphosate applied EPOST + LPOST at 0.375 + 0.562, 0.562 + 0.562, and 0.375 + 0.375 lb ae/A and glyphosate applied EPOST at 0.75 lb ae/A.

Table 2. Rattail fescue response to herbicide treatments in chemical fallow at Genesee and Moscow, ID in 2005.

			Genesee			Moscow		
			Rattail fescue					
			Control		Panicle density	Control		Panicle density
Treatment[1]	Rate[2]	Application timing[3]	5/12/2005	6/22/2005	7/08/2005	5/12/2005	6/22/2005	7/11/2005
	lb ae/A		----------%----------		no./yd^2	----------%----------		no./yd^2
Untreated check	--	--	--	--	4129	--	--	4211
Glyphosate	0.375	EPOST	78	36	3276	88	66	2620
Glyphosate	0.562	EPOST	90	66	2867	91	70	2253
Glyphosate	0.750	EPOST	89	68	1850	91	81	1517
Glyphosate	0.937	EPOST	90	73	1383	95	84	922
Paraquat/diuron	0.750	EPOST	76	24	3414	88	70	2671
Glyphosate	0.375	LPOST	35	21	2913	31	21	4403
Glyphosate	0.562	LPOST	49	40	2717	31	30	3757
Glyphosate	0.750	LPOST	44	51	1969	38	26	3936
Glyphosate	0.937	LPOST	55	60	1877	36	29	3544
Paraquat/diuron	0.750	LPOST	43	18	2625	75	61	3293
Glyphosate + glyphosate	0.375 0.375	EPOST LPOST	95	88	672	94	80	1747
Glyphosate + glyphosate	0.562 0.375	EPOST LPOST	98	91	749	96	89	659
Glyphosate + glyphosate	0.375 0.562	EPOST LPOST	97	94	431	97	90	1077
Glyphosate + glyphosate	0.562 0.562	EPOST LPOST	98	95	12	96	85	1736
Glyphosate + glyphosate	0.562 0.750	EPOST LPOST	99	94	18	97	89	620
Glyphosate + paraquat/diuron	0.375 0.750	EPOST LPOST	91	86	734	97	89	869
Paraquat/diuron + glyphosate	0.750 0.375	EPOST LPOST	88	65	2049	92	75	2697
LSD (0.05)			8	14	774	8	11	1212

[1] Glyphosate treatments contained ammonium sulfate (Bronc) at 8.5 lb/100 gal. Paraquat/diuron treatments contained non-ionic surfactant (R-11) at 0.25% v/v.

[2] Paraquat/diuron rates are lb ai/A.

[3] Application timing based on rattail fescue growth stage.

Rattail fescue control in chemical fallow with quizalofop and glyphosate. Eric D. Jemmett and Donald C. Thill. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339) Two studies were established in chemical fallow to investigate the response of rattail fescue (VLPMY) to quizalofop and glyphosate alone and in combination at different timings in Genesee and Moscow, ID. Plots were 8 by 30 ft arranged in a randomized complete block design with four replications. Rattail fescue seed was seeded at 16 lb/A using a double disk cone seeder in October of 2003 and 2004 with an additional broadcast seeding at 16 lb/A using a drop spreader in 2004. Herbicide treatments were applied using a backpack sprayer delivering 10 gpa at 34 psi and 3 mph (Table 1). Rattail fescue control of was visually evaluated June 14 and July 12, 2004 and May 12 and June 22, 2005. Rattail fescue panicles were counted July 16 and 22, 2004 and July 21 and 19, 2005 at Genesee and Moscow, respectively.

Table 1. Application conditions.

	Genesee, Idaho		Moscow, Idaho	
Application date	4/29/04	5/10/04	4/22/04	5/03/04
Timing	EPOST	LPOST	EPOST	LPOST
Rattail fescue growth stage	2 to 5 tiller	7 to 10 tiller	1 to 3 tiller	3 to 5 tiller
Air temperature (F)	54	49	60	65
Relative humidity (%)	48	64	50	46
Wind (mph)	3	5	4	5
Cloud cover (%)	0	100	80	40
Soil temperature (F)	45	57	55	60
pH	5.2		5.6	
OM%	3.3		2.8	
CEC (meg/100g)	19		16	
Texture	silt loam		silt loam	
Application date	3/03/05	4/18/05	3/03/05	4/15/05
Timing	EPOST	LPOST	EPOST	LPOST
Rattail fescue growth stage	2 to 5 tiller	7 to 10 tiller	1 to 3 tiller	6 to 8 tiller
Air temperature (F)	54	45	57	60
Relative humidity (%)	52	70	55	52
Wind (mph)	2	5	3	4
Cloud cover (%)	20	60	20	30
Soil temperature (F)	50	40	48	48
pH	5.4		5.6	
OM%	3.6		2.8	
CEC (meg/100g)	25		16	
Texture	silt loam		silt loam	

At Genesee and Moscow in 2004, treatments with glyphosate controlled rattail fescue 89 to 94% and 89 to 99%, respectively, while quizalofop alone did not control rattail fescue (Table 2). Glyphosate treatments reduced panicle density 98 to 99% compared to the untreated control and quizalofop alone.

At Genesee and Moscow in 2005, glyphosate treatments controlled rattail fescue 68 to 99% on May 12 and 36 to 73% on June 22 (Table 3). Quizalofop alone did not control rattail fescue. At Genesee, panicle density was reduced 60% in treatments containing glyphosate, except glyphosate alone applied EPOST compared to the untreated control. At Moscow, only quizalofop + glyphosate applied EPOST reduced panicle density (41%) compared to the untreated control.

Table 2. Rattail fescue response to herbicide treatments in chemical fallow at Genesee and Moscow, ID in 2004.

			Genesee			Moscow		
			Rattail fescue					
			Control		Panicle density	Control		Panicle density
Treatment[1]	Rate[2]	Application timing[3]	6/14/2004	7/12/2004	7/16/2004	6/14/2004	7/12/2004	7/22/2004
	lb ae/A		---------%---------		no./yd^2	---------%---------		no./yd^2
Untreated check	--	--	--	--	923	--	--	786
Quizalofop	0.069	EPOST	0	0	1354	1	3	1180
Quizalofop	0.069	LPOST	0	0	805	1	1	652
Glyphosate	0.750	EPOST	94	94	17	91	89	26
Glyphosate	0.750	LPOST	90	90	33	98	99	1
Quizalofop + glyphosate	0.069 0.75	EPOST	94	94	18	94	92	19
Quizalofop + glyphosate	0.069 0.75	LPOST	90	89	13	99	99	3
LSD (0.05)			3	4	389	4	6	185

[1] Glyphosate treatments contained ammonium sulfate (Bronc) at 8.5 lb/100 gal. Quizalofop treatments contained Moract, a crop oil consentrate (COC) at 1% v/v.

[2] Quizalofop rates are lb ai/A.

[3] Application timing based on rattail fescue growth stage.

Table 3. Rattail fescue response to herbicide treatments in chemical fallow at Genesee and Moscow, ID in 2005.

			Genesee			Moscow		
			Rattail fescue					
			Control		Panicle density	Control		Panicle density
Treatment[1]	Rate[2]	Application timing[3]	5/12/2005	6/22/2005	7/21/2005	5/12/2005	6/22/2005	7/19/2005
	lb ae/A		---------%---------		no./yd^2	---------%---------		no./yd^2
Untreated check	--	--	--	--	5390	--	--	3396
Quizalofop	0.069	EPOST	0	0	6872	1	0	4007
Quizalofop	0.069	LPOST	0	0	5960	1	0	4114
Glyphosate	0.750	EPOST	86	41	3561	89	58	2723
Glyphosate	0.750	LPOST	68	59	2198	99	36	2639
Quizalofop + glyphosate	0.069 0.75	EPOST	90	55	2754	93	73	1996
Quizalofop + glyphosate	0.069 0.75	LPOST	71	70	1478	99	39	2996
LSD (0.05)			6	15	2009	6	4	843

[1] Glyphosate treatments contained ammonium sulfate (Bronc) at 8.5 lb/100 gal. Quizalofop treatments contained Moract, a crop oil consentrate (COC) at 1% v/v.

[2] Quizalofop rates are lb ai/A.

[3] Application timing based on rattail fescue growth stage.

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 6.7 pH and 2.9% organic matter at the NDSU Carrington Research Extension Center. Herbicide treatments were applied to 5- by 25-ft plots with a pressurized hand-held plot sprayer at 17 gal/A and 30 psi through 8002 flat-fan nozzles. Fall sulfentrazone treatments were applied October 25, 2004 to a moist soil surface with 47 F, 71% RH, 15% clear sky, and 11 mph wind. On April 28, 2005, inoculated 'Integra' 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 to a dry soil surface on April 30 with 31 F, 64% RH, 30% clear sky, and 10 mph wind. Rainfall totaled 1.22 inches 8 d following PRE application. The trial area was treated on May 6 with a PRE burn-down application of glyphosate at 0.75 lb ae/A plus ammonium sulfate at 1% v/v. The early POST (EPOST) treatment was applied on May 23 with 73 F, 35% RH, 100% cloudy sky, and 6 mph wind to 2-inch tall field pea, 1- to 2-leaf green and yellow foxtail, 0.5-inch tall common lambsquarters, 0.5-inch tall prostrate and redroot pigweed, and 0.5-inch tall wild buckwheat. POST treatments were applied on June 6 with 75 F, 46% RH, clear sky, and 9 mph wind to 5- to 7-inch tall field pea, 2- to 4-leaf green and yellow foxtail, 1- to 3-inch tall common lambsquarters, 0.5- to 1-inch tall prostrate and redroot pigweed, and 1- to 2-inch tall wild buckwheat. Average plant density in untreated plots was measured on June 6: field pea = 11 plants/ft^2, foxtail = 35 plants/ft^2, common lambsquarters = 3 plants/ft^2, pigweed = 11 plants/ft^2 and wild buckwheat = 1 plant/ft^2. The trial was harvested with a plot combine on August 4.

Generally, fall- and PRE-applied treatments provided good to excellent broadleaf weed control when evaluated on June 3, except carfentrazone and thifensulfuron + tribenuron (Table 1). Fall- or PRE-applied sulfentrazone at 0.188 lb/A provided similar broadleaf weed control. Broadleaf weed control was reduced with fall-applied sulfentrazone at 0.094 lb/A followed by PRE application at 0.094 lb/A compared to fall- or PRE-applied sulfentrazone at 0.188 lb/A. Imazethapyr+pendimethalin provided 88% foxtail control and excellent broadleaf weed control (96 to 99%). Crop injury (reduced plant biomass) ranging from 17 to 18% occurred with spring-applied sulfentrazone at 0.188 lb/A (Table 2). Also, substantial crop injury occurred with imazamox at 0.031 lb/A + bentazon following pendimethalin. Severe pea injury and yield loss occurred with fomesafen. Weed control on August 4 ranged from 88 to 99% with fall-applied sulfentrazone at 0.188 lb/A followed by bentazon at 0.5 lb/A + sethoxydim at 0.1 lb/A, sulfentrazone + imazethapyr, imazethapyr + pendimethalin, and pendimethalin followed by imazamox at 0.031 lb/A + bentazon (Table 3). Sequentially-applied bentazon at 0.5 lb/A + sethoxydim at 0.1 lb/A provided 98% control of common lambsquarters compared to 75% control with bentazon at 1.0 lb/A + sethoxydim at 0.2 lb/A. Pea seed yield ranged from 68.9 to 70.7 bu/A with sulfentrazone followed by bentazon + sethoxydim, and imazethapyr + pendimethalin compared to the untreated check at 49.2 bu/A (Table 2).

Table 1. Weed control with soil-applied herbicides in no-till field pea , Carrington, 2005.

			6/3			
Treatment[1]	Application timing[2]	Rate	Foxtail spp.[3]	Common lambsquarters	Pigweed spp.[3]	Wild buckwheat
		lb ai/A	---% control---			
Untreated	x	x	0	0	0	0
Sulfentrazone	Fall	0.188	66	99	99	93
Sulfentrazone/Sulfentrazone	Fall/PRE	0.094/0.094	58	91	94	75
Sulfentrazone	PRE	0.188	73	99	99	94
Sulfentrazone+imazethapyr	PRE	0.188+0.031	76	99	99	94
Sulfentrazone+metribuzin	PRE	0.094+0.25	63	98	98	80
Imazethapyr+pendimethalin	PRE	0.031+1.5	88	99	99	96
Imazethapyr	PRE	0.031	74	99	99	96
Imazethapyr	PRE	0.031	73	99	99	99
Pendimethalin	PRE	1.5	76	85	93	86
Pendimethalin	PRE	1.5	86	88	96	99
Carfentrazone	PRE	0.008	0	0	0	0
Thifensulfuron+tribenuron+NIS	PRE	0.0075+0.0019+0.25%	0	0	0	0
LSD (0.05)			7	6	4	15

[1] Pendimethalin=ProwlH$_2$0, BASF; NIS=Preference, a nonionic surfactant from Agriliance. The trial was treated on May 6 with a PRE burndown application of glyphosate at 0.75 lb ae/A plus ammonium sulfate at 1% v/v.

[2] Fall=October 25, 2004; PRE=April 30, 2005.

[3] Foxtail spp.=Yellow and green; Pigweed spp.=Redroot and prostrate.

Table 2. Field pea response to herbicide treatments, Carrington, 2005.

Treatment[1]	Application timing[2]	Rate	Crop injury 6/3	Crop injury 7/2	Crop injury 8/4	Seed yield	Test weight
		lb ai/A	%			bu/A	lb/bu
Untreated	x	x	0	0	0	49.2	63.2
Sulfentrazone/Bentazon+ sethoxydim+MSO+UAN	Fall/POST	0.188/0.5+ 0.1+1%+2pt	0	0	0	70.6	63.3
Sulfentrazone/Sulfentrazone/ Bentazon+sethoxydim+MSO+ UAN	Fall/PRE/ POST	0.094/0.094/ 0.5+ 0.1+1%+ 2pt	0	8	6	68.9	63.5
Sulfentrazone/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.188/0.5+ 0.1+1%+2pt	18	12	0	69.3	63.4
Sulfentrazone+imazethapyr	PRE	0.188+0.031	17	7	0	62.5	63.5
Sulfentrazone+metribuzin/ Bentazon+sethoxydim+MSO+ UAN	PRE/POST	0.094+0.25/ 0.5+0.1+1%+ 2pt	0	0	0	61.4	63.0
Imazethapyr+pendimethalin	PRE	0.031+1.5	0	0	0	70.7	63.3
Imazethapyr/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.031/1.0+ 0.2+1%+2pt	0	0	0	58.3	63.0
Imazethapyr/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.031/0.5+ 0.1+1%+2pt	0	0	0	61.0	63.1
Pendimethalin/Imazamox+ bentazon+MSO+UAN	PRE/POST	1.5/0.031+0.188+1% +2pt	0	21	17	52.6	63.7
Pendimethalin/Imazamox+ bentazon+MSO+UAN	PRE/POST	1.5/0.016+0.188+1% +2pt	0	0	0	51.3	62.7
Carfentrazone/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.008/1.0+ 0.2+1%+2pt	0	0	3	51.8	63.5
Thifensulfuron+tribenuron+NIS/ Bentazon+ sethoxydim+MSO+ UAN	PRE/POST	0.0075+0.0019+ 0.25%/1.0+ 0.2+1%+2pt	0	0	2	55.9	62.5
Imazamox+bentazon+NIS+UAN	POST	0.031+0.188+1% +2pt	x	0	0	62.5	63.6
Imazamox+bentazon+MSO+ UAN	POST	0.016+0.188+1% +2pt	x	0	0	50.0	63.8
Imazamox+bentazon+ sethoxydim+MSO+UAN	POST	0.031+1.0+ 02+1%+2pt	x	0	2	46.6	63.5
Bentazon+sethoxydim+MSO+ UAN	POST	1.0+0.2+1%+ 2pt	x	0	2	57.4	62.9
Bentazon+sethoxydim+MSO+ UAN/Bentazon+sethoxydim+ MSO+ UAN	EPOST/ POST	0.5+0.1+1%+2pt/ 0.5+0.1+1%+2pt	x	0	2	61.6	63.1
Fomesafen+imazamox+ bentazon+MSO+UAN	POST	0.095+0.016+ 0.188+1%+2pt	x	95	83	8.4	64.1
Fomesafen+imazamox+ bentazon+MSO+UAN	POST	0.143+0.016+ 0.188+1%+2pt	x	95	90	6.9	64.3
LSD (0.05)			5	5	6	10.1	NS

[1] MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; Pendimethalin=ProwlH$_2$0, BASF; UAN=urea ammonium nitrate; NIS=Preference, a nonionic surfactant from Agriliance. The trial was treated on May 6 with a PRE burn-down application of glyphosate at 0.75 lb ae/A plus ammonium sulfate at 1% v/v.

[2] Fall=October 25, 2004; PRE=April 30, 2005; EPOST=May 23; POST=June 6.

Table 3. Weed control with soil- and POST-applied herbicides in no-till field pea, Carrington, 2005.

			7/2				8/4			
Treatment[1]	Application timing[2]	Rate	Foxtail spp.[3]	Common lambsquarters	Pigweed spp.[3]	Wild buckwheat	Foxtail spp.	Common lambsquarters	Pigweed spp.	Wild buckwheat
		lb ai/A	% control							
Untreated	x	x	0	0	0	0	0	0	0	0
Sulfentrazone/Bentazon+ sethoxydim+MSO+UAN	Fall/POST	0.188/0.5+ 0.1+1%+2pt	80	98	96	86	89	98	98	91
Sulfentrazone/Sulfentrazone/ Bentazon+sethoxydim+MSO+ UAN	Fall/PRE/ POST	0.094/0.094/ 0.5+ 0.1+1%+ 2pt	82	99	80	74	93	99	88	70
Sulfentrazone/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.188/0.5+ 0.1+1%+2pt	76	99	98	92	84	99	99	90
Sulfentrazone+imazethapyr	PRE	0.188+0.031	80	99	99	89	91	99	99	99
Sulfentrazone+metribuzin/ Bentazon+sethoxydim+MSO+ UAN	PRE/POST	0.094+0.25/ 0.5+0.1+1%+ 2pt	70	97	96	69	86	99	98	80
Imazethapyr+pendimethalin	PRE	0.031+1.5	96	96	99	91	99	99	99	99
Imazethapyr/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.031/1.0+ 0.2+1%+2pt	72	90	99	77	83	90	99	89
Imazethapyr/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.031/0.5+ 0.1+1%+2pt	73	93	98	83	82	97	99	99
Pendimethalin/Imazamox+ bentazon+MSO+UAN	PRE/POST	1.5/0.031+0.188+1% +2pt	98	99	99	78	98	99	99	88
Pendimethalin/Imazamox+ bentazon+MSO+UAN	PRE/POST	1.5/0.016+0.188+1% +2pt	97	95	99	69	98	96	99	70
Carfentrazone/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.008/1.0+ 0.2+1%+2pt	67	57	58	63	77	67	73	70
Thifensulfuron+tribenuron+ NIS/Bentazon+ sethoxydim+MSO+UAN	PRE/POST	0.0075+0.0019+ 0.25%/1.0+ 0.2+1%+2pt	67	71	70	61	74	70	72	67
Imazamox+bentazon+NIS +UAN	POST	0.031+0.188+1% +2pt	78	75	99	62	84	73	99	73
Imazamox+bentazon+MSO +UAN	POST	0.016+0.188+1% +2pt	81	81	98	63	86	86	96	75
Imazamox+bentazon+ sethoxydim+MSO+UAN	POST	0.031+1.0+ 02+1%+2pt	70	94	99	65	78	97	99	78
Bentazon+sethoxydim+MSO+ UAN	POST	1.0+0.2+1%+ 2pt	71	77	68	69	82	75	68	73
Bentazon+sethoxydim+MSO+ UAN/Bentazon+sethoxydim+ MSO+ UAN	EPOST/ POST	0.5+0.1+1%+2pt/ 0.5+0.1+1%+2pt	72	96	73	47	80	98	72	57
Fomesafen+imazamox+ bentazon+MSO+UAN	POST	0.095+0.016+ 0.188+1%+2pt	65	88	98	64	0	65	65	65
Fomesafen+imazamox+ bentazon+MSO+UAN	POST	0.143+0.016+ 0.188+1%+2pt	66	89	95	81	13	65	65	65
LSD (0.05)			8	11	9	18	13	6	6	15

[1] MSO=Destiny, a methylated seed oil from Agriliance, St. Paul, MN; Pendimethalin=ProwlH$_2$0, BASF; UAN=urea ammonium nitrate; NIS=Preference, a nonionic surfactant from Agriliance. The trial was treated on May 6 with a PRE burn-down application of glyphosate at 0.75 lb ae/A plus ammonium sulfate at 1% v/v.

[2] Fall=October 25, 2004; PRE=April 30, 2005; EPOST=May 23; POST=June 6.

[3] Foxtail spp.=Yellow and green; Pigweed spp.=Redroot and prostrate.

Herbicde screen in peppermint. Richard Affeldt, Chuck Cole, Bill Brewster, Jed Colquhoun, and Carol Mallory-Smith. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR, 97331-3002) A field study was conducted at Hyslop research farm to evaluate herbicides for potential safety on peppermint and weed control efficacy. 'Redefined Murray' peppermint was planted April 22, 2005. Several problem weeds were planted in early June including: redroot pigweed, common lambsquarters, annual sowthistle, and green foxtail. Six herbicides were tested at two rates each: DPX-KJM44, pyraflufen, trifloxysulfuron, cloransulam, pyrithiobac, and diflufenzopyr plus dicamba. The peppermint and weeds were grown separately in 8 ft by 30 ft plots with three replications arranged as randomized complete blocks. Herbicides were applied with a compressed air sprayer delivering 20 gpa at 20 psi at 3 mph. Application conditions and growth stages are presented in Table 1.

Table 1. Application conditions and growth stages.

Application date	June 30, 2005
Air temperature (F)	68
Relative humidity (%)	52
Wind velocity (mph)	0
Dew present	yes
Soil temperature (F)	65
Soil moisture	slight mud
Soil texture	silt loam
Soil pH	5.6
Soil OM (%)	2.8
Peppermint	18 inches tall, early bloom
Redroot pigweed	2-4 leaf
Common lambsquarters	2-4 leaf
Annual sowthistle	2 leaf
Mayweed chamomile	10 inches tall, early flower
Shepherd's-purse	2-4 leaf
Green foxtail	2-4 leaf

Pyraflufen caused minimal peppermint injury and controlled redroot pigweed, common lambsquarters, annual sowthistle, and shepherd's-purse (Table 2). Pyraflufen had little activity on the green foxtail. DPX-KJM44 caused minor peppermint injury, but at these rates did little to control any weeds except annual sowthistle. Diflufenzopyr plus dicamba was moderately injurious to the peppermint and was also very effective in controlling the weeds listed above. Cloransulam injury to peppermint was high, but weed control was very good. Diflufenzopyr plus dicamba and cloransulam might be more selective at lower rates. Mayweed chamomile was fairly large at the time of application, which may have resulted in poor control with most of these herbicides.

Table 2. Peppermint response and weed control in a herbicide screen at Hyslop Farm near Corvallis, Oregon, 2005.

		Peppermint							
Treatment	Rate	Aug 16	Sept 1	Redroot pigweed	Common lambsquarters	Annual sowthistle	Mayweed chamomile	Shepherd's-purse	Green foxtail
	lb ai/A	----- % injury -----		------------------------------------- % control Aug 16 -------------------------------------					
DPX-KJM44	0.008	15	12	60	33	85	3	13	0
DPX-KJM44	0.016	18	7	73	60	87	20	17	10
Pyraflufen	0.00325	0	5	92	86	78	20	52	0
Pyraflufen	0.0065	7	3	98	97	97	0	97	0
Trifloxysulfuron	0.00469	53	50	92	98	99	85	100	93
Trifloxysulfuron	0.00703	57	57	92	99	100	99	98	94
Cloransulam	0.02	33	25	40	37	99	70	100	17
Cloransulam	0.04	40	27	57	20	100	85	95	27
Pyrithiobac	0.064	40	25	100	91	96	0	100	87
Pyrithiobac	0.096	32	37	100	96	96	17	98	92
Diflufenzopyr+dicamba	0.175	17	28	96	99	99	33	93	67
Diflufenzopyr+dicamba	0.2625	18	43	98	100	100	57	97	88
Check	---	0	0	0	0	0	0	0	0
LSD (0.05)		8	12	22	19	8	46	27	24

Weed management in direct-seeded imidazolinone-resistant sunflower. Gregory J. Endres and Blaine G. Schatz. (Carrington Research Extension Center, North Dakota State University, Carrington, ND 58421) Weed control and crop response were investigated with selected soil-applied herbicides in direct-seeded, imidazolinone-resistant (Clearfield^{TM}) sunflower. The trial had a randomized complete block design with three replicates. The experiment was conducted on a loam soil with 6.7 pH and 2.9% organic matter at the NDSU Carrington Research Extension Center. Herbicide treatments were applied to 10 by 30 ft plots with a CO_2 pressurized hand-held plot sprayer at 17 gal/A and 30 psi through 8002 flat fan nozzles. Preplant (PP) fall sulfentrazone treatments were applied October 25, 2004, on a moist soil surface with 47 F, 71% RH, 15% clear sky, and 11 mph wind. Early PP spring treatments were applied April 30, 2005 on a dry soil surface with 34 F, 59% RH, 100% cloudy sky, and 13 mph wind. Rainfall totaled 1.22 inches during May 1 to 8. PP spring treatments were applied on May 25 on a dry soil surface with 62 F, 37% RH, 100% cloudy sky, and 9 mph wind. Rainfall totaled 0.83 inches during May 26 to June 5. Glyphosate at 0.75 lb ae/A + AMS at 1% v/v was applied across the trial on June 3. Mycogen '8N429CL' was direct-seeded in wheat stubble in 30-inch rows on June 10 and hand-thinned to 20,000 plants/A on July 6. PRE treatments were applied on a moist soil surface on June 13 with 60 F, 86% RH, 100% cloudy sky, and 12 mph wind. Rainfall totaled 1.64 inches during June 13 to 26. POST imazamox was applied on July 2 with 68 F, 83% RH, 90% clear sky, and 9 mph wind to V4- to V6-stage sunflower, tillering yellow foxtail, 2- to 5-inch tall common lambsquarters, 1- to 6-inch tall redroot pigweed, and 0.5- to 1-inch tall dandelion. Weed densities on July 5 were: yellow foxtail = 25 plants/ft^2, common lambsquarters = 1 plant/ft^2, redroot pigweed = 4 plants/ft^2, and dandelion = 1 plant/ft^2. The trial was harvested with a plot combine on October 26.

Adequate rainfall occurred for timely activation of soil-applied herbicides. Visual evaluation of soil-applied treatments on July 1 (before POST application of imazamox) indicated 79 to 81% control of yellow foxtail with pendamethalin (Table 1). Flumioxazin and carfentrazone/sulfentrazone controlled dandelion 81 to 90% and redroot pigweed 93 to 99%. Except for dandelion, weed control generally improved with imazamox following soil-applied treatments. Dandelion was suppressed (40 to 73% control) while redroot pigweed control was excellent (89 to 99%) with all treatments when evaluated on August 5. Treatments that included sulfentrazone provided 97 to 99% common lambsquarters control. No crop injury was detected in the trial (data not shown). Seed yield was significantly greater with all herbicide treatments compared to the untreated check (Table 2). Seed yield with fall-applied sulfentrazone was lower compared to other treatments. Yield greater than 1500 lb/A was achieved with PP spring-applied sulfentrazone, and flumioxazin.

Table 2. Direct-seeded imidazolinone-resistant sunflower response to herbicides.

Herbicide[1]			Seed	Test
Treatment	Rate	Timing	yield	weight
	lb ai/A		lb/A	lb/bu
Untreated check	x	x	503	29.3
Sulfentrazone/Imazamox	0.188/0.031	PPF/POST	1086	28.2
Sulfentrazone/Sulfentrazone/Imazamox	0.094/0.094/0.031	PPF/PPS/POST	1162	28.7
Sulfentrazone/Imazamox	0.188/0.031	EPPS/POST	1382	28.6
Sulfentrazone/Imazamox	0.188/0.031	PPS/POST	1575	29.0
Flumioxazin/Imazamox	0.063/0.031	EPPS/POST	1519	28.4
Flumioxazin/Imazamox	0.063/0.031	PPS/POST	1540	28.9
Pendamethalin/Imazamox	1.5/0.031	EPPS/POST	1263	28.6
Pendamethalin/Imazamox	1.5/0.031	PPS/POST	1490	28.4
Carfentrazone+NIS/Sulfentrazone/ Imazamox	0.008+0.25%/0.188/ 0.031	PPS/PRE/POST	1337	28.9
Imazamox	0.031	POST	1460	28.3
LSD (0.05)			306	NS

[1] Treatments: All imazamox treatments include NIS at 1% v/v and UAN at 2.5% v/v. Pendamethalin=Prowl H_20; NIS=Preference, a nonionic surfactant from Agriliance, at 0.25% v/v. Timing: PPF=October 25, 2004; EPPS=April 30, 2005; PPS=May 25; PRE=June 13; POST=July 2.

Table 1. Weed control in direct-seeded imidazolinone-resistant sunflower.

Herbicide[1]			1-Jul			5-Aug			
Treatment	Rate	Timing	yeft[2]	dali[3]	rrpw[4]	yeft	colq[5]	dali	rrpw
	lb ai/A		% control						
Untreated check	x	x	0	0	0	0	0	0	0
Sulfentrazone/Imazamox	0.188/0.031	PPF/POST	52	57	73	70	99	53	95
Sulfentrazone/Sulfentrazone/ Imazamox	0.094/0.094/ 0.031	PPF/PPS/POST	59	13	91	73	98	57	98
Sulfentrazone/Imazamox	0.188/0.031	EPPS/POST	63	58	78	71	99	62	98
Sulfentrazone/Imazamox	0.188/0.031	PPS/POST	70	58	91	77	97	57	99
Flumioxazin/Imazamox	0.063/0.031	EPPS/POST	69	81	93	77	80	70	98
Flumioxazin/Imazamox	0.063/0.031	PPS/POST	72	90	93	76	70	73	99
Pendamethalin/Imazamox	1.5/0.031	EPPS/POST	81	27	79	82	63	55	98
Pendamethalin/Imazamox	1.5/0.031	PPS/POST	79	73	74	88	79	66	99
Carfentrazone+NIS/ Sulfentrazone/Imazamox	0.008+0.25%/0. 188/0.031	PPS/PRE/POST	71	83	99	75	99	68	99
Imazamox	0.031	POST	x	x	x	70	70	40	89
LSD (0.05)			9	10	7	12	8	22	13

[1] Treatments: All imazamox treatments include NIS at 1% v/v and UAN at 2.5% v/v. NIS=Preference, a nonionic surfactant from Agriliance, at 0.25% v/v. Timing: PPF=October 25, 2004; EPPS=April 30, 2005; PPS=May 25; PRE=June 13; POST=July 2.

[2] yeft=green and yellow foxtail.

[3] dali=dandelion.

[4] rrpw=prostrate and redroot pigweed.

[5] colq=common lambsquarters.

Wild oat control in spring wheat with clodinafop plus broadleaf herbicides. 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 wheat to determine wild oat control with clodinafop applied at 0.05 an 0.0625 lb ai/A plus broadleaf herbicides. Wild oat was seeded to obtain a uniform population of about 20 plants/ft^2 on April 28, 2005, and 'Wawawai' spring wheat was seeded May 1. Herbicides were applied on May 25, 2005 with a CO_2 pressurized backpack sprayer delivering 10 gpa at 3 mph and 32 psi. Wheat was 5 in. tall with 2 leaves and wild oat had 3 leaves. Relative humidity, air and soil temperatures were 57%, 73 and 70 F, respectively. Soil pH, organic matter, CEC and texture were 4.3, 5.7%, 49 cmol/kg, and silty clay, 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 wheat grain was harvested at maturity.

No crop injury was visible throughout the season. Wild oat control was similar among herbicide treatments until heading (data not shown). Wild oat control on July 12 was 98% with both rates of clodinafop alone (Table). Wild oat control with clodinafop plus broadleaf herbicides averaged 89% and 94% with clodinafop at 0.05 and 0.0625 lb ai/A, respectively. Wild oat control was reduced most with clodinafop+thifensulfuron/tribenuron+MCPA (mean=86%) compared to clodinafop alone (98%). Thifensulfuron/tribenuron+MCPA reduced wild oat control more with clodinafop at 0.05 lb/A (82%) than at 0.0625 lb/A (89%). Wild oat control was 90% or greater with other clodinafop/broadleaf herbicide combinations.

Grain yield was low due to supersaturated soil conditions after wheat emergence. The untreated control did not produce enough grain for an accurate test weight measurement, but test weight did not vary among herbicide treatments. Average grain yield from clodinafop+thifensulfuron/tribenuron+MCPA treated wheat compared to clodinafop alone was 1086 and 1680 lb/A, respectively.

Table. Wild oat control and spring wheat grain yield near Moscow, Idaho.

Treatment[1]	Rate	Wild oat control	Wheat grain Yield	Wheat grain Test wt
	lb ai/A	%	lb/A	lb/bu
Clodinafop+prosulfuron	0.05+0.0178	91	1556	62
Clodinafop+prosulfuron	0.0625+0.0178	97	1504	62
Clodinafop+thifensulfuron+tribenuron	0.05+0.0188[2]	94	1663	62
Clodinafop+thifensulfuron+tribenuron	0.0625+0.0188[2]	96	1836	62
Clodinafop+thifensulfuron+tribenuron+MCPA	0.05+0.0188[2]+0.35	82	1019	61
Clodinafop+thifensulfuron+tribenuron+MCPA	0.0625+0.0188[2]+0.35	89	1152	62
Clodinafop+thifensulfuron+tribenuron+bromoxynil/MCPA	0.05+0.0188[2]+0.375	90	1326	61
Clodinafop+thifensulfuron+tribenuron+bromoxynil/MCPA	0.0625+0.0188[2]+0.375	93	1547	62
Clodinafop	0.05	98	1604	62
Clodinafop	0.0625	98	1756	61
Untreated	-	-	164	-
LSD (0.05)	-	4	756	NS

[1] Clodinafop formulation included surfactant.

[2] Thifensulfuron at 0.0141 and tribenuron at 0.0047 lb ai/A were mixed to simulate Affinity, the 4:1 premixture.

Wild oat control in spring wheat with flucarbazone. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Two studies were established in 'Wawawai' spring wheat on the University of Idaho Plant Science Farm near Moscow, ID to evaluate wild oat control with flucarbazone applied at four timings and flucarbazone applied at two timings, at different rates and combined with bromoxynil/MCPA. Wild oat and spring wheat were seeded on April 27 and May 2, 2005, respectively, with a grain box drill. The 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). Wheat injury and wild oat control were evaluated visually during the growing season. Wheat seed was harvested with a small plot combine on August 25, 2005.

Table 1. Application and soil data.

	Flucarbazone timing study				Flucarbazone timing, rate, and combination study	
Application date	4/28/05	5/4/05	5/25/05	6/14/05	5/25/05	6/6/05
Growth stage						
Spring wheat	preplant	preemergence	2 leaf	jointing	2 leaf	4 to 6 leaf
Wild oat	preemergence	preemergence	3 leaf	3 tiller	3 leaf	6 leaf
Air temperature (F)	60	62	66	63	66	58
Relative humidity (%)	40	50	50	59	50	63
Wind (mph, direction)	0	2, N	1, N	1, N	1, S	3, NW
Cloud cover (%)	20	10	20	100	10	60
Soil moisture	dry	dry	dry	dry	dry	moist
Soil temperature at 2 in (F)	54	53	59	50	59	49
Soil						
pH	4.3					
OM (%)	5.7					
CEC (meq/100g)	49					
Texture	salty clay					

In the flucarbazone timing study, flucarbazone combined with fenoxaprop or clodinafop and applied at jointing injured wheat 31 and 39%, respectively (Table 2). Wild oat control was 92 to 99% with flucarbazone treatments applied at the two leaf or jointing stage. No other treatments controlled wild oat. Wheat seed yield was lowest for the untreated check and flucarbazone combined with fenoxaprop, but did not differ from flucarbazone combined with clodinafop or flucarbazone at 0.0178 lb ai/A applied preplant. The spring wheat stand was variable and non-competitive. Wheat test weight was not available due to low seed yield in most treatments.

In the flucarbazone timing, rate and combination study, mesosulfuron alone applied at the six leaf stage injured wheat 16%, but did not differ from flucarbazone at 0.0268 lb ai/A and mesosulfuron plus bromoxynil/MCPA both applied at the six leaf stage (8 and 10%) (Table 3). Mesosulfuron (Osprey) is not registered in spring wheat and is known to cause injury in spring wheat. All treatments controlled wild oat 83% or better, except flucarbazone at 0.0178 lb ai/A applied at the six leaf timing and fenoxaprop treatments applied at the three leaf timing. Flucarbazone at 0.0178 lb ai/A controlled wild oat better at the three leaf timing (94%) than at the six leaf timing (50%), while fenoxaprop combined with bromoxynil/MCPA controlled wild oat better at the later timing (98%) compared to the early timing (76%). Wheat seed yield was lowest for the untreated check, but did not differ from flucarbazone at 0.0178 lb ai/A and flucarbazone plus bromoxynil/MCPA applied at the six leaf timing; fenoxaprop alone at the six leaf timing; and all mesosulfuron treatments, expect alone at the three leaf timing. The spring wheat stand was variable and non-competitive. Wheat test weight was lowest for the untreated check (58.7 lb/bu).

Table 2. Wild oat control and wheat response with flucarbazone applied at four timings near Moscow, Idaho in 2005.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	Wild oat control[3]	Wheat yield
	lb ai/A		%	%	lb/A
Flucarbazone	0.0178	preplant	0	15	556
Flucarbazone	0.0268	preplant	0	28	748
Flucarbazone	0.0178	preemergence	0	44	1003
Flucarbazone	0.0268	preemergence	0	69	921
Flucarbazone +	0.0178				
2,4-D amine	0.375	2 leaf	0	92	1245
Flucarbazone +	0.0268				
2,4-D amine	0.375	2 leaf	0	95	808
Flucarbazone +	0.0268				
clodinafop	0.0094	jointing	39	99	422
Flucarbazone +	0.0268				
fenoxaprop	0.0039	jointing	31	99	308
Untreated check	--	--	--	--	156
LSD (0.05)			15	17	428
Density (plants/ft^2)				20	

[1] A non-ionic surfactant/deposition aid (Liberate) was applied at 0.25% v/v with all postemergence treatments. A crop oil concentrate (Score) was applied with clodinafop at 2 oz/A.

[2] Application timing based on wheat growth stage.

[3] July 20, 2005 evaluation.

Table 3. Wild oat control and wheat response with flucarbazone applied at two timings, different rates, and combined with bromoxynil/MCPA near Moscow, Idaho in 2005.

Treatment[1]	Rate	Application timing[2]	Wheat injury[3]	Wild oat control[3]	Wheat	
					Yield	Test weight
	lb ai/A		%	%	bu/A	lb/bu
Flucarbazone	0.0178	3 leaf	1	94	42	60.5
Flucarbazone	0.0178	6 leaf	4	50	29	60.1
Flucarbazone	0.0223	3 leaf	0	98	51	60.9
Flucarbazone	0.0223	6 leaf	3	99	39	61.5
Flucarbazone	0.0268	3 leaf	1	94	36	60.7
Flucarbazone	0.0268	6 leaf	8	99	37	61.4
Flucarbazone + bromoxynil/MCPA	0.0178 0.5	3 leaf	0	93	38	59.8
Flucarbazone + bromoxynil/MCPA	0.0178 0.5	6 leaf	2	98	33	61.0
Flucarbazone + bromoxynil/MCPA	0.0268 0.5	3 leaf	4	99	44	61.2
Flucarbazone + bromoxynil/MCPA	0.0268 0.5	6 leaf	2	99	36	61.3
Clodinafop	0.05	3 leaf	0	85	48	60.7
Clodinafop	0.05	6 leaf	4	97	43	61.5
Clodinafop + bromoxynil/MCPA	0.05 0.5	3 leaf	0	83	40	60.4
Clodinafop + bromoxynil/MCPA	0.05 0.5	6 leaf	6	98	38	61.5
Fenoxaprop	0.082	3 leaf	0	79	47	60.8
Fenoxaprop	0.082	6 leaf	2	94	34	60.9
Fenoxaprop + bromoxynil/MCPA	0.082 0.5	3 leaf	0	76	41	60.4
Fenoxaprop + bromoxynil/MCPA	0.082 0.5	6 leaf	2	98	35	61.4
Mesosulfuron	0.0089	3 leaf	1	86	40	61.1
Mesosulfuron	0.0089	6 leaf	16	96	22	61.6
Mesosulfuron + bromoxynil/MCPA	0.0089 0.5	3 leaf	4	96	32	60.2
Mesosulfuron + bromoxynil/MCPA	0.0089 0.5	6 leaf	10	98	34	60.8
Untreated check	--	--	--	--	21	58.7
LSD (0.05)			8	19	13	1.1
Density (plants/ft^2)				5		

[1] A non-ionic surfactant/deposition aid (Liberate) was applied at 0.25% v/v with all flucarbazone treatments without bromoxynil/MCPA. A non-ionic surfactant (R-11) and urea ammonium nitrate (URAN) were applied at 0.5%v/v and 5%v/v, respectively, with mesosulfuron treatments. Bromoxynil/MCPA rate is in lb ae/A.

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

[3] July 20, 2005 evaluation.

Wild oat control in spring wheat with flucarbazone combined with various adjuvants and clodinafop. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in 'Alpowa' spring wheat to evaluate wild oat control with clodinafop and with flucarbazone combined with adjuvants near Genesee and Grangeville, Idaho, respectively. The 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). Studies were oversprayed for broadleaf weed control with fluroxypyr at 0.1331 lb ae/A and MCPA ester at 0.5325 lb ae/A on May 26 at the Grangeville site and fluroxypyr at 0.1331 lb ae/A and thifensulfuron/tribenuron at 0.0156 lb ai/A on June 8, 2005 at the Genesee site. Wheat injury and weed control were evaluated visually during the growing season. Wheat seed was harvested with a small plot combine on August 22 and 24, 2005 at the Grangeville and Genesee locations, respectively.

Table 1. Application and soil data.

Location	Grangeville, Idaho	Genesee, Idaho
Application date	5/11/05	5/21/05
Growth stage		
Spring wheat	2 tiller	4 tiller
Wild oat	3 leaf	3 tiller
Air temperature (F)	64	66
Relative humidity (%)	60	57
Wind (mph, direction)	1, NW	3, E
Cloud cover (%)	70	100
Soil moisture	very wet	wet
Soil temperature at 2 in (F)	50	60
Soil		
pH	5.7	5.8
OM (%)	6.1	3.7
CEC (meq/100g)	38	30
texture	silty clay loam	silt loam

At the Grangeville study, all treatments injured spring wheat 5 to 10% on May 26, 2005 (Table 2). By June 20, 2005, no treatment visually injured wheat (data not shown). Wild oat control tended to be higher with the addition of NIS and Bronc Max, but did not differ from any treatments. Wheat seed yield and test weight ranged from 18 to 29 bu/A and 60.3 to 62.3 lb/bu, respectively, and did not differ among treatments. Wheat seed test weight was generally higher for the untreated check compared to all other treatments.

At the Genesee study, no treatment injured wheat (data not shown). All treatments controlled wild oat 95 to 99%, except tralkoxydim and flucarbazone (76 and 51%) (Table 3). Wheat seed yield was higher for clodinafop treatments than mesosulfuron and tralkoxydim treated plots, but all treatments yielded more wheat seed than the untreated check. It is likely that reduced wheat yield in the mesosulfuron treatment was related to crop injury even though no visible injury was observed. Mesosulfuron (Osprey) is not registered on spring wheat and is known to cause spring wheat injury.

Table 2. Wild oat control and wheat response with flucarbazone combined with various adjuvants near Grangeville, Idaho in 2005.

Treatment[1]	Rate	Wheat injury[2]	Wild oat control[3]	Wheat Yield	Wheat Test weight
	lb ai/A			bu/A	lb/bu
Flucarbazone +	0.0175				
R-11	0.25 % v/v	8	65	29	61.4
Flucarbazone +	0.0175				
R-11 +	0.25 %v/v				
Bronc Max	0.5% v/v	10	73	26	61.3
Flucarbazone +	0.027				
Renegade	1.75 pt/A	10	59	21	60.4
Flucarbazone +	0.027				
Renegade +	1.75 pt/A				
In-Place	2 oz/A	5	60	18	60.3
Untreated check	--	--	--	22	62.3
LSD (0.05)		NS	NS	NS	NS
Density (plants/ft^2)			85		

[1] R-11 is 90% nonionic surfactant (NIS); 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] May 26, 2005 evaluation.

[3] July 19, 2005 evaluation.

Table 3. Wild oat control and wheat response with clodinafop and other grass herbicides near Genesee, Idaho in 2005.

Treatment[1]	Rate	Wild oat control[2]	Wheat yield
	lb ai/A	%	lb/A
Clodinafop	0.05	99	1130
Clodinafop	0.0625	99	1150
Pinoxaden +	0.054		
A12127S	0.6 pt/A	98	1051
Mesosulfuron +	0.0089		
NIS +	0.5% v/v		
UAN	2 qt/A	95	688
Flucarbazone +	0.027		
NIS	0.25% v/v	51	739
Tralkoxydim +	0.24		
NIS/COC +	0.5% v/v		
AMS	15 lb ai/100 gal	76	694
Untreated check	--	--	247
LSD (0.05)		19	412
Density (plants/ft^2)		90	

[1] A12127S is an adjuvant, NIS is non ionic surfactant (R-11), UAN is urea ammonium nitrate (URAN), NIS/COC is a non-ionic surfactant and crop oil concentrate (Supercharge), and AMS is ammonium sulfate (Bronc).

[2]

Wild oat control in spring wheat with grass herbicides combined with thifensulfuron and tribenuron. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in 'Alpowa' spring wheat near Genesee, ID to evaluate wild oat control with grass herbicides combined with thifensulfuron and tribenuron. In one study, clodinafop and fenoxaprop were combined with two different formulations of tribenuron and thifensulfuron at a one to one, one to two, and a one to four ratio. In a second study, six grass herbicides were combined with a one to one and a one to four ratio of thifensulfuron to tribenuron. The 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). Wheat injury and wild oat control were evaluated visually during the growing season. Wheat seed was harvested with a small plot combine on August 24, 2005.

Table 1. Application and soil data.

	Clodinafop and fenoxaprop study	Six grass herbicide study
Application date	5/23/05	5/24/05
Growth stage		
Spring wheat	4 tiller	4 tiller
Wild oat	3 tiller	3 tiller
Air temperature (F)	60	60
Relative humidity (%)	60	55
Wind (mph, direction)	3, W	5, SW
Cloud cover (%)	40	30
Soil moisture	wet	moist
Soil temperature at 2 in (F)	56	60
Soil		
pH	5.8	
OM (%)	3.7	
CEC (meq/100g)	30	
texture	silt loam	

In the clodinafop and fenoxaprop study, no treatment injured winter wheat (data not shown). All treatments controlled wild oat 90 to 99% (Table 2). The addition of thifensulfuron and tribenuron at any formulation or ratio did not reduce wild oat control compared to fenoxaprop or clodinafop alone (95 and 99%). Wheat seed yield was lowest for the untreated check. No wheat test weight was available for the untreated check due to low seed yield. Wheat test weight did not differ among herbicide treatments.

In the six grass herbicide study, mesosulfuron + thifensulfuron at 0.015 lb ai/A + tribenuron at 0.00375 lb ai/A injured wheat 12% but did not differ from all propoxycarbazone, flucarbazone, and mesosulfuron treatments (5 to 8%) (Table 3). Mesosulfuron (Osprey) is not registered in spring wheat and is known to cause injury in spring wheat. Wild oat control was 87 to 99% and did not differ among treatments. Wheat seed yield ranged from 982 to 2079 lb/A and did not differ among treatments. Wheat test weight was not available due to low seed yield in most treatments.

Table 2. Wild oat control and wheat response with clodinafop and fenoxaprop combined with two formulations of thifensulfuron and tribenuron near Genesee, Idaho in 2005.

Treatment[1]	Formulation	Rate	Wild oat control[2]	Wheat	
				Yield	Test weight
		lb ai/A	%	lb/A	lb/bu
Clodinafop	0.5 lb ai/gal	0.0625	99	1780	63.6
Clodinafop +	0.5 lb ai/gal	0.0625			
thifensulfuron +	50%	0.015			
tribenuron	50%	0.00375	98	1734	61.3
Clodinafop +	0.5 lb ai/gal	0.0625			
thifensulfuron +	75%	0.015			
tribenuron	75%	0.00375	99	1794	62.2
Clodinafop +	0.5 lb ai/gal	0.0625			
thifensulfuron +	50%	0.00938			
tribenuron	50%	0.00938	98	1630	62.1
Clodinafop +	0.5 lb ai/gal	0.0625			
thifensulfuron +	75%	0.00938			
tribenuron	75%	0.00938	99	1472	62.6
Clodinafop +	0.5 lb ai/gal	0.0625			
thifensulfuron +	50%	0.0188			
tribenuron	50%	0.00938	99	1708	63.0
Clodinafop +	0.5 lb ai/gal	0.0625			
thifensulfuron +	75%	0.0188			
tribenuron	75%	0.00938	99	1827	63.0
Fenoxaprop	1 lb ai/gal	0.0828	95	1638	62.4
Fenoxaprop +	1 lb ai/gal	0.0828			
thifensulfuron +	50%	0.015			
tribenuron	50%	0.00375	99	1764	64.1
Fenoxaprop +	1 lb ai/gal	0.0828			
thifensulfuron +	75%	0.015			
tribenuron	75%	0.00375	96	1692	62.5
Fenoxaprop +	1 lb ai/gal	0.0828			
thifensulfuron +	50%	0.00938			
tribenuron	50%	0.00938	97	1705	62.3
Fenoxaprop +	1 lb ai/gal	0.0828			
thifensulfuron +	75%	0.00938			
tribenuron	75%	0.00938	90	2012	62.6
Fenoxaprop +	1 lb ai/gal	0.0828			
thifensulfuron +	50%	0.0188			
tribenuron	50%	0.00938	93	1918	62.0
Fenoxaprop +	1 lb ai/gal	0.0828			
thifensulfuron +	75%	0.0188			
tribenuron	75%	0.00938	99	1832	63.9
Untreated check	--	--	--	204	--
LSD (0.05)			6	498	NS
Density (plants/ft^2)			85		

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

[2] July 25, 2005 evaluation.

Table 3. Wild oat control and wheat response with grass herbicides combined with thifensulfuron and tribenuron near Genesee, Idaho in 2005.

Treatment[1]	Rate	Spring wheat injury[2]	Wild oat control[2]	Wheat yield
	lb ai/A	%	%	lb/A
Propoxycarbazone	0.0403	5	79	1495
Propoxycarbazone +	0.0403			
thifensulfuron +	0.015			
tribenuron	0.00375	7	89	1621
Propoxycarbazone +	0.0403			
thifensulfuron +	0.00938			
tribenuron	0.00938	6	88	1375
Flucarbazone	0.0263	8	89	1614
Flucarbazone +	0.0263			
thifensulfuron +	0.015			
tribenuron	0.00375	5	89	1426
Flucarbazone +	0.0263			
thifensulfuron +	0.00938			
tribenuron	0.00938	8	84	982
Mesosulfuron	0.0134	6	99	1364
Mesosulfuron +	0.0134			
thifensulfuron +	0.015			
tribenuron	0.00375	12	99	1843
Mesosulfuron +	0.0134			
thifensulfuron +	0.00938			
tribenuron	0.00938	8	99	1553
Clodinafop	0.0625	0	95	2021
Clodinafop +	0.0625			
thifensulfuron +	0.015			
tribenuron	0.00375	0	91	1659
Clodinafop +	0.0625			
thifensulfuron +	0.00938			
tribenuron	0.00938	0	94	1385
Fenoxaprop	0.0828	0	87	1837
Fenoxaprop +	0.0828			
thifensulfuron +	0.015			
tribenuron	0.00375	0	84	1980
Fenoxaprop +	0.0828			
thifensulfuron +	0.00938			
tribenuron	0.00938	0	87	1518
Pinoxaden	0.054	0	99	1900
Pinoxaden +	0.054			
thifensulfuron +	0.015			
tribenuron	0.00375	0	92	2079
Pinoxaden +	0.054			
thifensulfuron +	0.00938			
tribenuron	0.00938	0	86	1542
Untreated check	--	--	--	1146
LSD (0.05)		8	NS	NS
Density (plants/ft^2)			45	

[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. A12127S is an adjuvant and was applied at 0.6 pt/A with pinoxaden treatments.

[2] July 25, 2005 evaluation. The wild oat population was higher in two out the four replications.

Evaluation of wild oat control with thifensulfuron & tribenuron formulations tank mixed with wild oat 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 wild oat and broadleaf weed control with different formulations and ratios of thifensulfuron & tribenuron tank mixed with fenoxaprop and clodinafop. 'Alpowa' was planted April 7, 2005, at 100 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Rad silt loam (20.4% sand, 71.0% silt, and 8.6% clay) with a pH of 8.1, 1.5% organic matter, and CEC of 17.0-meq/100 g soil. Herbicides were applied on May 20, 2005, with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 20 psi. Environmental conditions at application were as follows: air temperature 78 F, soil temperature 60 F, relative humidity 49%, wind speed 2 mph, and 30% cloud cover. Wild oat (AVEFA), kochia (KCHSC), and common lambsquarters (CHEAL) densities averaged 69, 26, and 27 plants/ft^2, respectively. Crop injury was evaluated visually 17 days after treatment (DAT) on June 6. Crop injury and weed species control were evaluated visually 32 and 82 DAT on June 21 and August 11, respectively. Grain was harvested August 24 with a small-plot combine.

Crop injury ranged from 25 to 31% at 17 DAT, 25 to 43% at 32 DAT, and decreased to $\leq$6% at the third evaluation 82 DAT, with no differences among herbicide treatments at any of the evaluation dates (Table). Wild oat control ranged from 93 to 100% with no differences among herbicide treatments. Kochia control 32 and 82 DAT ranged from 77 to 93% and 46 to 75%, respectively with no differences among herbicide treatments. Only two treatments, thifensulfuron & tribenuron SPEC XP + fenoxaprop + R-11 and thifensulfuron & tribenuron-1 XP + fenoxaprop + R-11 had acceptable kochia control (70 to 75%) at 82 DAT. Clodinafop alone had the poorest but still acceptable common lambsquarters control at 86%. Thifensulfuron & tribenuron SPEC XP + fenoxaprop + R-11 and thifensulfuron & tribenuron-1 XP + fenoxaprop + R-11 numerically had the best overall weed control, but there were no differences among herbicide treatments. Grain yield ranged from 3 to 83 bu/A. Thifensulfuron & tribenuron TM SG + fenoxaprop + R-11 and thifensulfuron & tribenuron-1 SG + fenoxaprop + R-11 were among the highest yielding treatments at 83 bu/A. All herbicide treatments had significantly higher grain yield than the check, and there were no differences among herbicide treatments.

Table. Crop injury, weed control, and grain yield with thifensulfuron & tribenuron tank mixed near Kimberly, Idaho.[1]

					Weed control[2]					
	Application	Crop injury			AVEFA		KCHSC		CHEAL	Grain
Treatment[3]	rate	6/6	6/21	8/11	6/21	8/11	6/21	8/11	6/21	yield
	lb ai/A	%								bu/A
Check	-	-	-	-	-	-	-	-	-	3b
Clodinafop	0.0625	28a	35a	4a	94a	100a	77a	58a	86c	63a
Thifensulfuron & tribenuron TM SG + clodinafop	0.01875 + 0.0625	30a	33a	4a	95a	100a	86a	58a	100a	66a
Thifensulfuron & tribenuron TM XP + clodinafop	0.01875 + 0.0625	28a	34a	5a	96a	100a	82a	46a	100a	65a
Thifensulfuron & tribenuron SPEC SG + clodinafop	0.01875 + 0.0625	28a	31a	4a	95a	100a	90a	61a	100a	73a
Thifensulfuron & tribenuron SPEC XP + clodinafop	0.01875 + 0.0625	30a	31a	6a	96a	100a	93a	63a	100a	60a
Thifensulfuron & tribenuron-1 SG + clodinafop	0.01875 + 0.0625	29a	34a	6a	95a	99a	91a	49a	100a	62a
Thifensulfuron & tribenuron-1 XP + clodinafop	0.01875 + 0.0625	29a	34a	5a	96a	100a	93a	64a	100a	73a
Fenoxaprop	0.08313	31a	43a	6a	93a	100a	91a	54a	97c	62a
Thifensulfuron & tribenuron TM SG + fenoxaprop + R-11	0.01875 + 0.08313 + 0.25 %v/v	26a	29a	3a	94a	100a	84a	65a	100a	83a
Thifensulfuron & tribenuron TM XP + fenoxaprop + R-11	0.01875 + 0.08313 + 0.25 %v/v	25a	31a	4a	95a	100a	85a	63a	100a	73a
Thifensulfuron & tribenuron SPEC SG + fenoxaprop + R-11	0.01875 + 0.08313 + 0.25 %v/v	25a	25a	3a	95a	100a	86a	64a	100a	78a
Thifensulfuron & tribenuron SPEC XP + fenoxaprop + R-11	0.01875 + 0.08313 + 0.25 %v/v	31a	28a	4a	96a	100a	91a	75a	100a	75a
Thifensulfuron & tribenuron-1 SG + fenoxaprop + R-11	0.01875 + 0.08313 + 0.25 % v/v	26a	29a	3a	94a	100a	87a	68a	100a	83a
Thifensulfuron & tribenuron-1 XP + fenoxaprop + R-11	0.01875 + 0.08313 + 0.25 %v/v	31a	33a	4a	95a	100a	92a	70a	100a	70a

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

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

[3] R-11 is a nonionic surfactant. Thifensulfuron & tribenuron TM SG is a 4:1 mixture of thifensulfuron and tribenuron in a 50% soluble granular formulation. Thifensulfuron & tribenuron TM XP is a 4:1 mixture of thifensulfuron and tribenuron in a 75% extrudable paste formulation. Thifensulfuron & tribenuron SPEC SG is a 1:1 mixture of thifensulfuron and tribenuron in a 50% soluble granular formulation. Thifensulfuron & tribenuron SPEC XP is a 1:1 mixture of thifensulfuron and tribenuron in a 75% extrudable paste formulation. Thifensulfuron & tribenuron-1 SG is a 2:1 mixture of thifensulfuron and tribenuron in a 50% soluble granular formulation. Thifensulfuron & tribenuron-1 XP is a 2:1 mixture of thifensulfuron and tribenuron in a 75% extrudable paste formulation.

Comparing pinoxaden crop tolerance and wild oat control to competitor standards in spring wheat. Michael P. Quinn, Don W. Morishita, and Robyn C. Walton. (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 crop tolerance and wild oat control with pinoxaden to fenoxaprop and tralkoxydim in spring wheat. 'Alpowa' was planted April 12, 2005, at 100 lb/A. Experimental design was a randomized complete block with four replications and individual plots were 8 by 30 ft. Soil type was a Rad silt loam (20.4% sand, 71.0% silt, and 8.6% clay) with a pH of 8.1, 1.5% organic matter, and CEC of 17.0-meq/100 g soil. Herbicides were applied May 20, 2005, with a CO_2-pressurized bicycle-wheel sprayer with 11001 flat fan nozzles calibrated to deliver 10 gpa at 20 psi. Environmental conditions at application were as follows: air temperature 78 F, soil temperature 62 F, relative humidity 49%, wind speed 2 mph, and 30% cloud cover. Wild oat (AVEFA), kochia (KCHSC), and common lambsquarters (CHEAL) densities averaged 186, 48, and 10 plants/ft^2, respectively. Crop injury was evaluated visually 17 days after treatment (DAT) on June 6. Crop injury and weed control were evaluated visually 32 and 82 DAT on June 21 and August 11. Grain was harvested August 23 with a small-plot combine.

Crop injury ranged from 15 to 36% at the first evaluation, 28 to 43% at the second evaluation, and 1 to 5% at the third evaluation with no difference among herbicide treatments at any evaluation (Table). Wild oat control was acceptable only with treatments containing fenoxaprop and ranged from 76 to 100%. Wild oat control for all other pinoxaden and tralkoxydim treatments averaged <54%. Wild oat control with tralkoxydim was poor because Supercharge, a proprietary adjuvant, was inadvertently omitted from all applications containing tralkoxydim. It is not known why wild oat control with pinoxaden was poor. Kochia and common lambsquarters control ranged from 92 to 100% with all wild oat herbicide treatments applied with one of the broadleaf herbicides with the exception of fenoxaprop + thifesulfuron & tribenuron. With this treatment, kochia control averaged 65%. Fenoxaprop alone and in combination were among the highest yielding treatments at 68 and 82 bu/A, respectively. While fenoxaprop alone and fenoxaprop + thifensulfuron & tribenuron had poorer broadleaf control, the improved wild oat control appears to have compensated. This suggests that, in this study, competition from wild oat had a greater impact on final yield than the broadleaf weeds.

Table. Crop injury, weed control, and grain yield with pinoxaden compared to competitive standards near Kimberly, ID.[1]

					Weed control[2]						
	Application	Crop injury			AVEFA		KCHSC		CHEAL		Grain
Treatment[3]	rate	6/6	6/21	8/11	6/21	8/11	6/21	8/11	6/21	8/11	yield
	lb ai/A	----------------	----------------	----------------	----------------	----------------	-------%-------	----------------	----------------	----------------	bu/A
Check	-	-	-	-	-	-	-	-	-	-	4c
Pinoxaden + Adigore	0.054 + 9.6 fl oz/A	26a	39a	4a	53cd	41c	72c	78bc	93ab	97a	58ab
Pinoxaden + Adigore + bromoxynil & MCPA	0.054 + 9.6 fl oz/A + 0.5	24a	35a	4a	48de	37cd	96a	100a	100a	100a	49b
Pinoxaden + Adigore + thifensulfuron & tribenuron	0.054 + 9.6 fl oz/A + 0.02813	23a	43a	5a	35e	24cd	93ab	100a	100a	100a	20c
Fenoxaprop	0.083	36a	41a	4a	91ab	99a	57c	0d	81b	0b	68ab
Fenoxaprop + bromoxynil & MCPA	0.083 + 0.5	28a	36a	1a	79b	76b	92ab	94ab	100a	100a	82a
Fenoxaprop + thifensulfuron & tribenuron	0.083 + 0.02813	21a	39a	1a	94a	100a	64c	65c	100a	100a	82a
Tralkoxydim	0.18	19a	28a	5a	11f	24cd	74bc	99a	95ab	100a	22c
Tralkoxydim + bromoxynil & MCPA	0.18 + 0.5	18a	35a	3a	64c	53bc	97a	100a	99a	100a	52b
Tralkoxydim + thifensulfuron & tribenuron	0.18 + 0.02813	15a	41a	5a	3f	14d	92ab	100a	100a	100a	17c

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

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

[3] Adigore is adjuvant naptha depleted. Bromoxynil & MCPA is a 1:1 commercially formulated pre-mixture. Thifensulfuron & tribenuron is a 2:1 commercially formulated premixture of thifensulfuron and tribenuron in a 75% extrudable paste formulation.

Italian ryegrass control in spring wheat. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established at the University of Idaho Plant Science Farm near Moscow, Idaho in 'AP603CL' Clearfield spring wheat and 'Wawawai' spring wheat to evaluate Italian ryegrass control with imazamox/MCPA and pendimethalin, respectively. Spring wheat at 90 lb/A and Italian ryegrass at 20 lb/A were seeded with a grain drill box on April 28, 2005. 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). Both studies were oversprayed with thifensulfuron/tribenuron at 0.0156 lb ai/A and dicamba at 0.125 lb ae/A to control broadleaf weeds. Spring wheat injury and weed control were evaluated visually. Wheat seed from the imazamox/MCPA and pendimethalin studies was harvested with a small plot combine on August 16 and 25, 2005, respectively.

Table 1. Application and soil data.

	The imazamox/MCPA study	The pendimethalin study	
Application date	May 25, 2005	May 4, 2005	May 25, 2005
Spring wheat variety	AP603CL	Wawawai	
Growth stage			
Spring wheat	3 leaf	preemergence	3 leaf
Italian ryegrass (LOLMU)	3 leaf	preemergence	3 leaf
Wild oat (AVEFA)	--	preemergence	2 leaf
Air temperature (F)	70	62	70
Relative humidity (%)	55	50	45
Wind (mph, direction)	2, N	2, N	0
Cloud cover (%)	20	0	0
Soil moisture	dry	moist	dry
Soil temperature at 2 in (F)	60	53	63
Soil			
pH	4.3		
OM (%)	5.7		
CEC (meq/100g)	49		
Texture	silty clay		

In the imazamox/MCPA study, no treatment visually injured spring wheat (data not shown). All treatments controlled Italian ryegrass 85 to 99% except clodinafop (28%) (Table 2). Poor Italian ryegrass control with clodinafop was mostly likely due to an ACCase resistant population (seed source was Willamette Valley, OR). Wheat seed yield was higher for all imazamox treatments compared to clodinafop, pinoxaden, and the untreated check. Wheat test weight ranged from 61.1 to 62.2 lb/bu and did not differ among treatments.

In the pendimethalin study, no treatment visually injured spring wheat (data not shown). All postemergence treatments controlled wild oat 94 to 99% (Table 3). Pinoxaden treatments and flucarbazone alone controlled Italian ryegrass 88 to 97%, while no other treatment adequately controlled Italian ryegrass. Poor Italian ryegrass control with clodinafop and tralkoxydim was mostly likely due to an ACCase resistant population. The addition of pendimethalin with any treatment did not improve weed control. Wheat seed yield for the flucarbazone alone treatment was 58 bu/A but did not differ from any postemergence treatment, which were all greater than the untreated check. Wheat test weight ranged from 60.0 to 61.6 lb/bu and did not differ among treatments.

Table 2. Italian ryegrass control and wheat response with imazamox/MCPA near Moscow, Idaho 2005.

Treatment[1]	Rate	LOLMU control[2]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Imazamox	0.0313	94	45	61.9
Imazamox/MCPA	0.281	99	44	61.1
Imazamox/MCPA +	0.281			
bromoxynil/MCPA	0.75	98	41	61.8
Flucarbazone	0.027	94	41	61.9
Clodinafop	0.625	28	37	61.6
Pinoxaden +	0.054			
A12127S	0.6 pt/A	85	35	62.2
Untreated check	--	--	33	62.0
LSD (0.05)		19	5	NS
Density (plants/ft^2)		5		

[1] A 90% nonionic surfactant (R-11) was applied at 0.25% v/v with imazamox and flucarbazone treatments. Urea ammonium nitrate (URAN) was applied at 2.5% v/v with all imazamox treatments. A12127S is an adjuvant.

[2] July 14, 2005 evaluation.

Table 3. Grass weed control and spring wheat response with pendimethalin near Moscow, Idaho in 2005.

Treatment[1]	Rate	Application Timing[2]	Weed control[3]		Spring wheat	
			AVEFA	LOLMU	Yield	Test weight
	lb ai/A		%	%	bu/A	lb/bu
Pendimethalin	1.25	preemergence	30	25	48	61.4
Flufenacet	0.36	preemergence	10	32	38	61.1
Flufenacet +	0.36					
Pendimethalin	1.25	preemergence	25	28	35	60.7
Flufenacet/metribuzin	0.425	preemergence	20	54	36	60.0
Flufenacet/metribuzin +	0.425					
pendimethalin	0.026	preemergence	20	40	42	61.2
Clodinafop	0.0625	3 leaf	99	45	53	61.3
Clodinafop +	0.0625					
pendimethalin	1.25	3 leaf	99	58	52	61.6
Pinoxaden	0.834	3 leaf	99	88	52	61.1
Pinoxaden +	0.834					
pendimethalin	1.25	3 leaf	99	94	52	60.6
Flucarbazone	0.027	3 leaf	99	97	58	61.1
Flucarbazone +	0.027					
pendimethalin	1.25	3 leaf	94	70	53	61.2
Tralkoxydim	0.24	3 leaf	96	61	52	61.0
Tralkoxydim +	0.24					
pendimethalin	1.25	3 leaf	99	60	56	61.2
Untreated check	--	--	--	--	39	61.5
LSD (0.05)			29	17	8	NS
Density (plants/ft^2)			1	5		

[1] A12127S (an adjuvant) was applied at 0.6 pt/A with pinoxaden; a non ionic surfactant (R-11) at 0.25% v/v was applied with flucarbazone; and ammonium sulfate (Bronc) at 15 lb ai/100 gal and a non ionic surfactant/crop oil concentrate blend (Supercharge) at 0.5% v/v were applied with tralkoxydim.

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

[3] July 14, 2005 evaluation.

ACCase-resistant Italian ryegrass and wild oat control with pinoxaden and other grass herbicides. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) ACCase-resistant grass weed populations are prevalent in northern Idaho. Pinoxaden is a new ACCase-inhibiting herbicide that soon will be registered for use in wheat and barley. Studies were established in previously identified ACCase-resistant weed populations near Grangeville and Moscow, Idaho to evaluate wild oat and Italian ryegrass control, respectively, with pinoxaden and other grass herbicides. 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). Weed control was evaluated visually. Weed seed was collected at maturity in each herbicide treatment and will be screened in the greenhouse to confirm resistance.

Table 1. Application and soil data.

Location	Grangeville, Idaho	Moscow, Idaho
Application date	May 19, 2005	June 7, 2005
Growth stage		
Italian ryegrass (LOLMU)	--	4 leaf
Wild oat (AVEFA)	3 to 4 leaf	--
Air temperature (F)	56	56
Relative humidity (%)	75	60
Wind (mph, direction)	1, NE	3, SW
Cloud cover (%)	100	70
Soil moisture	wet	dry
Soil temperature at 2 in (F)	57	46
Soil		
pH	5.7	5.0
OM (%)	6.1	3.2
CEC (meq/100g)	38	21
texture	silty clay loam	silt loam

At the Grangeville study on June 20, clethodim and pinoxaden controlled wild oat 98 and 99% but were not different from fenoxaprop and imazamox (93 and 94%) (Table 2). Wild oat control ranged from 75 to 79% with clodinafop, mesosulfuron, and flucarbazone, but was poorest with tralkoxydim (19%). On July 19, all treatments controlled wild oat 85% or better, except clodinafop, flucarbazone, and tralkoxydim which suppressed wild oat 20 to 68%.

At the Moscow study on June 28, Italian ryegrass control was 98% with mesosulfuron but did not differ from clethodim, pinoxaden, or imazamox (77 to 96%) (Table 3). Flucarbazone controlled Italian ryegrass 72%, while clodinafop, diclofop, and tralkoxydim did not control Italian ryegrass (0 to 21%). On July 21, Italian ryegrass control was best with mesosulfuron, pinoxaden, and clethodim (81 to 98%). Imazamox and clodinafop suppressed Italian ryegrass 44 and 46%, respectively, but was not different from diclofop (29%). Italian ryegrass control was least with tralkoxydim and flucarbazone (15%).

Table 2. Wild oat control with pinoxaden and other grass herbicides near Grangeville, Idaho in 2005.

Treatment[1]	Rate	Wild oat control	
		June 20	July 19
	lb ai/A	--------------------%--------------------	
Pinoxaden +	0.054		
A12127S	0.6 pt/A	98	99
Clodinafop	0.05	75	68
Tralkoxydim +	0.24		
NIS/COC +	0.5% v/v		
AMS	15 lb ai/ 100 gal	18	20
Clethodim +	0.125		
COC	1% v/v	99	98
Mesosulfuron +	0.013		
MSO	2% v/v	78	96
Imazamox +	0.048		
MSO	2% v/v	94	98
Flucarbazone +	0.027		
NIS	0.25% v/v	79	40
Fenoxaprop	0.083	93	85
LSD (0.05)		16	14
Density (plants/ft^2)		85	

[1] A12127S is an adjuvant, NIS/COC is a non-ionic surfactant and crop oil concentrate (Supercharge), AMS is ammonium sulfate (Bronc), COC is a crop oil concentrate (Moract), MSO is a methylated seed oil, and NIS is non-ionic surfactant (R-11).

Table 3. Italian ryegrass control with pinoxaden and other grass herbicides near Moscow, Idaho in 2005.

Treatment[1]	Rate	Italian ryegrass control	
		June 28	July 21
	lb ai/A	--------------------%--------------------	
Pinoxaden +	0.054		
A12127S	0.6 pt/A	80	97
Clodinafop	0.05	21	44
Tralkoxydim +	0.24		
NIS/COC +	0.5% v/v		
AMS	15 lb ai/ 100 gal	0	15
Clethodim +	0.125		
COC	1% v/v	96	98
Mesosulfuron +	0.013		
MSO	2% v/v	98	81
Imazamox +	0.048		
MSO	2% v/v	77	46
Flucarbazone +	0.027		
NIS	0.25% v/v	72	15
Diclofop +	1		
COC	1% v/v	10	29
LSD (0.05)		25	26
Density (plants/ft^2)		7	

[1] A12127S is an adjuvant, NIS/COC is a non-ionic surfactant and crop oil concentrate (Supercharge), AMS is ammonium sulfate (Bronc), COC is a crop oil concentrate (Moract), MSO is a methylated seed oil, and NIS is non-ionic surfactant (R-11).

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, OR CF102, 99-419, 99-435, and 99-420-9), 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, both studies were oversprayed with bromoxynil/MCPA at 0.5 lb ae/A and dicamba at 0.094 lb ai/A on April 22 and 29, 2005 at Potlatch and Grangeville, respectively. In both experiments, wheat injury was evaluated visually, and wheat seed was harvested on August 15 and 16, 2005 at Potlatch and Grangeville, respectively.

Table 1. Application and soil data.

	Potlatch		Grangeville	
Planting date	October 15, 2004		October 13, 2004	
Application date	4/10/05	5/4/05	4/18/05	5/11/05
Wheat growth stage	2 tiller	4 tiller	2 tiller	7 tiller
Air temperature (F)	55	58	45	60
Relative humidity (%)	63	75	75	66
Wind (mph, direction)	2, SW	1, SE	7, NW	4, E
Cloud cover (%)	30	40	60	40
Soil moisture	moist	wet	wet	very wet
Soil temperature at 2 in (F)	45	50	45	45
pH	4.8		4.9	
OM (%)	2.6		5.9	
CEC (meq/100g)	22		37	
Texture	silt loam		clay loam	

At Potlatch, wheat injury was greater with imazamox at 0.094 lb ai/A (10%) than imazamox at 0.047 lb ai/A (2%) [LSD (0.05) = 3] and greater at the 4 tiller (9%) than the 2 tiller application time (3%) [LSD (0.05) = 3]. At the 4 tiller application time, wheat injury increased with increasing imazamox rate (Table 2). Wheat seed yield was greater for OR CF102 (116 bu/A) than ID 587, 99-435, 99-419,and 99-420-9, which yielded 95, 101, 102, and 102 bu/A, respectively [LSD (0.05) = 9]. Test weight ranged from 58 to 61 lb/bu and did not differ among wheat variety, application time, or imazamox rate (data not shown).

At Grangeville, wheat injury was greater with imazamox at 0.094 lb ai/A (11%) than imazamox at 0.047 lb ai/A (1%) [LSD (0.05) = 2] and greater at the 7 tiller (9%) than the 2 tiller application time (2%) [LSD (0.05) = 2]. At the 7 tiller application time, wheat injury increased with increasing imazamox rate (Table 3). Wheat seed yield was reduced by imazamox at 0.094 lb ai/A (96 bu/A) compared to imazamox at 0.047 lb ai/A (104 bu/A) [LSD (0.05) = 4] and by the 7 tiller application time (97 bu/A) compared to the 2 tiller application time (102 bu/A) [LSD (0.05) = 4]. At the 7 tiller application time, wheat seed yield was reduced by increasing imazamox rate (Table 3). Test weight was lower for OR CF102 (58 lb/bu) than 99-419 and 99-420-9 (60 lb/bu) but did not differ from ID 587, 99-435 (59 bu/A) [LSD (0.05) = 1]. Test weight of OR CF 102 decreased with increasing imazamox rate (Table 4).

Table 2. Wheat injury near Potlatch averaged over variety in 2005.

Application time	Imazamox rate[1]	Wheat injury[2]
	lb ai/A	%
2 tiller	0	--
	0.047	2
	0.094	3
4 tiller	0	--
	0.047	3
	0.094	16
LSD (0.05)		5

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

[2] June 14, 2005 evaluation.

Table 3. Wheat injury and yield near Grangeville averaged over variety in 2005.

		Wheat	
Application time	Imazamox rate[1]	Injury[2]	Yield
	lb ai/A	%	bu/A
2 tiller	0	--	103
	0.047	1	103
	0.094	3	101
7 tiller	0	--	103
	0.047	1	104
	0.094	18	90
LSD (0.05)		3	7

[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] July 19, 2005 evaluation.

Table 4. Wheat test weight near Grangeville averaged over imazamox application time in 2005.

Wheat variety	Imazamox rate[1]	Wheat test weight
	lb ai/A	lb/bu
ID 587	0	59
	0.047	59
	0.094	59
OR CF102	0	58
	0.047	59
	0.094	56
99-419	0	60
	0.047	60
	0.094	60
99-435	0	59
	0.047	59
	0.094	60
99-420-9	0	59
	0.047	60
	0.094	60
LSD (0.05)		2

[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.

Clearfield winter wheat tolerance to imazamox and thifensulfuron/tribenuron combinations. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established in weed free 'ID 587' Clearfield winter wheat at the University of Idaho Plant Science Farm near Moscow, Idaho to evaluate winter wheat response to split applications of imazamox and thifensulfuron/tribenuron. Studies were arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Wheat injury was evaluated visually every seven days until heading. Wheat seed was harvested with a small plot combine on August 2, 2005.

Table 1. Application and soil data.

Application date	4/6/05	4/13/05	4/21/05	4/26/05	5/4/05	5/13/05	5/21/05
Winter wheat growth stage	8 tiller	9 tiller	9 tiller	prejoint	prejoint	prejoint	jointing
Air temperature (F)	67	43	63	72	64	68	49
Relative humidity (%)	47	70	50	65	45	66	76
Wind (mph, direction)	4, N	5, NW	3, S	1, W	0	0	1, W
Cloud cover (%)	80	100	80	10	0	80	0
Soil moisture	wet	wet	moist	dry	moist	wet	wet
Soil temperature at 2 in (F)	50	40	51	60	60	59	50
Soil							
pH				5.1			
OM (%)				3.3			
CEC (meq/100g)				24			
texture				silt loam			

At all evaluation dates, no treatment visually injured wheat (data not shown). Wheat seed yield for all treatments was equal to or greater than the untreated check (Table 2). Wheat seed test weight was not different among treatments, but tended to be lower for all herbicide treatments compared to the untreated check.

Table 2. Winter wheat yield and test weight with imazamox and thifensulfuron/tribenuron combinations near Moscow, ID in 2005.

		Application	Wheat	
Treatment[1]	Rate	date	Yield	Test weight
	lb ai/A		bu/A	lb/bu
Thifensulfuron/tribenuron +	0.0156	4/6/05		
imazamox	0.0313	4/26/05	143	58.0
Thifensulfuron/tribenuron +	0.0156	4/13/05		
imazamox	0.0313	4/26/05	129	60.1
Thifensulfuron/tribenuron +	0.0156	4/21/05		
imazamox	0.0313	4/26/05	139	58.6
Thifensulfuron/tribenuron +	0.0156			
imazamox	0.0313	4/26/05	131	59.9
Imazamox	0.0313	4/26/05	140	58.3
Pinoxaden	0.0535	4/26/05	137	57.4
Thifensulfuron/tribenuron +	0.0156	5/4/05		
imazamox	0.0313	4/26/05	129	60.2
Thifensulfuron/tribenuron +	0.0156	5/13/05		
imazamox	0.0313	4/26/05	142	56.5
Thifensulfuron/tribenuron +	0.0156	5/21/05		
imazamox	0.0313	4/26/05	138	57.9
Untreated check	--	--	121	61.0
LSD (0.05)			11	NS

[1] A non-ionic surfactant (R-11) at 0.25% v/v was applied with all thifensulfuron/tribenuron and imazamox treatments. Urea ammonium nitrate (URAN) at 2.5% v/v was applied with all imazamox treatments. A12127C is an adjuvant that was applied with pinoxaden at 0.6 pt/A.

California brome control in imazamox-resistant wheat. Richard Affeldt, Chuck Cole, Bill Brewster, Jed Colquhoun, and Carol Mallory-Smith. (Department of Crop and Soil Science, Oregon State University, Corvallis, OR, 97331-3002) California brome is a short-lived perennial that infests perennial grasses grown for seed. Wheat is often grown in rotation with grass grown for seed in western Oregon. Currently the best options for California brome control in winter wheat are flufenacet plus metribuzin and sulfosulfuron. A trial was conducted at the Hyslop research farm to evaluate California brome control with imazamox in imazamox-resistant winter wheat. 'Clearfirst' winter wheat was seeded on October 13, 2004. Plots were 8 ft by 36 ft with four replications arranged as randomized complete blocks. Herbicides were applied with a compressed-air sprayer delivering 20 gpa and 20 psi at 3 mph. Application conditions and growth stages are presented in Table 1.

Table 1. Application conditions and growth stages at Hyslop farm.

Application date	Oct 21, 2004	Dec 15, 2004	Feb 1, 2005
California brome stage	spike	2-4 leaf	4-7 leaf, 0-3 tiller
Wheat growth stage	spike	5-6 leaf, 2-3 tiller	8 inch
Air temperature (F)	54	45	41
Relative humidity (%)	79	89	84
Wind velocity (mph)	3	3	2
Soil temperature (F)	51	43	43
Soil moisture	muddy	slightly muddy	slightly muddy
Soil texture		silt loam	
Soil pH		5.6	
Soil OM (%)		2.9	

California brome control with imazamox was similar to control with sulfosulfuron (Table 2). Wheat injury was minimal (data not shown). On February 8, California brome control with flufenacet plus metribuzin applied in October was better than sulfosulfuron or imazamox applied in December, however, by March 22 there was no difference. In a similar trial, flufenacet plus metribuzin followed by imazamox controlled 99% of the California brome (data not shown).

Table 2. California brome control in 'Clearfirst' winter wheat at Hyslop farm.

Treatment	Rate	Application date	California brome Nov 10, 2004	Feb 8, 2005	Mar 22, 2005
	lb ai/A		% control		
Flufenacet + metribuzin[1]	0.34 + 0.141	Oct 21, 2004	90	76	85
Mesosulfuron[2]	0.0134	Dec 15, 2004	---	8	0
Sulfosulfuron[3]	0.031	Dec 15, 2004	---	43	81
Imazamox[4]	0.047	Dec 15, 2004	---	35	83
Imazamox[4]	0.047	Feb 1, 2005	---	0	55
LSD (0.05)			---	29	28

[1] Applied with nonionic surfactant at 0.25% v/v.

[2] Applied with nonionic surfactant at 0.5% v/v and 32% urea ammonium nitrate at 2.5% v/v.

[3] Applied with nonionic surfactant at 0.5% v/v.

[4] Applied with nonionic surfactant at 0.25% v/v and 32% urea ammonium nitrate at 2.5% v/v.

Downy brome control in Clearfield^{TM} winter wheat. Larry H. Bennett, Sandra M. Frost and Daniel A. Ball (Oregon State University – CBARC, Pendleton, OR 97801). A study was established at the Columbia Basin Agricultural Research Center, Pendleton, OR to evaluate control of downy brome in Clearfield^{TM} winter wheat. Plots were 9 by 30 ft arranged in a randomized complete block design with 4 replications. Soil at the site was a silt loam (23.6% sand, 58.9% silt, 17.5% clay, 2.2% organic matter, 5.5 pH, and CEC of 15.7 meq/100g). Clearfield Wheat variety ID-587 was planted October 1, 2004 with a John Deere 9400 drill. Herbicide treatments were applied using a 9 ft hand-held boom, CO_2 pressurized sprayer delivering 10 gpa at 20 psi. Pre-emergence (PRE) treatments were applied October 2, 2004. Early postemergence (EPOST) treatments were applied January 27, 2005 when downy brome was at the 5 to 6 leaf stage (Table 1). Crop injury was evaluated March 7, 2005. Control of downy brome was visually evaluated on March 7 and May 23, 2005. Plots were harvested July 15, 2005 using a Hege small plot combine. Wheat was further cleaned with an "Almaco" cleaner, weighed, and yield converted to bu/A using 60 lb/bu as the standard test weight. Mention of products used in this trial should not be considered to be a product endorsement or recommendation for commercial use.

Table 1. Application conditions.

	Oct 2, 2004	Jan 27, 2005
Timing	PRE	EPOST
Wheat (leaf)	PRE	7-8
Downy brome (leaf)	PRE	5-6
Air temperature (F)	55	55
Relative humidity (%)	70	65
Wind speed (mph)	1	3
Soil temperature (F at 1 inch)	55	58
Cloud cover (%)	0	30

Results indicated very little crop injury in any of the treatments (6% or less) and the crop recovered over time (Table 2). Downy brome control on March 7, 2005 ranged from 74 to 97% in the treated plots, with the PRE treatment of flufenacet + metribuzin giving the least control. Downy brome control with imazamox was excellent with an adjuvant mixture of non-ionic surfactant and UAN. When ammonium sulfate (AMS) was substituted for UAN, downy brome control decreased 20 to 30%. An EPOST treatment of metribuzin to plots treated with flufenacet + metribuzin PRE increased downy brome control from 55% up to 75%. Propoxycarbazone-sodium or sulfosulfuron were not as effective in controlling downy brome as the most effective treatments of imazamox, averaging 76% and 81% control, respectively, at the final rating on May 23, 2005. All treatments gave significantly higher yields than the untreated control.

Table 2. Downy brome control in Clearfield^{TM} winter wheat at Pendleton, OR.

			Crop injury	Downy brome control		Crop yield
Treatment[1]	Rate	Timing	3/7/05	3/7/05	5/23/05	7/15/05
	-----lb ai/a-----		---------------%---------------			--bu/a--
Untreated check	-----	--	0	0	0	67
Imazamox + NIS + UAN	0.031 + 0.25% v/v + 2.5% v/v	EPOST	0	96	99	104
Imazamox + NIS + UAN + bromoxynil + MCPA	0.031 + 0.25% v/v + 2.5% v/v + 0.75	EPOST	3	89	100	105
Imazamox + NIS + UAN	0.031 + 0.25% v/v + 3 gal/a	EPOST	1	93	100	101
Imazamox + NIS + UAN + bromoxynil + MCPA	0.031 + 0.25% v/v + 3 gal/a + 0.75	EPOST	5	89	100	99
Imazamox + NIS + AMS	0.031 + 0.25% v/v + 1.5 lb/a	EPOST	0	90	83	99
Imazamox + NIS + AMS + bromoxynil + MCPA	0.031 + 0.25% v/v + 1.5 lb/a + 0.75	EPOST	6	86	100	103
Imazamox + NIS + AMS	0.031 + 0.25% v/v + 2.5 lb/a	EPOST	0	79	70	93
Imazamox + NIS + AMS + bromoxynil + MCPA	0.031 + 0.25% v/v + 2.5 lb/a + 0.75	EPOST	3	89	100	107
Flufenacet + metribuzin	0.43	PRE	0	74	55	101
Flufenacet + metribuzin / metribuzin	0.43 / 0.19	PRE / EPOST	1	86	75	101
Flufenacet + metribuzin / imazamox + NIS + UAN	0.43 / 0.38 + 0.25% v/v + 2.5% v/v	PRE / EPOST	0	97	100	105
Imazamox + NIS + UAN	0.47 + 0.25% v/v + 2.5% v/v	EPOST	0	92	100	105
Procarbazone-sodium + NIS	0.04 + 0.25% v/v	EPOST	0	91	76	97
Sulfosulfuron + NIS	0.03+ 0.5% v/v	EPOST	0	85	81	98
LSD (0.05)			2	6	8	13

[1] NIS = non-ionic surfactant; UAN = Solution 32; AMS = ammonium sulfate; bromoxynil + MCPA = Bronate; flufenacet + metribuzin = Axiom.

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) Studies were established near Lewiston, Idaho in 'ID 587' imidazolinone-resistant winter wheat. Three studies evaluated weed control and wheat response with propoxycarbazone/mesosulfuron alone; propoxycarbazone/mesosulfuron combined with broadleaf herbicides; and imazamox alone or in 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). The propoxycarbazone/mesosulfuron alone study was oversprayed on May 16, 2005 with fluroxypyr at 0.1331 lb ae/A plus MCPA ester at 0.5325 lb ae/A to control broadleaf weeds. In all experiments, wheat injury and weed control were evaluated visually during the growing season, and wheat seed was harvested on August 1, 2005.

Table 1. Application and soil data.

Study	Propoxycarbazone /mesosulfuron	Propoxycarbazone /mesosulfuron with broadleaf herbicides	Imazamox
Application date	April 16, 2005	April 16, 2005	April 19, 2005
Growth stage			
Wheat	2 tiller	2 tiller	2 tiller
Downy brome (BROTE)	2 tiller	2 tiller	2 tiller
Air temperature (F)	56	60	54
Relative humidity (%)	43	43	48
Wind (mph, direction)	1, NW	2, SW	3, NW
Cloud cover (%)	80	60	80
Soil moisture	wet	wet	wet
Soil temperature at 2 in (F)	50	53	48
pH	5.6		
OM (%)	3.9		
CEC (meq/100g)	22		
Texture	silt loam		

In the propoxycarbazone/mesosulfuron study, no treatment visually injured winter wheat (data not shown). Downy brome control was best with propoxycarbazone alone or with metribuzin (92 and 94%) and least with propoxycarbazone/mesosulfuron treatments (25 to 41%), except at the low rate without UAN (Table 2). Wheat seed yield for all treatments was higher than the untreated check, except sulfosulfuron plus metribuzin, mesosulfuron, and propoxycarbazone/mesosulfuron at the low rate with UAN or the high rate without UAN. Wheat yield did not correlate with visual control due to high variability in wheat stand from intense rodent damage. Wheat seed test weight ranged from 55 to 59 lb/bu and did not differ among treatments.

In the propoxycarbazone/mesosulfuron combined with broadleaf herbicides study, no treatment injured wheat (data not shown). Downy brome control was reduced 18 and 44% by the addition of MCPA amine and metribuzin, respectively, compared to propoxycarbazone/mesosulfuron alone (68%) (Table 3). All other broadleaf herbicide combinations controlled downy brome better than propoxycarbazone/mesosulfuron alone (76 to 95%). Wheat seed yield ranged from 32 to 39 bu/A and did not differ among treatments and the untreated check. Wheat seed test weight was lowest in the propoxycarbazone/mesosulfuron treatment and the untreated check.

In the imazamox study, no treatment injured wheat (data not shown). All imazamox and propoxycarbazone treatments controlled downy brome 97 to 99% (Table 4). Downy brome control with sulfosulfuron was 89% and pendimethalin alone did not control downy brome. Wheat seed yield (35 to 55 bu/A) did not differ among treatments but tended to be lower in the untreated check (35 bu/A). Wheat seed test weight was lowest for the pendimethalin treatment and the untreated check (56.6 and 56.7 lb/bu).

Table 2. Downy brome control and wheat response with propoxycarbazone /mesosulfuron near Lewiston, Idaho in 2005.

Treatment[1]	Rate	Downy brome control[2]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Propoxycarbazone/mesosulfuron +	0.038			
NIS	0.5% v/v	53	42	56
Propoxycarbazone/mesosulfuron +	0.038			
NIS +	0.5% v/v			
UAN	2 qt/A	41	36	57
Propoxycarbazone/mesosulfuron +	0.044			
NIS	0.5% v/v	25	32	58
Propoxycarbazone/mesosulfuron +	0.044			
NIS +	0.5% v/v			
UAN	2 qt/A	29	41	55
Mesosulfuron +	0.0134			
NIS +	0.5% v/v			
UAN	2 qt/A	63	35	58
Propoxycarbazone +	0.04			
NIS +	0.25% v/v			
UAN	2 qt/A	94	37	58
Propoxycarbazone +	0.04			
NIS +	0.25% v/v			
metribuzin	0.1875	92	43	59
Sulfosulfuron +	0.0312			
NIS	0.5% v/v	51	41	56
Sulfosulfuron +	0.0312			
NIS +	0.5% v/v			
metribuzin	0.1875	63	33	59
Untreated check	--	--	28	57
LSD (0.05)		26	8	NS
Density (plants/ft^2)		5		

[1] NIS is 90% nonionic surfactant (R-11) and UAN is urea ammonium nitrate (URAN).

[2] May 26, 2005 evaluation.

Table 3. Downy brome control and wheat response with propoxycarbazone/mesosulfuron combined with broadleaf herbicides near Lewiston, Idaho in 2005.

Treatment[1]	Rate[2]	Downy brome control[3]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Propoxycarbazone/mesosulfuron	0.038	68	35	58.6
Propoxycarbazone/mesosulfuron +	0.038			
clopyralid/MCPA	0.61	90	35	59.7
Propoxycarbazone/mesosulfuron +	0.038			
fluroxypyr +	0.1			
MCPA ester	0.4	87	38	60.1
Propoxycarbazone/mesosulfuron +	0.038			
metsulfuron +	0.004			
MCPA ester	0.5	95	35	60.1
Propoxycarbazone/mesosulfuron +	0.038			
thifensulfuron/tribenuron +	0.016			
MCPA ester	0.5	91	39	59.5
Propoxycarbazone/mesosulfuron +	0.038			
bromoxynil/MCPA	0.75	95	38	59.9
Propoxycarbazone/mesosulfuron +	0.038			
MCPA ester	0.75	94	33	59.4
Propoxycarbazone/mesosulfuron +	0.038			
MCPA amine	0.75	56	32	59.4
Propoxycarbazone/mesosulfuron +	0.038			
metribuzin	0.188	38	38	59.9
Propoxycarbazone/mesosulfuron +	0.038			
metribuzin +	0.188			
MCPA ester	0.5	76	38	60.0
Untreated check	--	--	37	58.5
LSD (0.05)		8	NS	0.8
Density (plants/ft^2)		5		

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[1] All treatments included NIS a 90% non-ionic surfactant (R-11) at 0.5 %v/v and urea ammonium nitrate (URAN) at 2 qt/A, except metribuzin which excluded the urea ammonium nitrate. MCPA ester combined fluroxypyr is Sword, while all other MCPA ester treatments are Rhonox.

[2] Clopyralid/MCPA,. fluroxypyr, MCPA ester, bromoxynil/MCPA rates are in lb ae/A.

[3] May 26, 2005 evaluation.

Table 4. Downy brome control and wheat response with imazamox alone or in combinations near Lewiston, Idaho in 2005.

Treatment[1]	Rate	Downy brome control[2]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Imazamox/MCPA	0.352	99	52	60.1
Imazamox	0.031	99	47	60.1
Imazamox	0.039	99	52	59.6
Imazamox +	0.039			
pendimethalin	0.71	99	51	60.4
Imazamox +	0.039			
pendimethalin	0.95	99	55	58.2
Pendimethalin	0.95	5	41	56.6
Imazamox +	0.039			
UAN	30% v/v	99	48	60.2
Imazamox +	0.039			
AMS	15 lb ai/100 gal	99	50	60.0
Imazamox +	0.039			
AMS	25 lb ai/100 gal	99	47	59.6
Imazamox +	0.039			
fluroxypyr +	0.094			
2,4-D amine	0.237	99	48	59.3
Imazamox +	0.039			
UAN +	30% v/v			
fluroxypyr +	0.094			
2,4-D amine	0.237	99	42	60.0
Imazamox +	0.039			
AMS +	15 lb ai/100 gal			
fluroxypyr +	0.094			
2,4-D amine	0.237	99	48	60.0
Imazamox +	0.039			
AMS +	25 lb ai/100gal			
fluroxypyr +	0.094			
2,4-D amine	0.237	99	48	60.1
Propoxycarbazone	0.04	98	48	58.8
Sulfosulfuron	0.031	89	41	59.5
Propoxycarbazone/mesosulfuron	0.038	97	48	60.2
Untreated check	--	--	35	56.7
LSD (0.05)		3	NS	1.4
Density (plants/ft^2)		5		

[1] Non ionic surfactant (R-11) was applied at 0.25% v/v with imazamox and imazamox/MCPA treatments and at 0.5% v/v with propoxycarbazone, sulfosulfuron, and propoxycarbazone/mesosulfuron. Urea ammonium nitrate (URAN) was applied at 2.5% v/v with all treatments, except pendimethalin alone and imazamox with UAN at 30% v/v or AMS. Fluroxypyr rate is in lb ae/A.

[2] May 26, 2005 evaluation.

Downy brome control in Clearfield^{TM} winter wheat with propoxycarbazone-sodium. Sandra M. Frost, Larry H. Bennett, and Daniel A. Ball (Oregon State University – CBARC, Pendleton, OR 97801). A study was established at the Columbia Basin Agricultural Research Center, Pendleton, OR to evaluate control of downy brome in Clearfield^{TM} winter wheat. Plots were 9 by 30 ft arranged in a randomized complete block design with 4 replications. Soil at the site was a silt loam (31.6% sand, 54.9% silt, 13.5% clay, 1.6% organic matter, 6.3 pH, and CEC of 11.8 meq/100g). Clearfield winter wheat, variety ORCF-101, was planted October 6, 2004 with a John Deere 9400 drill. Herbicide treatments were applied using a 9 ft hand-held boom, CO_2 pressured sprayer delivering 16 gpa at 30 psi. Early postemergence (EPOST) treatments were applied November 22, 2004 when downy brome was at the 1 to 2 leaf stage. Late postemergence (LPOST) treatments were applied on February 1, 2005, when downy brome was at the 4 to 7 leaf stage of growth (Table 1). Control of downy brome was visually evaluated on April 14 and May 23, 2005. Plots were harvested July 18, 2005 using a Hege small plot combine. Wheat was further cleaned with an "Almaco" cleaner, weighed, and yield converted to bu/A. Mention of products used in this trial should not be considered to be a product endorsement or recommendation for commercial use.

Table 1. Application conditions.

	Nov 22, 2004	Feb 1, 2005
Timing	EPOST	LPOST
Downy brome (leaf)	1-2	4-7
Air temperature (F)	55	55
Relative humidity (%)	38	36
Wind speed (mph)	2	1
Soil temperature (F at 1 inch)	48	46
Cloud cover (%)	90	5

The high rate propoxycarbazone-sodium + mesosulfuron-methyl applied LPOST and imazamox applied at both timings were the only treatments that gave at least 90% control of downy brome when evaluated April 14, 2005 (Table 2). The EPOST application of mesosulfuron-methyl was the least effective treatment. Final ratings were taken on May 23, 2005 when the downy brome was headed out. At this time only the two imazamox treatments were giving 98% or greater control. The LPOST applications of propoxycarbazone-sodium + mesosulfuron-methyl and mesosulfuron-methyl were the next best treatments, averaging 71 to 78% control. All of the EPOST treatments, with the exception of imazamox, averaged 50% or less. All of the treated plots yielded more than the untreated control. The highest yield was in the EPOST application of imazamox plots, while the lowest yield in the treated plots was from mesosulfuron-methyl applied EPOST.

Table 2. Downy brome control in Clearfield™ winter wheat.

Treatment[1]	Rate	Timing	Crop injury	Downy brome control		Crop yield
			4/14/05	4/14/05	5/23/05	7/18/05
	--lb ai/a--		---------------------	%---------------------		--bu/a--
Untreated check	-----	--	0	0	0	54
Propoxycarbazone-sodium + mesosulfuron-methyl	0.014 + 0.007	EPOST	0	78	41	89
Propoxycarbazone-sodium + mesosulfuron-methyl	0.016 + 0.008	EPOST	0	79	46	91
Propoxycarbazone-sodium	0.039	EPOST	0	79	49	91
Mesosulfuron-methyl	0.013	EPOST	0	55	26	82
Sulfosulfuron	0.031	EPOST	0	80	50	98
Imazamox + UAN	0.031 + 2.5% v/v	EPOST	0	96	99	103
Propoxycarbazone-sodium + mesosulfuron-methyl	0.014 + 0.007	LPOST	0	84	71	92
Propoxycarbazone-sodium + mesosulfuron-methyl	0.016 + 0.008	LPOST	0	91	73	93
Propoxycarbazone-sodium	0.039	LPOST	0	78	54	87
Mesosulfuron-methyl	0.013	LPOST	0	80	78	91
Sulfosulfuron	0.031	LPOST	0	81	56	98
Imazamox + UAN	0.38 + 2.5% v/v	LPOST	0	95	98	98
LSD (0.05)			NS	11	18	13

[1] All herbicide treatments included non-ionic surfactant at 0.5% v/v. UAN = Solution 32 at 2.5% v/v.

Rattail fescue control with imazamox and adjuvants in Clearfield™ winter wheat. Sandra M. Frost, Larry H. Bennett, and Daniel A. Ball (Oregon State University – CBARC, Pendleton, OR 97801). A study was established at the Columbia Basin Agricultural Research Center, Pendleton, OR to evaluate control of rattail fescue in Clearfield™ winter wheat. Plots were 10 by 30 ft arranged in a randomized complete block design with 3 replications. Soil at the site was a silt loam 25.6% sand, 59.9% silt, 14.5% clay, 2.3% organic matter, 5.6 pH, and CEC of 15.9 meq/100g). Clearfield wheat, variety ORCF-101, was planted October 1, 2004 with a John Deere 1560 drill. Herbicide treatments were applied using a 9 ft hand-held boom, CO_2 pressured sprayer delivering 10 gpa at 20 psi. Pre-emergence (PRE) treatments were applied October 2, 2004. Spike treatments were applied October 11, 2004 to wheat at the 1 leaf stage. Early postemergence (EPOST) treatments were applied January 27, 2005 when rattail fescue was at the 5 to 7 leaf stage (Table 1). Crop injury was evaluated April 13, 2005. Control of rattail fescue was visually evaluated on March 7 and April 13, 2005. Plots were harvested July 18, 2005 using a Hege small plot combine. Wheat was further cleaned with an "Almaco" cleaner, weighed, and yield converted to bushels/acre using a 60 lb/bushel standard test weight. Mention of products used in this trial should not be considered to be a product endorsement or recommendation for commercial use.

Table 1. Application conditions.

	Oct 2, 2004	Oct 11, 2004	Jan 27, 2005
Timing	PRE	Spike	EPOST
Wheat (leaf)	PRE	1	6-8
Rattail fescue (leaf)	PRE	1	6-8
Air temperature (F)	54	64	53
Relative humidity (%)	74	44	64
Wind speed (mph)	1	3	3
Soil temperature (F at 1 inch)	48	62	48
Cloud cover (%)	0	0	30

None of the treatments injured the wheat. Flufenacet + metribuzin treatments alone or followed by metribuzin EPOST provided 100% control of rattail fescue on March 7, 2005, which was better than all other treatments on that date. All of the treatments, with the exception of pendimethalin applied either PRE or at spike stage, gave good control of rattail fescue on April 13, 2005 (Table 2). There were no significant yield differences between any of the treatments. Even though there were wide variations in control of rattail fescue, apparently, the weed competition was not sufficient to cause a yield loss.

Table 2. Rattail fescue control in Clearfield™ winter wheat at Pendleton, OR.

			Crop injury	Rattail fescue control		Crop yield
Treatment[1]	Rate	Timing	4/14/05	3/7/05	4/13/05	7/18/05
	---lb ai/a---		-------------------%-------------------			--bu/a--
Untreated check		--	0	0	0	91
Imazamox + NIS + UAN	0.031 + 0.25% v/v + 2.5% v/v	EPOST	0	70	97	107
Imazamox + NIS + UAN + bromoxynil + MCPA	0.031 + 0.25% v/v + 2.5% v/v + 0.0.375 + 0.375	EPOST	0	73	100	103
Imazamox + NIS + UAN	0.031 + 0.25% v/v + 3 gal/a	EPOST	0	70	99	105
Imazamox + NIS + UAN + bromoxynil + MCPA	0.031 + 0.25% v/v + 3 gal/a + 0.375 + 0.375	EPOST	0	77	100	99
Imazamox + NIS + AMS	0.031 + 0.25% v/v + 1.5 lb/a	EPOST	0	73	100	101
Imazamox + NIS + AMS + bromoxynil + MCPA	0.031 + 0.25% v/v + 1.5 lb/a + 0.375 + 0.375	EPOST	0	75	100	106
Imazamox + NIS + AMS	0.031 + 0.25% v/v + 2.5 lb/a	EPOST	0	73	99	106
Imazamox + NIS + AMS + bromoxynil + MCPA	0.031 + 0.25% v/v + 2.5 lb/a + 0.375 + 0.375	EPOST	0	75	100	101
Flufenacet + metribuzin	0.344 + 0.086	PRE	0	100	98	102
Flufenacet + metribuzin / metribuzin	0.344 + 0.086 / 0.19	PRE / EPOST	0	100	100	94
Flufenacet + metribuzin / imazamox + NIS + UAN	0.344 + 0.086 / 0.031 + 0.25% v/v + 2.5% v/v	PRE / EPOST	0	100	100	101
Pendimethalin	0.75	PRE	0	53	50	94
Pendimethalin	1.5	PRE	0	67	77	101
Pendimethalin	0.75	SPIKE	0	47	40	94
Pendimethalin	1.5	SPIKE	0	53	63	94
LSD (0.05)			NS	12	7	NS

[1] NIS = non-ionic surfactant; UAN = Solution 32; AMS = ammonium sulfate; bromoxynil + MCPA = Bronate; flufenacet + metribuzin = Axiom; pendimethalin = Prowl H2O.

Rattail fescue control in imazamox-tolerant winter wheat with various herbicides. Eric D. Jemmett, Traci Rauch, and Donald C. Thill (Plant Science Division, University of Idaho, Moscow, ID 83844-2339). Studies were established near Genesee and Moscow, ID in winter wheat to investigate the response of rattail fescue (VLPMY) to different formulations and timings of herbicides. 'Clearfirst' winter wheat and rattail fescue were planted October 4 and 8, 2004 at Genesee and Moscow, respectively. Rattail fescue seed was seeded at 16 lb/A using a double disk cone seeder and was broadcast seeded at 16 lb/A using a drop spreader. Winter wheat was seeded at 100 lb/A. All plots were 8 by 30 ft arranged in a randomized complete block design with four replications. Herbicide treatments were applied using a backpack sprayer calibrated to deliver 10 gpa at 34 psi and 3 mph (Table 1). Control of rattail fescue was visually evaluated twice during spring 2005. Rattail fescue panicles were counted and biomass was collected June 20 and 21, 2005 at Genesee and Moscow, respectively. Crop stand was determined March 3, 2005 at Moscow and Genesee. Crop injury was visually evaluated May 12 and 19, 2005 at Genesee and Moscow, respectively. Crop height was measured and crop heads were counted at Genesee and Moscow on June 13 and 20, 2005, respectively. The crop was harvested at Genesee and Moscow on August 3 and 8, 2005, respectively, with a small plot combine and harvested seed was cleaned.

Table 1. Application conditions.

	Genesee, Idaho		Moscow, Idaho	
Application dates	10/11/04	4/07/05	10/11/04	4/06/05
Timing	PRE	EPOST	PRE	EPOST
Winter wheat growth stage	preemergence	3 to 4 tiller	preemergence	3 to 4 tiller
Rattail fescue growth stage	preemergence	4 to 6 leaf	preemergence	4 to 6 leaf
Air temperature (F)	60	58	62	64
Relative humidity (%)	58	65	57	47
Wind (mph)	3	4	2	2
Cloud cover (%)	70	100	80	70
Soil temperature (F)	50	40	55	46
pH	5.4		5.1	
OM%	3.6		3.1	
CEC (meg/100g)	25		17	
Texture	silt loam		silt loam	

At Genesee, wheat height for pendimethalin + mesosulfuron, flufenacet + diuron or imazamox, imazamox, flufenacet applied preemergence, and mesosulfuron + MSO treated plots was shorter than the untreated check (Table 2). There was no difference among treatments for wheat plant number and heads per yard of row. Mesosulfuron + MSO injured wheat 3% (Table 3). Wheat yield was not different from the untreated check for any herbicide treated plot. Flufenacet applied alone preemergence controlled rattail fescue better than flufenacet applied early postemergence (on May 15 but not at the June 22 evaluation), mesosulfuron + NIS, diuron, and pendimethalin combination (except with flufenacet). All treatments reduced rattail fescue biomass and panicle density compared to the untreated control. Rattail fescue plots treated with flufenacet applied preemergence alone or in combination with other herbicides did not produce any panicles or accumulate any biomass.

At Moscow, there was no difference among treatments for wheat plants per yard of row, plant height, and heads per yard of row (Table 4). Rattail fescue plots treated with mesosulfuron alone or in combination with other herbicides injured wheat 4 to 8% (Table 5). Wheat yield was not different among treatments. Flufenacet applied alone in preemergent combination with other herbicides controlled rattail fescue 91 to 95% over both evaluations, except flufenacet + NIS applied early postemergence, which controlled rattail fescue only 44% on May 19. All treatments reduced rattail fescue biomass and panicle density compared to the untreated control. Rattail fescue plots treated with mesosulfuron + MSO and flufenacet applied preemergence alone or in combination with other herbicides did not produce any panicles or accumulate any biomass.

Table 2. Rattail fescue and winter wheat responses to herbicide treatments at Genesee, Idaho in 2005.

			Wheat[3]			Rattail fescue[3]	
Treatment[1]	Rate	Application timing[2]	Plants	Height	Heads	Panicle density[4]	Biomass
	lb ai/A		no./yd row	inch	no./yd row	no./yd^2	oz/yd^2
Untreated check	–	–	25 a	31.8 ab	61 a	193 a	0.57 a
Pendimethalin	0.750	PRE	24 a	31.7 abc	47 a	16 de	0.07 bc
Flufenacet	0.360	PRE	24 a	29.9 cde	42 a	0 e	0.00 c
Flufenacet + pendimethalin	0.360 0.750	PRE	26 a	30.7 a-d	45 a	0 e	0.00 c
Flufenacet + NIS	0.360	EPOST	21 a	30.6 a-d	51 a	10 de	0.04 c
Sulfosulfuron + NIS + UAN	0.031	EPOST	25 a	30.4 a-d	48 a	48 b-e	0.12 bc
Mesosulfuron + NIS + UAN	0.013	EPOST	25 a	30.7 a-d	47 a	59 bcd	0.11 bc
Mesosulfuron + MSO + UAN	0.013	EPOST	26 a	28.4 e	56 a	13 de	0.03 c
Diuron	1.000	EPOST	25 a	31.4 a-d	63 a	33 b-e	0.17 bc
Imazamox + NIS + UAN	0.047	EPOST	23 a	29.8 de	53 a	13 de	0.03 c
Fluefenacet + sulfosulfuron + NIS + UAN	0.360 0.031	PRE EPOST	24 a	30.3 bcd	51 a	0 e	0.00 c
Flufenacet + mesosulfuron + NIS + UAN	0.360 0.013	PRE EPOST	24 a	30.7 a-d	52 a	0 e	0.00 c
Flufenacet + diuron	0.360 1.000	PRE EPOST	22 a	29.9 cde	48 a	0 e	0.00 c
Flufenacet + imazamox + NIS + UAN	0.360 0.047	PRE EPOST	23 a	29.8 cde	45 a	0 e	0.00 c
Pendimethalin + flufenacet + NIS	0.750 0.360	PRE EPOST	24 a	32.2 a	53 a	23 cde	0.06 bc
Pendimethalin + sulfosulfuron + NIS + UAN	0.750 0.031	PRE EPOST	24 a	30.7 a-d	53 a	82 d	0.23 b
Pendimethalin + mesosulfuron + NIS + UAN	0.750 0.013	PRE EPOST	27 a	29.9 cde	54 a	51 b-e	0.15 bc
Pendimethalin + diuron	0.750 1.000	PRE EPOST	25 a	31.2 a-d	57 a	46 b-e	0.14 bc
Pendimethalin + imazamox + NIS + UAN	0.750 0.047	PRE EPOST	24 a	30.3 bcd	58 a	77 bc	0.18 bc

[1] EPOST treatments, except diuron received a non-ionic surfactant (NIS) (R-11) at 0.5 % v/v. Sulfosulfuron, mesosulfuron, and imazamox treatments received urea ammonium nitrate (UAN) at 2.5% v/v (Solution 32). MSO is methylated seed oil.

[2] PRE – preemergence treatments applied after seeding, but before crop and rattail fescue emergence. EPOST – early postemergence applied to rattail fescue in the 4 to 6 leaf stage of growth.

[3] Means within a column, followed by the same letter, do not significantly differ at P=0.05.

[4] Rattail panicle density was used due to inability to distinguish between plants for an accurate plant count.

Table 3. Rattail fescue control and winter wheat response to herbicide treatments at Genesee, Idaho in 2005.

Treatment[1]	Rate	Application timing[2]	Wheat Injury	Wheat Yield	Rattail fescue control 5/12/2005	Rattail fescue control 6/22/2005
	lb ai/A		%	bu/A	%	%
Untreated check	–	–	–	69	–	–
Pendimethalin	0.750	PRE	0	74	85	84
Flufenacet	0.360	PRE	0	74	95	95
Flufenacet + pendimethalin	0.360 0.750	PRE	0	74	91	93
Flufenacet + NIS	0.360	EPOST	0	72	65	78
Sulfosulfuron + NIS + UAN	0.031	EPOST	0	77	70	83
Mesosulfuron + NIS + UAN	0.013	EPOST	0	72	50	65
Mesosulfuron + MSO + UAN	0.013	EPOST	3	71	84	83
Diuron	1.000	EPOST	0	82	50	73
Imazamox + NIS + UAN	0.047	EPOST	0	73	74	84
Flufenacet + sulfosulfuron + NIS + UAN	0.360 0.031	PRE EPOST	0	76	95	88
Flufenacet + mesosulfuron + NIS + UAN	0.360 0.013	PRE EPOST	0	78	94	93
Flufenacet + diuron	0.360 1.000	PRE EPOST	0	81	89	93
Flufenacet + imazamox + NIS + UAN	0.360 0.047	PRE EPOST	0	76	93	94
Pendimethalin + flufenacet + NIS	0.750 0.360	PRE EPOST	0	78	78	79
Pendimethalin + sulfosulfuron + NIS + UAN	0.750 0.031	PRE EPOST	0	72	50	64
Pendimethalin + mesosulfuron + NIS + UAN	0.750 0.013	PRE EPOST	0	71	51	56
Pendimethalin + diuron	0.750 1.000	PRE EPOST	0	77	41	64
Pendimethalin + imazamox + NIS + UAN	0.750 0.047	PRE EPOST	0	79	50	75
LSD (0.05)			1	NS	26	19

[1] EPOST treatments, except diuron received a non-ionic surfactant (NIS) (R-11) at 0.5 % v/v. Sulfosulfuron, mesosulfuron, and imazamox treatments received urea ammonium nitrate (UAN) at 2.5% v/v (Solution 32). MSO is methylated seed oil.

[2] PRE – preemergence treatments applied after seeding, but before crop and rattail fescue emergence. EPOST – early postemergence applied to rattail fescue in the 4 to 6 leaf stage of growth.

Table 4. Rattail fescue and winter wheat response to herbicide treatments at Moscow, Idaho in 2005.

			Wheat[3]			Rattail fescue[3]	
Treatment[1]	Rate	Application timing[2]	Plants	Height	Heads	Panicle density[4]	Biomass
	lb ai/A		no./yd row	inch	no./yd row	no./yd^2	oz/yd^2
Untreated check	–	–	29 a	35 a	122 a	250 a	1.09 a
Pendimethalin	0.750	PRE	28 a	36 a	91 a	3 bc	0.01 c
Flufenacet	0.360	PRE	27 a	36 a	99 a	0 c	0.00 c
Flufenacet + pendimethalin	0.360 0.750	PRE	27 a	36 a	98 a	0 c	0.00 c
Flufenacet + NIS	0.360	EPOST	25 a	35 a	94 a	9 bc	0.03 bc
Sulfosulfuron + NIS + UAN	0.031	EPOST	25 a	35 a	115 a	7 bc	0.03 bc
Mesosulfuron + NIS + UAN	0.013	EPOST	26 a	35 a	114 a	59 b	0.15 bc
Mesosulfuron + MSO + UAN	0.013	EPOST	25 a	34 a	108 a	0 c	0.00 c
Diuron	1.000	EPOST	29 a	35 a	109 a	15 bc	0.07 bc
Imazamox + NIS + UAN	0.047	EPOST	30 a	35 a	103 a	2 bc	0.02 c
Fluefenacet + sulfosulfuron + NIS + UAN	0.360 0.031	PRE EPOST	27 a	34 a	104 a	0 c	0.00 c
Flufenacet + mesosulfuron + NIS + UAN	0.360 0.013	PRE EPOST	31 a	35 a	106 a	0 c	0.00 c
Flufenacet + diuron	0.360 1.000	PRE EPOST	28 a	34 a	92 a	0 c	0.00 c
Flufenacet + imazamox + NIS + UAN	0.360 0.047	PRE EPOST	24 a	35 a	99 a	0 c	0.00 c
Pendimethalin + flufenacet + NIS	0.750 0.360	PRE EPOST	24 a	35 a	95 a	9 bc	0.03 bc
Pendimethalin + sulfosulfuron + NIS + UAN	0.750 0.031	PRE EPOST	21 a	35 a	101 a	10 bc	0.04 bc
Pendimethalin + mesosulfuron + NIS + UAN	0.750 0.013	PRE EPOST	26 a	35 a	98 a	59 b	0.20 b
Pendimethalin + diuron	0.750 1.000	PRE EPOST	24 a	35 a	97 a	22 bc	0.05 bc
Pendimethalin + imazamox + NIS + UAN	0.750 0.047	PRE EPOST	25 a	34 a	97 a	5 bc	0.05 bc

[1] EPOST treatments, except diuron received a non-ionic surfactant (NIS) (R-11) at 0.5 % v/v. Sulfosulfuron, mesosulfuron, and imazamox treatments received urea ammonium nitrate (UAN) at 2.5% v/v (Solution 32). MSO is methylated seed oil.

[2] PRE – preemergence treatments applied after seeding, but before crop and rattail fescue emergence. EPOST – early postemergence applied to rattail fescue in the 4 to 6 leaf stage of growth.

[3] Means within a column, followed by the same letter, do not significantly differ at P=0.05.

[4] Rattail panicle density was used due to inability to distinguish between plants for an accurate plant count.

Table 5. Rattail fescue control and winter wheat response to herbicide treatments at Moscow, Idaho in 2005.

Treatment[1]	Rate	Application timing[2]	Wheat		Rattail fescue control	
			Injury	Yield	5/19/2005	6/22/2005
	lb ai/A		%	bu/A	———— %	————
Untreated check	–	–	–	95	–	–
Pendimethalin	0.750	PRE	0	88	84	85
Flufenacet	0.360	PRE	0	108	95	94
Flufenacet + pendimethalin	0.360 0.750	PRE	0	101	95	91
Flufenacet + NIS	0.360	EPOST	0	100	44	93
Sulfosulfuron + NIS + UAN	0.031	EPOST	0	97	44	80
Mesosulfuron + NIS + UAN	0.013	EPOST	4	104	31	63
Mesosulfuron + MSO + UAN	0.013	EPOST	8	101	68	83
Diuron	1.000	EPOST	0	95	56	73
Imazamox + NIS + UAN	0.047	EPOST	0	107	38	76
Fluefenacet + sulfosulfuron + NIS + UAN	0.360 0.031	PRE EPOST	0	104	95	94
Flufenacet + mesosulfuron + NIS + UAN	0.360 0.013	PRE EPOST	4	120	95	95
Flufenacet + diuron	0.360 1.000	PRE EPOST	0	99	95	95
Flufenacet + imazamox + NIS + UAN	0.360 0.047	PRE EPOST	0	104	95	95
Pendimethalin + flufenacet + NIS	0.750 0.360	PRE EPOST	0	114	44	79
Pendimethalin + sulfosulfuron + NIS + UAN	0.750 0.031	PRE EPOST	0	102	38	80
Pendimethalin + mesosulfuron + NIS + UAN	0.750 0.013	PRE EPOST	4	93	29	71
Pendimethalin + diuron	0.750 1.000	PRE EPOST	0	84	43	73
Pendimethalin + imazamox + NIS + UAN	0.750 0.047	PRE EPOST	0	94	56	69
LSD (0.05)			2	NS	25	21

[1] EPOST treatments, except diuron received a non-ionic surfactant (NIS) (R-11) at 0.5 % v/v. Sulfosulfuron, mesosulfuron, and imazamox treatments received urea ammonium nitrate (UAN) at 2.5% v/v (Solution 32). MSO is methylated seed oil.

[2] PRE – preemergence treatments applied after seeding, but before crop and rattail fescue emergence. EPOST – early postemergence applied to rattail fescue in the 4 to 6 leaf stage of growth.

Rattail fescue control in chemical fallow and winter wheat with pinoxaden and various other herbicides.

Eric D. Jemmett and Donald C. Thill. (Plant Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established near Genesee and Potlatch, ID in chemical fallow and winter wheat, respectively, to investigate rattail fescue (VLPMY) control and wheat response to different formulations and timings with pinoxaden and various other herbicides. Madsen winter wheat was planted at 100 lb/A using a no till drill. Plots were 4 by 32 ft and 8 by 30 ft at Genesee and Potlatch, respectively, arranged in a randomized complete block design with four replications and an untreated check. Herbicide treatments were applied using a backpack sprayer delivering 10 gpa at 34 psi and 3 mph (Table 1). Rattail fescue density was heavy at Genesee and moderate to heavy at Potlatch. Rattail fescue control and winter wheat injury was evaluated visually. Winter wheat was not harvested due to poor rattail fescue control with all treatments.

	Genesee, Idaho		Potlatch, Idaho	
Application date	4/19/05	5/15/05	4/13/05	4/19/05
Rattail fescue growth stage	2 to 4 leaf	3 to 5 tiller	5 to 7 leaf	3 to 5 tiller
Winter wheat growth stage	--	--	4 to 6 leaf	5 to 8 leaf
Air temperature (F)	48	75	55	56
Relative humidity (%)	70	50	60	58
Wind (mph)	3	2	3	2
Cloud cover (%)	100	40	90	75
Soil temperature (F)	40	57	42	44
pH	5.4		4.8	
OM%	3.6		2.6	
CEC (meg/100g)	25		22	
Texture	silt loam		silt loam	

At the Genesee study, rattail fescue was controlled best with mesosulfuron (39 to 49%), while pinoxaden did not control rattail fescue (Table 2).

At the Potlatch study, treatments containing UAN injured winter wheat 7 and 16% (Table 3). Flucarbazone suppressed rattail fescue 8 to 23%, except flucarbazone + NIS and flucarbazon + NIS + metribuzin at 0.14 lb ai/A, which did not control rattail fescue. Pinoxaden and mesosulfuron treatments did not control rattail fescue.

Table 2. Rattail fescue response to pinoxaden and mesosulfuron in chemical fallow near Genesee, ID in 2005.

			VLPMY control	
Treatment[1]	Rate	Application timing[2]	5/12/2005	6/21/2005
	lb ai/A		----------%----------	
Pinoxaden	0.0535	2 to 4 leaf	0	0
Pinoxaden	0.0535	3 to 5 tiller	0	0
Pinoxaden + AMS/citric acid	0.0535 + 2.0 qt/A	2 to 4 leaf	0	0
Pinoxaden + AMS/citric acid	0.0535 + 2.0 qt/A	3 to 5 tiller	0	0
Mesosulfuron	0.0134	2 to 4 leaf	49	39
LSD (0.05)			5	5

[1] Pinoxaden treatments were applied with adjuvant (A12127S) at 0.6 pt/A. Mesosulfuron was applied with UAN (Solution 32) at 5% v/v and non-ionic surfactant (R-11) at 0.5% v/v. AMS/citric acid is Bronc Max.

[2] Application timing based on rattail fescue growth stage.

Table 3. Rattail fescue response to herbicide treatments in winter wheat near Potlatch, ID in 2005.

Treatment[1]	Rate	Application timing[2]	Wheat injury 4/19/2005	VLPMY control 6/21/2005
	lb ai/A		----------%----------	
Pinoxaden	0.0535	5 to 7 leaf	0	0
Pinoxaden	0.0535	3 to 5 tiller	0	0
Pinoxaden + AMS/citric acid	0.0535 + 2.0 qt/100 gal	5 to 7 leaf	0	0
Pinoxaden + AMS/citric acid	0.0535 + 2.0 qt/100 gal	3 to 5 tiller	0	0
Mesosulfuron + NIS + UAN	0.0134 + 0.5% v/v 5% v/v	5 to 7 leaf	0	0
Flucarbazone + NIS	0.0268 + 0.25% v/v	5 to 7 leaf	0	0
Flucarbazone + NIS + AMS	0.0268 + 0.25% v/v 15 lb ai/100 gal	5 to 7 leaf	0	23
Flucarbazone + NIS + UAN	0.0268 + 0.25% v/v 50% v/v	5 to 7 leaf	16	15
Flucarbazone + MSO + UAN	0.0268 + 1.5 pt/A 50% v/v	5 to 7 leaf	7	8
Flucarbazone + MSO + AMS	0.0178 + 1.5 pt/A 15 lb ai/100 gal	5 to 7 leaf	0	10
Flucarbazone + MSO + AMS	0.0268 + 1.5 pt/A 15 lb ai/100 gal	5 to 7 leaf	0	23
Flucarbazone + NIS + metribuzin	0.0268 + 0.25% v/v 0.14	5 to 7 leaf	0	0
Flucarbazone + NIS + metribuzin	0.0268 + 0.25% v/v 0.188	5 to 7 leaf	0	8
LSD (0.05)			1	16

[1] Pinoxaden treatments were applied with adjuvant (A12127S) at 0.6 pt/A. UAN is urea ammonium nitrate (Solution 32). NIS is non-ionic surfactant (R-11). AMS is ammonium sulfate (Bronc). MSO is methylated seed oil. AMS/citric acid is Bronc Max.

[2] Application timing based on rattail fescue growth stage.

Wild oat control in Clearfield winter wheat with imazamox and pinoxaden. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established in 'ID 587' Clearfield winter wheat near Bonners Ferry, ID to evaluate wild oat control with imazamox and pinoxaden. The 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). On May 12, 2005, the imazamox study was oversprayed with fluroxypyr at 0.1125 lb ae/A and bromoxynil/MCPA at 0.5 lb ae/A, and the pinoxaden study was oversprayed with fluroxypyr at 0.1875 lb ae/A for broadleaf weed control. Wheat injury and weed control were evaluated visually during the growing season. Wheat seed was harvested with a small plot combine on August 23, 2005.

Table 1. Application and soil data for both studies.

	Pinoxaden study	Imazamox study
Application date	5/12/05	5/12/05
Growth stage		
Winter wheat	4 tiller	4 tiller
Wild oat	3 leaf	3 leaf
Air temperature (F)	68	73
Relative humidity (%)	60	55
Wind (mph, direction)	0	0
Cloud cover (%)	30	20
Soil moisture	dry	dry
Soil temperature at 2 in (F)	60	63
Soil		
pH	7.6	
OM (%)	4.0	
CEC (meq/100g)	31	
texture	silt loam	

In the pinoxaden study, no treatment injured winter wheat (data not shown). Wild oat control was best with pinoxaden alone (99%), but did not differ from any treatment except flucarbazone combined with thifensulfuron/tribenuron or bromoxynil/MCPA (74 and 86%) (Table 2). The addition of bromoxynil/MCPA or thifensulfuron/tribenuron to flucarbazone reduced wild oat control 5 and 18%, respectively, compared to flucarbazone alone. Wheat seed yield and test weight ranged from 41 to 53 bu/A and 49.2 to 51.8 lb/bu, respectively, and did not differ among treatments.

In the imazamox study, imazamox/MCPA injured winter wheat 13% and was not different from imazamox + UAN at 30% v/v (8%) on July 13, 2005 (Table 3). All treatments controlled wild oat 87 to 99% except imazamox + AMS at 15 lb/100 gal (72%). Wheat seed yield and test weight ranged from 44 to 50 bu/A and 49.5 to 52.2 lb/bu, respectively, and did not differ among treatments.

Table 2. Wild oat control and wheat response with pinoxaden, mesosulfuron, and flucarbazone near Bonners Ferry, Idaho in 2005.

Treatment[1]	Rate	Wild oat control[2]	Wheat	
			Yield	Test weight
	lb ai/A	%	bu/A	lb/bu
Pinoxaden +	0.054			
A12127S	0.6 pt/A	99	46	50.3
Pinoxaden +	0.054			
A12127S +	0.6 pt/A			
bromoxynil/MCPA	0.5	98	53	49.2
Pinoxaden +	0.054			
A12127S +	0.6 pt/A			
thifensulfuron/tribenuron	0.0187	93	46	51.8
Mesosulfuron +	0.0089			
NIS +	0.25% v/v			
UAN	2 qt/A	92	45	51.1
Mesosulfuron +	0.0089			
NIS +	0.25% v/v			
UAN +	2 qt/A			
bromoxynil/MCPA	0.5	91	51	50.6
Mesosulfuron +	0.0089			
NIS +	0.25% v/v			
UAN +	2 qt/A			
thifensulfuron/tribenuron	0.0187	89	41	51.0
Flucarbazone +	0.027			
NIS	0.25% v/v	90	49	51.2
Flucarbazone +	0.027			
NIS +	0.25% v/v			
bromoxynil/MCPA	0.5	86	42	49.6
Flucarbazone +	0.027			
NIS +	0.25% v/v			
thifensulfuron/tribenuron	0.0187	74	45	51.2
Untreated check	--	--	41	51.1
LSD (0.10)		12	NS	NS
Density (plants/ft^2)		8		

[1] Bromoxynil/MCPA rate is in lb ae/A. A12127S is an adjuvant; NIS is a 90% non ionic surfactant (R-11); and UAN is urea ammonium nitrate (URAN).

[2] July 13, 2005 evaluation.

Table 3. Wild oat control and wheat response with imazamox near Bonners Ferry, Idaho in 2005.

				Wheat	
Treatment[1]	Rate	Wheat injury[2]	Wild oat control[2]	Yield	Test weight
	lb ai/A	%	%	bu/A	lb/bu
Imazamox +	0.039				
UAN	2.5% v/v	0	92	48	52.2
Imazamox +	0.039				
UAN	30% v/v	8	87	45	49.9
Imazamox +	0.039				
AMS	15 lb/100 gal	1	72	49	50.8
Imazamox +	0.039				
AMS	25 lb/100 gal	1	99	48	51.3
Flucarbazone	0.027	3	87	48	51.3
Mesosulfuron +	0.0089				
UAN	5% v/v	3	92	48	50.7
Clodinafop	0.5	0	88	50	51.6
Pinoxaden +	0.054				
A12127S	0.6 pt/A	0	98	46	50.8
Imazamox/MCPA +	0.352				
UAN	2.5% v/v	13	96	44	49.5
Untreated check	--	--	--	45	50.6
LSD (0.05)		6	14	NS	NS
Density (plants/ft^2)			8		

[1] A 90% nonionic surfactant (R-11) was applied at 0.25% v/v with imazamox treatments and 0.5% v/v with flucarbazone and mesosulfuron. A12127S is an adjuvant.

[2] July 13, 2005 evaluation

Interactions of wild oat herbicides with thifensulfuron-methyl and tribenuron-methyl. Sandra M. Frost, Larry H. Bennett, and Daniel A. Ball (Oregon State University – CBARC, Pendleton, OR 97801). A study was established in a commercial winter wheat field with a heavy infestation of wild oat, near Mission, OR to investigate the interactions of wild oat herbicides with thifensulfuron-methyl and tribenuron-methyl. Plots were 9 by 30 ft arranged in a randomized complete block design with 3 replications. Soil at the site was a silt loam (20.6% sand, 58.9% silt, 20.5% clay, 3.8% organic matter, 5.8 pH, and CEC of 28.0 meq/100g). An early-postemergence (EPOST) herbicide treatment was applied on March 8, 2005, using a 9 ft hand-held boom, CO_2 pressured sprayer delivering 16 gpa at 30 psi (Table 1). Crop injury was visually evaluated April 8, 2005. Control of wild oat was visually evaluated on April 8 and May 2, 2005. Plots were harvested July 27, 2005 with a small Hege plot combine. Samples were further cleaned by hand to get the final yield values. Mention of products used in this trial should not be considered to be a product endorsement or recommendation for commercial use.

Table 1. Application conditions.

	Mar 8, 2005
Timing	EPOST
Wild oat (tiller)	0-2
Wheat (tiller)	2-4
Air temperature (F)	64
Relative humidity (%)	34
Wind speed (mph)	2
Soil temperature (F at 1 inch)	54
Cloud cover (%)	0

Wild oat control ranged from 45 to 70% with propoxycarbazone-sodium, flucarbazone, and both mesosulfuron-methyl formulations, while control with clodinafop-propargyl and fenoxaprop-ethyl was 85% or greater (Table 2). The addition of thifensulfuron-methyl or tribenuron-methyl did not affect performance of any of the products. Crop yield differed significantly among treatments. Treatments that gave good wild oat control, such as fenoxaprop-ethyl and clodinafop-propargyl, had the highest yields, averaging 46 to 54 bu/a, while treatments that gave only partial control averaged 12 to 27 bu/a. The lowest yield was in the untreated control which averaged 7 bu/a.

Table 2. Interactions of wild oat herbicides with thifensulfuron-methyl and tribenuron-methyl in winter wheat.

Treatment[1]	Rate	Timing	Crop injury	Wild oat control		Crop yield
			4/8/05	4/8/05	5/2/05	7/27/05
	-----lb ai/a-----		--------------%--------------			--bu/a--
Untreated control	-----		0	0	0	7
Propoxycarbazone-sodium	0.039	EPOST	0	70	53	18
Propoxycarbazone-sodium + thifensulfuron-methyl	0.039 + 0.019	EPOST	0	68	47	12
Propoxycarbazone-sodium + thifensulfuron-methyl + tribenuron-methyl	0.039 + 0.019 + 0.009	EPOST	0	70	50	17
Flucarbazone	0.026	EPOST	0	70	87	27
Flucarbazone + thifensulfuron-methyl	0.026 + 0.019	EPOST	0	68	78	23
Flucarbazone + thifensulfuron-methyl + tribenuron-methyl	0.026 + 0.019 + 0.009	EPOST	0	70	77	17
Mesosulfuron-methyl[2]	0.013	EPOST	0	70	77	18
Mesosulfuron-methyl[2] + thifensulfuron-methyl	0.013 + 0.019	EPOST	0	68	80	16
Mesosulfuron-methyl[2] + thifensulfuron-methyl + tribenuron - methyl	0.013 + 0.019 + 0.009	EPOST	0	65	82	15
Mesosulfuron-methyl[3]	0.003	EPOST	0	48	10	15
Mesosulfuron-methyl[3] + thifensulfuron-methyl	0.003 + 0.019	EPOST	0	45	13	13
Mesosulfuron-methyl[3] + thifensulfuron-methyl + tribenuron-methyl	0.003 + 0.019 + 0.009	EPOST	0	62	20	13
Clodinafop-propargyl	0.063	EPOST	0	85	99	47
Clodinafop-propargyl + thifensulfuron-methyl	0.063 + 0.019	EPOST	0	85	99	47
Clodinafop-propargyl + thifensulfuron-methyl + tribenuron-methyl	0.063 + 0.019 + 0.009	EPOST	0	85	99	46
Fenoxaprop-ethyl	0.096	EPOST	0	87	99	54
Fenoxaprop-ethyl + thifensulfuron-methyl	0.96 + 0.019	EPOST	0	85	99	51
Fenoxaprop-ethyl + thifensulfuron-methyl + tribenuron-methyl	0.96 + 0.019 + 0.009	EPOST	0	87	99	48
LSD (0.05)			NS	5	7	8

[1] All treatments included non-ionic surfactant at 0.25% v/v.

[2] mesosulfuron-methyl = Osprey formulation.

[3] mesosulfuron-methyl = Silverado formulation.

Italian ryegrass control in winter wheat with flufenacet 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, Genesee, ID and Moscow, ID in winter wheat to evaluate Italian ryegrass (LOLMU) control and wheat response with flufenacet alone and 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 I). Studies were oversprayed with thifensulfuron/tribenuron at 0.0156 lb ai/A plus MCPA amine at 0.25 lb ae/A at the Pullman site on May 24, 2005; and with thifensulfuron/tribenuron at 0.0156 lb ai/A plus fluroxypyr at 0.1331 lb ae/A at the Genesee site; and thifensulfuron/tribenuron at 0.0156 lb ai/A at Moscow on May 25, 2005 to control broadleaf weeds. Wheat injury and weed control were evaluated visually. Wheat seed was harvested with a small plot combine at the Genesee and Pullman studies on August 9 and 12, 2005, respectively. Wheat seed was not harvested at the Moscow study due to poor Italian ryegrass control.

Table 1. Application and soil data.

Location	Genesee, Idaho		Moscow, Idaho		Pullman, WA	
Application date	10/06/04	4/26/05	9/27/04	4/25/05	10/7/04	5/4/05
Winter wheat variety	Cashup		Lambert/Mohler		ORCF101	
Growth stage						
Italian ryegrass (LOLMU)	preemergence	1 to 3 tiller	preemergence	1 to 4 tiller	preemergence	1 to 3 tiller
Winter wheat	preemergence	4 to 7 tiller	preemergence	3 to 4 tiller	preemergence	8 to 9 tiller
Air temperature (F)	60	69	80	68	60	62
Relative humidity (%)	60	56	45	57	62	52
Wind (mph, direction)	1, SW	2, NW	3, E	5, NW	3, SE	1, E
Cloud cover (%)	100	10	0	10	40	75
Soil moisture	dry	dry	dry	moist	dry	moist
Soil temperature at 2 in (F)	50	65	58	64	50	65
pH	5.3		5.1		5.3	
OM (%)	4.2		3.1		3.0	
CEC (meq/100g)	30		24		2	
Texture	silt loam		silt loam		loam	

At all sites, no treatment visually injured wheat (data not shown). At the Genesee study, mesosulfuron and triasulfuron treatments controlled Italian ryegrass the best (82 to 99%) while control was poorest with flucarbazone alone (5%) (Table 2). At the Moscow study, mesosulfuron was the only treatment to adequately control Italian ryegrass (83 and 90%), while all other treatments suppressed Italian ryegrass 0 to 40%. At the Pullman study, Italian ryegrass control was best with mesosulfuron (99%) but did not differ from flucarbazone treatments and flufenacet plus triasulfuron (88 to 93%). Wheat seed yield and test weight did not differ among treatments or from the untreated check and ranged from 110 to 138 bu/A and 62 lb/bu, respectively, at the Genesee study and 96 to 110 bu/A and 59 to 61 lb/bu, respectively, at the Pullman study.

Table 2. Italian ryegrass control and wheat yield and test weight with flufenacet combinations near Genesee, ID, Moscow, ID, and Pullman, WA in 2005.

			Genesee			Moscow	Pullman		
		Application	LOLMU	Wheat		LOLMU	LOLMU	Wheat	
Treatment[1]	Rate	timing[2]	control[3]	Yield	Test weight	control[4]	control[5]	Yield	Test weight
	lb ai/A		%	bu/A	lb/bu	%	%	bu/A	lb/bu
Flufenacet/metribuzin	0.425	preemergence	33	119	62	20	64	109	60
Flufenacet	0.34	preemergence	49	135	62	18	71	103	60
Triasulfuron	0.026	preemergence	83	138	62	0	35	105	61
Chlorsulfuron/metsulfuron	0.023	preemergence	44	132	62	0	49	104	60
Flufenacet/metribuzin +	0.425								
triasulfuron	0.026	preemergence	84	127	62	28	76	110	60
Flufenacet/metribuzin +	0.425								
chlorsulfuron/metsulfuron	0.023	preemergence	53	132	62	24	83	105	59
Flufenacet +	0.34								
triasulfuron	0.026	preemergence	82	121	62	40	88	109	59
Flufenacet +	0.34								
chlorsulfuron/metsulfuron	0.023	preemergence	51	112	62	28	85	101	59
Flucarbazone	0.027	postemergence	5	110	62	0	90	101	59
Mesosulfuron	0.013	postemergence	89	119	62	83	99	102	59
Flufenacet +	0.34	preemergence							
flucarbazone	0.027	postemergence	53	113	62	26	93	104	59
Flufenacet +	0.34	preemergence							
mesosulfuron	0.013	postemergence	99	123	62	90	99	106	59
Untreated check	--	--	--	119	62	--	--	96	60
LSD (0.05)			25	NS	NS	23	14	NS	NS
Density (plants/ft^2)			5			80	15		

[1] A non-ionic surfactant (R-11) at 0.25% v/v and modified seed oil (MSO) at 1.5 pt/A was applied with flucarbazone and mesosulfuron treatments, respectively.

[2] Application timing based on Italian ryegrass growth stage. Postemergence = 1 to 3 tiller for Genesee, 1 to 4 tiller for Moscow, and 1 to 3 tiller for Pullman.

[3] June 28, 2005 evaluation date.

[4] June 29, 2005 evaluation date.

[5] July, 15, 2005 evaluation date.

Italian ryegrass control in winter wheat with imazamox and imazamox/MCPA. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Two studies were established near Pullman, WA in imidazolinone-tolerant wheat to evaluate Italian ryegrass and winter wheat response with imazamox combined with flufenacet/metribuzin, adjuvants or broadleaf weeds and imazamox/MCPA. Plots were 8 by 30 ft and arranged in a randomized complete block design with four replications and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Italian ryegrass control was evaluated visually. Wheat seed was harvested with a small plot combine on August 12, 2005.

Table 1. Application and soil data.

Study	Imazamox combinations		Imazamox/MCPA
Application date	October 6, 2004	May 9, 2005	May 6, 2005
Growth stage			
Winter wheat	preemergence	8 to 9 tiller	8 to 9 tiller
Italian ryegrass	preemergence	2 tiller	2 tiller
Air temperature (F)	60	65	57
Relative humidity (%)	55	68	90
Wind (mph, direction)	2, SE	4, E	3, SW
Cloud cover (%)	80	100	100
Soil moisture	dry	moist	wet
Soil temperature at 2 in (F)	50	50	52
pH	5.3		
OM (%)	3.0		
CEC (meq/100g)	20		
Texture	loam		

In the imazamox combinations study, no treatment injured winter wheat (data not shown). All treatments controlled Italian ryegrass 91 to 99% except, flufenacet/metribuzin alone or combined with triasulfuron, mesosulfuron + NIS + UAN, and imazamox alone + AMS or UAN at 2.5% v/v (Table 2). Wheat seed yield and test weight ranged from 103 to 112 bu/A and 58 to 60 lb/bu, respectively, and did not differ among treatments.

In the imazamox/MCPA study, no treatment injured winter wheat (data not shown). Imazamox/MCPA at the two highest rates, imazamox, mesosulfuron, and pinoxaden controlled Italian ryegrass 90 to 94% (Table 3). Italian ryegrass was not controlled by the low rate of imazamox/MCPA, flucarbazone or clodinafop. Wheat seed yield was higher than the untreated check for all treatments except clodinafop. Wheat test weight did not differ among treatments and ranged from 55 to 57 lb/bu.

Table 2. Italian ryegrass control and winter wheat response with imazamox combinations near Pullman, WA in 2005.

Treatment[1]	Rate	Application timing[2]	Italian ryegrass control[3]	Wheat	
				Yield	Test weight
	lb ai/A		%	bu/A	lb/bu
Flufenacet/metribuzin	0.425	preemergence	80	110	58
Flufenacet/metribuzin +	0.425				
triasulfuron	0.026	preemergence	89	112	59
Flufenacet/metribuzin +	0.425	preemergence			
imazamox +	0.039	1 to 3 tiller			
UAN	2.5% v/v		97	111	58
Flufenacet/metribuzin +	0.425	preemergence			
imazamox +	0.039	1 to 3 tiller			
UAN	30% v/v		99	106	58
Flufenacet/metribuzin +	0.425	preemergence			
imazamox +	0.039	1 to 3 tiller			
AMS	15 lb ai/100 gal		94	110	59
Flufenacet/metribuzin +	0.425	preemergence			
imazamox +	0.039	1 to 3 tiller			
AMS	25 lb ai/100 gal		96	110	59
Imazamox +	0.039				
UAN	2.5% v/v	1 to 3 tiller	80	109	59
Imazamox +	0.039				
UAN	30% v/v	1 to 3 tiller	95	103	58
Imazamox +	0.039				
AMS	15 lb ai/100 gal	1 to 3 tiller	87	107	59
Imazamox +	0.039				
AMS	25 lb ai/100 gal	1 to 3 tiller	88	106	58
Imazamox/MCPA +	0.352				
UAN	2.5% v/v	1 to 3 tiller	91	107	58
Flufenacet/metribuzin +	0.425				
imazamox +	0.039				
clopyralid/MCPA +	0.606				
UAN	2.5% v/v	1 to 3 tiller	97	111	60
Flufenacet/metribuzin +	0.425				
imazamox +	0.039				
clopyralid/MCPA +	0.606				
UAN	30% v/v	1 to 3 tiller	98	103	59
Flufenacet/metribuzin +	0.425				
imazamox +	0.039				
clopyralid/MCPA +	0.606				
AMS	15 lb ai/100 gal	1 to 3 tiller	99	100	59
Flufenacet/metribuzin +	0.425				
imazamox +	0.039				
clopyralid/MCPA +	0.606				
AMS	25 lb ai/100 gal	1 to 3 tiller	98	106	59
Mesosulfuron +	0.0134				
NIS +	0.5% v/v				
UAN	5% v/v	1 to 3 tiller	88	103	58
Mesosulfuron +	0.0134				
MSO	1.5 pt/A	1 to 3 tiller	94	108	59
Untreated check	--		--	105	60
LSD (0.05)			9	NS	NS
Density (plants/ft^2)			5		

[1] NIS is a non-ionic surfactant (R-11) and applied at 0.25% v/v with imazamox treatments. UAN is a 32% urea ammonium nitrate (URAN); AMS is ammonium sulfate (Bronc); and MSO is methylated seed oil. Imazamox/MCPA is BAS 777001H.

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

[3] July 15, 2005 evaluation.

Table 3. Italian ryegrass control and winter wheat response with imazamox/MCPA near Pullman, WA in 2005.

Treatment[1]	Rate	Italian ryegrass control[2]	Wheat Yield	Wheat Test weight
	lb ai/A	%	bu/A	lb/bu
Imazamox/MCPA	0.281	79	95	57
Imazamox/MCPA	0.352	93	92	55
Imazamox/MCPA	0.422	94	98	57
Imazamox	0.039	90	100	57
Flucarbazone	0.027	65	95	56
Mesosulfuron	0.0134	91	98	57
Clodinafop	0.0625	46	88	56
Pinoxaden	0.0535	92	99	56
Untreated check	--	--	77	56
LSD (0.05)		18	12	NS
Density (plants/ft^2)		20		

[1] A non-ionic surfactant (R-11) was applied with imazamox treatments at 0.25% v/v and with flucarbazone and mesosulfuron treatments at 0.5% v/v. Urea ammonium nitrate (URAN) was applied with imazamox and mesosulfuron treatments at 2.5% v/v. A12127S is an adjuvant and applied with pinoxaden at 0.6 pt/A. Imazamox/MCPA is BAS 777002H.

[2] July 15, 2005 evaluation.

Effect of growth stage and application date on Italian ryegrass control with mesosulfuron-methyl. Chuck Cole, Richard Affeldt, Bill Brewster, Carol Mallory-Smith, and Jed Colquhoun (Department of Crop and Soil Science, Oregon State University, Corvallis, OR 97331-3002) Trials were conducted in 2003-2004 and 2004-2005 at the Hyslop Research Farm near Corvallis, Oregon, to assess application timing of mesosulfuron-methyl for the control of Italian ryegrass. Italian ryegrass was seeded on three dates each year (Table 3), and mesosulfuron-methyl was applied at 0.0134 lbs ai/A with mefenpyr at 0.0268 lbs ai/A on six dates each year (Table 1). Treatments were applied with a single-wheel, compressed air plot sprayer calibrated to deliver 20 gpa at 20 psi. Temperature and humidity at each application are presented in Table 2, and Italian ryegrass growth stage in each planting on the six application dates in each year is presented in Table 3. Fresh weight biomass was obtained by hand-harvesting the Italian ryegrass in two, one-square yard quadrats in each plot in April of each year.

Applying mesosulfuron-methyl on Italian ryegrass before any of the plants had reached the 4-leaf stage of growth accounted for all treatments that provided less than a 70% reduction in Italian ryegrass fresh weight (Table 3). Although the fresh weight of Italian ryegrass that was over 8 inches tall when treated was usually reduced by more than 80% compared to the untreated control, wheat yield reductions from competition would be expected by delaying mesosulfuron-methyl applications that late. Our research has shown that maximum wheat yields in Western Oregon are obtained when ryegrass competition is removed prior to the tillering stage of wheat development. Date of mesosulfuron-methyl application influenced Italian ryegrass control less than did growth stage since at least 90% control was achieved in at least one planting for each application date in each year.

Table 1. Mesosulfuron-methyl application dates for the 2003-2004 and 2004-2005 crop years.

	Crop Year	
No.	2003-2004	2004-2005
1	November 3	November 8
2	November 13	November 22
3	December 2	December 9
4	December 15	December 21
5	January 13	January 13
6	February 10	February 14

Table 2. Temperature and humidity readings for six application dates in each year of the study.

	Air temperature		Soil temperature		Relative humidity	
	Year					
Application date	03-'04	04-'05	03-'04	04-'05	03-'04	04-'05
No.	F		F		%	
1	43	49	42	48	93	77
2	53	39	55	38	76	82
3	51	52	51	50	84	87
4	38	38	39	30	85	90
5	46	43	44	42	83	68
6	44	38	41	36	88	88

Table 3. Italian ryegrass stage of growth at application and fresh weight as affected by mesosulfuron-methyl application timing.

		Italian ryegrass growth stage			Italian ryegrass fresh weight	
Application date	Planting date	2003-2004	2004-2005		2003-2004	2004-2005
No.					% of untreated control	
1	Sept. 25, 2003;	3-4 leaf	2 tiller		5	5
2	Sept. 30, 2004	1-2 tiller	8-10 inch		6	5
3		6-8 inch	12 inch		18	6
4		8-10 inch	15 inch		17	5
5		10 inch	16 inch		16	9
6		16 inch	18-20 inch		22	18
				$LSD_{(0.05)}$	11	17
1	Oct. 13, 2003;	1-2 leaf	1-2 leaf		18	21
2	Oct. 13, 2004	2-3 leaf	3-4 leaf		22	13
3		1-2 tiller	3-5 tiller		2	1
4		3-5 tiller	7 inch		1	2
5		3-5 tiller	9 inch		1	2
6		5-6 inch	16 inch		5	9
				$LSD_{(0.05)}$	21	16
1	Oct. 22, 2003;	spike	spike		75	80
2	Oct. 25, 2004	1 leaf	1 leaf		64	38
3		1-2 leaf	2-3 leaf		32	4
4		2-4 leaf	3-4 leaf		3	3
5		3-4 leaf	2-3 tiller		2	2
6		2-3 tiller	5-9 inch		10	1
				$LSD_{(0.05)}$	16	17

<u>Italian ryegrass control and winter wheat tolerance to pendimethalin</u>. Traci A. Rauch and Donald C. Thill. (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) Studies were established near Moscow, Idaho to evaluate Italian ryegrass control and winter wheat tolerance with pendimethalin applied at two timings. Plots were 8 by 30 ft, arranged in a randomized complete block design with four replications, and included an untreated check. All herbicide treatments were applied using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). Italian ryegrass control and winter wheat injury were evaluated visually. Winter wheat was not harvested due to poor Italian ryegrass control.

Table 1. Application and soil data.

Application date	September 27, 2004	October 4, 2004	April 25, 2005
Growth stage			
Winter wheat	preemergence	spike	3 to 4 tiller
Italian ryegrass (LOLMU)	preemergence	spike	1 to 4 tiller
Air temperature (F)	78	60	68
Relative humidity (%)	48	60	57
Wind (mph, direction)	3, NE	4, SE	5, NW
Cloud cover (%)	0	0	10
Soil moisture	dry	dry	moist
Soil temperature at 2 in (F)	58	46	64
Soil			
pH		5.1	
OM (%)		3.1	
CEC (meq/100g)		24	
Texture		silt loam	

On October 26, 2004, March 18 and April 25, 2005, winter wheat was not injured by any treatment applied preemergence or at the wheat spike growth stage (data not shown). Mesosulfuron injured wheat 6 and 8% on June 6, but no injury was visible by June 29, 2005 (Table 2). Mesosulfuron suppressed Italian ryegrass 35 to 55% on June 6 and 50 to 71% on June 29, 2005. No other treatment controlled Italian ryegrass.

Table 2. Winter wheat response and Italian ryegrass control with pendimethalin near Moscow, Idaho in 2005.

Treatment[1]	Rate	Application Timing[2]	Winter wheat injury[3]	Italian ryegrass control	
				June 6	June 29
	lb ai/A		---------%---------		
Flufenacet/metribuzin +	0.425	preemergence			
triasulfuron	0.026	preemergence	0	0	0
Pendimethalin	0.75	preemergence	0	0	0
Pendimethalin	1.5	preemergence	0	0	0
Pendimethalin	0.75	spike	0	0	0
Pendimethalin	1.5	spike	0	0	0
Mesosulfuron +	0.013				
NIS +	0.5% v/v				
UAN	2 qt/A	3 to 4 tiller	6	35	50
Mesosulfuron +	0.013				
MSO	1.5 pt/A	3 to 4 tiller	8	55	71
LSD (0.05)			2	8	9
Density (plants/ft^2)				95	

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[1] NIS is a non-ionic surfactant (R-11), UAN is urea ammonium nitrate (URAN), and MSO is a methylated seed oil.

[2] Application timing is based on winter wheat growth stage.

[3] June 6, 2005 evaluation date.

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) Studies were established in winter wheat to evaluate Italian ryegrass and wheat response with triasulfuron combinations and flufenacet/metribuzin combined with mesosulfuron near Moscow, ID and Pullman, WA, respectively. 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 Pullman site was oversprayed with thifensulfuron/tribenuron at 0.0156 lb ai/A on May 24; and the Moscow site was oversprayed with thifensulfuron/tribenuron at 0.0156 lb ai/A plus fluroxypyr at 0.1331 lb ai/A on May 25, 2005. Italian ryegrass control was evaluated visually. Wheat seed was harvested with a small plot combine at Moscow and Pullman on August 9 and 12, 2005, respectively.

Table 1. Application and soil data.

Location	Moscow, Idaho		Pullman, Washington	
Winter wheat variety	Cashup		ORCF 101	
Application date	10/6/04	4/26/05	10/12/04	5/4/05
Wheat growth stage	preemergence	4 to 6 tiller	preemergence	8 to 9 tiller
Italian ryegrass growth stage	preemergence	1 to 3 tiller	preemergence	1 to 3 tiller
Air temperature (F)	60	69	64	62
Relative humidity (%)	60	56	56	52
Wind (mph, direction)	1, SW	2, NW	1, NW	1, E
Cloud cover (%)	100	10	0	75
Soil moisture	dry	dry	dry	moist
Soil temperature at 2 in (F)	50	65	55	65
pH	5.3		5.3	
OM (%)	4.2		3.0	
CEC (meq/100g)	30		20	
Texture	silt loam		loam	

At Moscow, no treatment injured winter wheat (data not shown). Mesosulfuron, pinoxaden, and all triasulfuron combinations controlled Italian ryegrass 84 to 99% (Table 2). Tralkoxydim, clodinafop, and triasulfuron alone did not control Italian ryegrass (42 to 66%). Wheat seed yield (119 to 140 bu/A) and test weight (62 lb/bu) did not differ among treatments, but wheat seed yield tended to be lower in the untreated check (119 bu/A).

At Pullman, no treatment injured winter wheat (data not shown). Italian ryegrass control was best with all mesosulfuron treatments (98 to 99%) but did not differ from triasulfuron alone and the three highest rates of flufenacet/metribuzin (92 to 96%) (Table 3). Wheat seed yield was lowest for the highest rate of flufenacet/metribuzin combined with mesosulfuron (96 bu/A) but did not differ from the untreated check (99 bu/A). Wheat test weight did not differ among treatments and ranged from 54 to 58 lb/bu.

Table 2. Italian ryegrass control and winter wheat response with triasulfuron combinations near Moscow, ID in 2005.

Treatment[1]	Rate	Application timing[2]	Italian ryegrass control[3]	Wheat	
				Yield	Test weight
	lb ai/A		%	bu/A	lb/bu
Triasulfuron	0.026	preemergence	66	136	62
Tralkoxydim	0.25	1 to 3 tiller	42	132	62
Clodinafop	0.0625	1 to 3 tiller	45	126	62
Pinoxaden	0.0535	1 to 3 tiller	97	125	62
Mesosulfuron	0.0134	1 to 3 tiller	92	124	62
Triasulfuron +	0.026	preemergence			
tralkoxydim	0.25	1 to 3 tiller	84	140	62
Triasulfuron +	0.026	preemergence			
clodinafop	0.0625	1 to 3 tiller	84	137	62
Triasulfuron +	0.026	preemergence			
pinoxaden	0.0535	1 to 3 tiller	99	133	62
Triasulfuron +	0.026	preemergence			
mesosulfuron	0.0134	1 to 3 tiller	99	129	62
Untreated check	--	--	--	119	62
LSD (0.05)			17	NS	NS
Density (plants/ft^2)			8		

[1] A non-ionic surfactant/crop oil concentrate blend (Supercharge) was applied at 0.5% v/v with tralkoxydim. A12127S is an adjuvant and applied with pinoxaden at 0.6 pt/A. A non-ionic surfactant (R-11) at 0.5% v/v and urea ammonium nitrate (URAN) at 5% v/v was applied with mesosulfuron.

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

[3] June 28, 2005 evaluation.

Table 3. Italian ryegrass control and winter wheat response with flufenacet/metribuzin and mesosulfuron combinations near Pullman, WA in 2005.

Treatment[1]	Rate	Application timing[2]	Italian ryegrass control[3]	Wheat	
				Yield	Test weight
	lb ai/A		%	bu/A	lb/bu
Triasulfuron	0.026	preemergence	92	104	57
Flufenacet/metribuzin	0.17	preemergence	87	105	56
Flufenacet/metribuzin	0.255	preemergence	87	107	58
Flufenacet/metribuzin	0.34	preemergence	96	104	58
Flufenacet/metribuzin	0.425	preemergence	93	110	56
Mesosulfuron	0.0134	1 to 3 tiller	98	103	58
Triasulfuron +	0.026				
flufenacet/metribuzin	0.425	preemergence	92	107	57
Triasulfuron +	0.026	preemergence			
mesosulfuron	0.0134	1 to 3 tiller	99	103	57
Flufenacet/metribuzin +	0.17	preemergence			
mesosulfuron	0.0134	1 to 3 tiller	98	107	55
Flufenacet/metribuzin +	0.255	preemergence			
mesosulfuron	0.0134	1 to 3 tiller	99	108	56
Flufenacet/metribuzin +	0.34	preemergence			
mesosulfuron	0.0134	1 to 3 tiller	99	104	56
Flufenacet/metribuzin +	0.425	preemergence			
mesosulfuron	0.0134	1 to 3 tiller	99	96	54
Untreated check	--	--	--	99	56
LSD (0.05)			9	7	NS
Density (plants/ft^2)			5		

[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] July 15, 2005 evaluation.

Rotational crop response to propoxycarbazone/mesosulfuron. Traci A. Rauch and Donald C. Thill (Crop and Weed Science Division, University of Idaho, Moscow, ID 83844-2339) A study was established near Lewiston, Idaho to evaluate spring barley, lentil, pea, and yellow mustard response to propoxycarbazone/mesosulfuron and sulfosulfuron persistence. The experimental design was a randomized split-block with four replications. Main plots were four rotational crops (10 by 128 ft) and subplots were seven herbicide treatments and an untreated check (16 by 40 ft). All herbicide treatments were applied in 2004 using a CO_2 pressurized backpack sprayer calibrated to deliver 10 gpa at 32 psi and 3 mph (Table 1). The study was moldboard plowed fall 2004 and field cultivated spring 2005. 'Camas' barley, 'Mason' lentil, 'Kritia' pea, and 'IdaGold' yellow mustard were seeded on March 15, 2005. On May 21, 2005, pea was oversprayed for pea leaf weevil with esfenvalerate at 0.05 lb ai/A. On May 31, 2005, pea and lentil were oversprayed with quizalofop at 0.07 lb ai/A for grass weed control. On June 24, 2005, barley, lentil, and pea were oversprayed with dimethoate at 0.5 lb ai/A for aphid control. Rotational crop injury was evaluated visually and seed harvested with a small plot combine on July 26, 2005.

Table 1. Application and soil data.

Application date	April 7, 2004
Wheat growth stage	5 to 7 tiller
Air temperature (F)	63
Relative humidity (%)	55
Wind (mph, direction)	3, NW
Cloud cover (%)	0
Soil moisture	dry
Soil temperature at 2 in (F)	52
pH	5.2
OM (%)	3.2
CEC (meq/100g)	20
Texture	silt loam

Spring lentil, pea and barley yield and spring barley test weight did not differ among treatments or from the untreated check (Table 2). Yellow mustard yield tended to decrease with increasing propoxycarbazone /mesosulfuron dose compared to the untreated check.

Table 2. Spring barley, lentil, pea, and yellow mustard response to propoxycarbazone/mesosulfuron near Lewiston, Idaho in 2005.

		S. lentil	S. pea	Y. mustard	S. barley	
Treatment[1]	Rate	yield	yield	yield	Yield	Test weight
		lb/A				lb/bu
Propoxycarbazone/mesosulfuron	0.02	131	295	540	1141	55
Propoxycarbazone/mesosulfuron	0.027	120	372	558	1030	54
Propoxycarbazone/mesosulfuron	0.04	208	406	506	1056	55
Propoxycarbazone/mesosulfuron	0.054	159	456	512	774	55
Propoxycarbazone/mesosulfuron	0.079	196	344	508	1091	54
Propoxycarbazone/mesosulfuron	0.106	197	369	424	979	53
Sulfosulfuron	0.031	228	295	397	985	55
Untreated check	--	157	330	589	1075	55
LSD (0.05)		NS	NS	NS	NS	NS

[1] 90% nonionic surfactant (R-11) was applied at 0.5% v/v with all treatments.

A management approach based on disrupting weed population growth. Randy L. Anderson. (USDA-ARS, Brookings SD 57006). Producers in the Central Great Plains are changing their winter wheat-fallow rotation to include corn, proso millet, sunflower, and forage crops. This change is occurring because of conservation tillage; preserving crop residues on the soil surface improves water relations such that more cropping is possible before fallow is needed again.

With crop diversity, producers have developed management systems based on disrupting weed population dynamics. Systems are comprised of cultural tactics in five categories that favor loss of live seed in soil, reduce weed seedling establishment, and minimize seed production of weeds present in crops (Figure 1). Success with this approach requires tactics in each of the five component areas. This report describes the various tactics used in this approach.

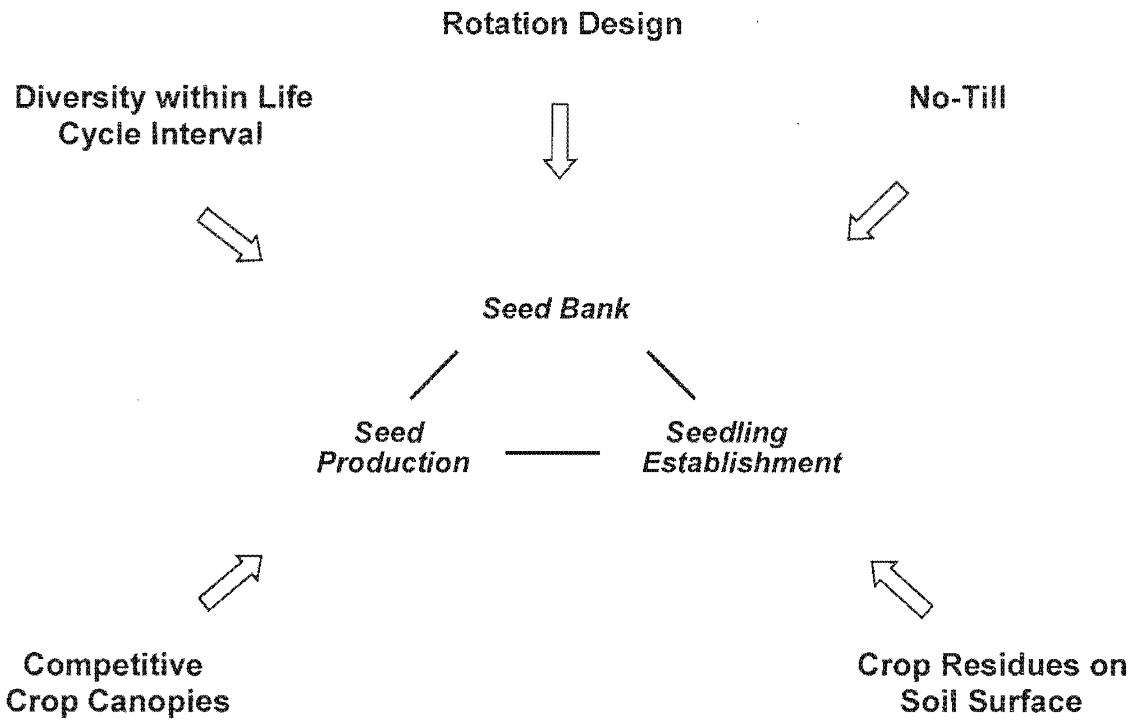

Figure 1. Components of weed population management in semiarid rotations.

Rotation design: sequencing of cool season and warm season crops

In this region, both cool season and warm season crops are available. Producers have noted that weed density is less if rotations are comprised of two cool season crops followed by two warm season crops. Fallow, if used, fits in either category. However, it is critical that crops within a life cycle interval, i.e. warm season crops, differ in planting date. For example, weed density is lower if corn and sunflower are used in place of two years of corn. The difference in planting dates (4 weeks) between corn and sunflower enables producers to reduce weed seedling density 50% before planting sunflower. Growing winter wheat two years in a row is especially favorable for population growth with winter annual grasses.

***Tillage lessens impact of rotation design on weed dynamics*:**

Tillage, even with subsurface implements such as the sweep plow or rodweeder, reduces the effect of rotation design on weed community density. Longer survival of weed seeds buried in soil by tillage leads to more weed seedlings in future years (Figure 2). Note that the difference in seedling emergence between tilled and no-till systems increases with time; in the third year, seedling density was eight-fold greater with tillage compared to no-till. Higher number of weed seedlings in tilled systems leads to more escapes and subsequently, more weed seed production.

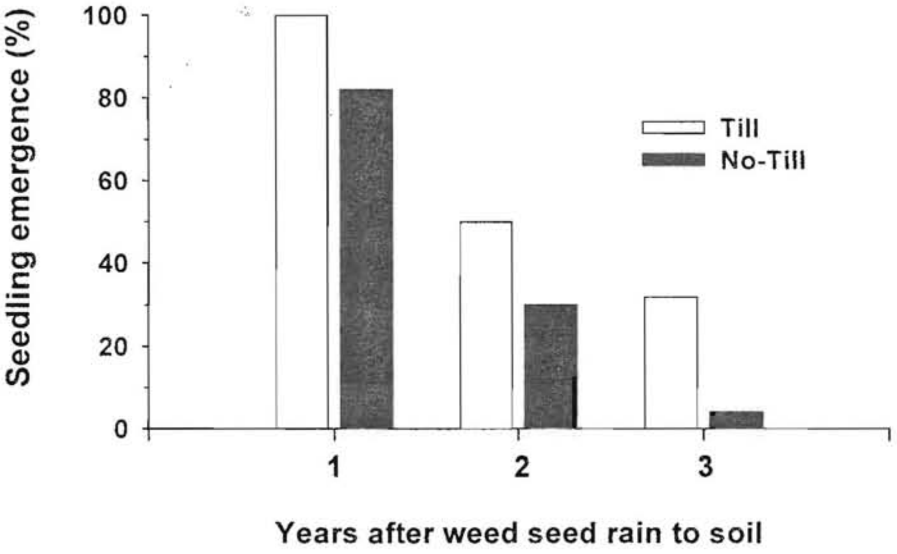

Figure 2. Seedling emergence of a weed community across time, as affected by tillage. [Adapted from Egley and Williams (*1990 Weed Science 38:504*); Mohler (*1993 Ecological Applications 3:53*); and Popay et al. (*1994 Weed Research 34:403*)]

Crop residues on soil surface suppress weed seedling establishment:

Preserving crop residue on the soil surface also helps weed management; weed seedling establishment is reduced 12% for each 1000 lbs of winter wheat residue/ac on the soil surface [Wicks et al. (*1994 Weed Science 42:141*)]. To accentuate this suppression of weed establishment, producers increase residue production in winter wheat with higher seeding rates and banding liquid N fertilizer near the seed row at planting.

Competitive crop canopies reduce seed production of individual plants:

Even with excellent weed control, weed escapes still establish in crops. Producers are reducing seed production by these plants with cultural practices that strengthen the crop canopy. Suppression of seed production can approach 90% if three cultural practices are combined together. Favorable practices include higher seeding rates, narrow row spacing, fertilizer banding, tall cultivars, and delayed planting. Impact of individual practices vary among crops, but competitiveness of crops is always highest with three practices combined.

Success with the Population Management Approach

Producers are effectively controlling weeds with 50% less herbicides compared with earlier no-till cropping systems. Some crops can be grown without herbicides because weed density is so low. However, producers have noted that tactics in each of the categories are needed to reduce weed populations.

To strengthen this approach, producers are seeking cultural strategies to reduce use of herbicides during non-crop intervals. They are especially concerned with weed resistance to glyphosate.

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 564 specimens for identification in 2005. The utilization of the lab was up from 372 submissions from 2004 (Figure 1). Two hundred and fourty-four exotic species were identified. Seventeen samples were submitted from out of state. A total of 34 counties submitted samples. The number of counties that submitted samples was up from 29 counties in 2004 (Figure 3). The lab identified 18 exotic species that were new county records (see Table and Figure 2). No new state records were reported to the lab. Species in table 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. Identified exotic species new to a county based on the Invaders database in Idaho in 2005.

County	Family	*Scientific Name*	Common Name
Ada	Chenopodiaceae	*Atriplex micrantha*	weedy orache
Bonneville	Asteraceae	*Chondrilla juncea*	rush skeletonweed
Boundary	Gentianaceae	*Centaurium erythraea*	European centaury
Caribou	Brassicaceae	*Alyssum desertorum*	dwarf alyssum
Franklin	Caryophyllaceae	*Saponaria officinalis*	bouncingbet
Fremont	Ranunculaceae	*Ceratocephala testiculata*	burr buttercup
Gem	Fabaceae	*Cytisus scoparius*	scotchbroom
Idaho	Malvaceae	*Malva neglecta*	common mallow
Idaho	Poaceae	*Thinopyrum intermedium*	intermediate wheatgrass
Idaho	Fabaceae	*Trifolium aureum*	hop clover
Idaho	Lamiaceae	*Galeopsis tetrahit*	common hempnettle
Kootenai	Poaceae	*Bromus erectus*	meadow brome
Kootenai	Asteraceae	*Logfia arvensis*	field filago
Latah	Rosaceae	*Potentilla argentea*	silvery cinquefoil
Latah	Asteraceae	*Logfia arvensis*	field filago
Power	Asteraceae	*Sonchus arvensis* spp. *uliginosus*	marsh sowthistle
Power	Zygophyllaceae	*Zygophyllum fabago*	Syrian beancaper

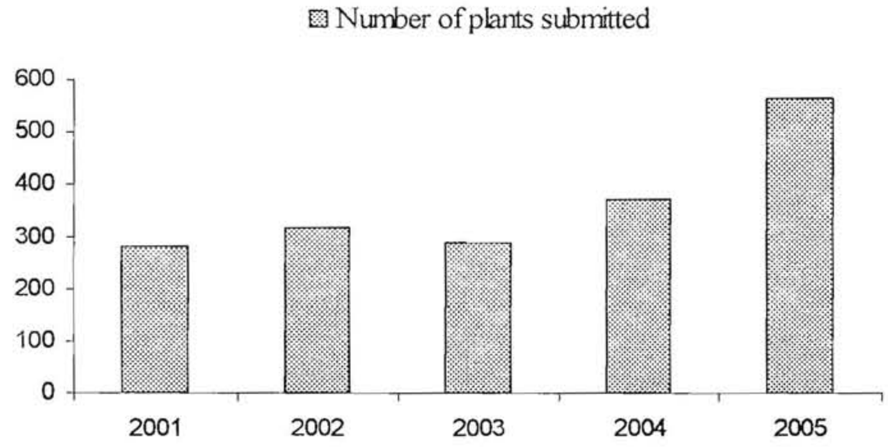

Figure 1. Erickson Weed Diagnostic Laboratory received 564 plant specimens for identification in 2005. The utilization of the lab was up from 372 submissions in 2004.

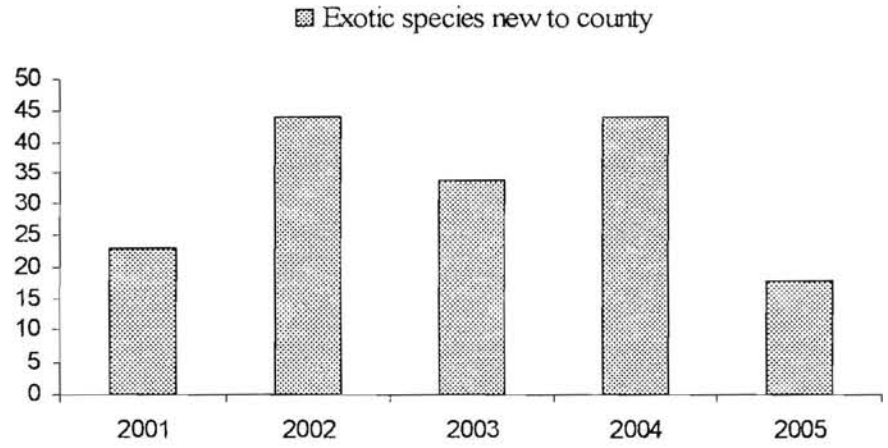

Figure 2. The lab identified 18 exotic species that were new Idaho county records.

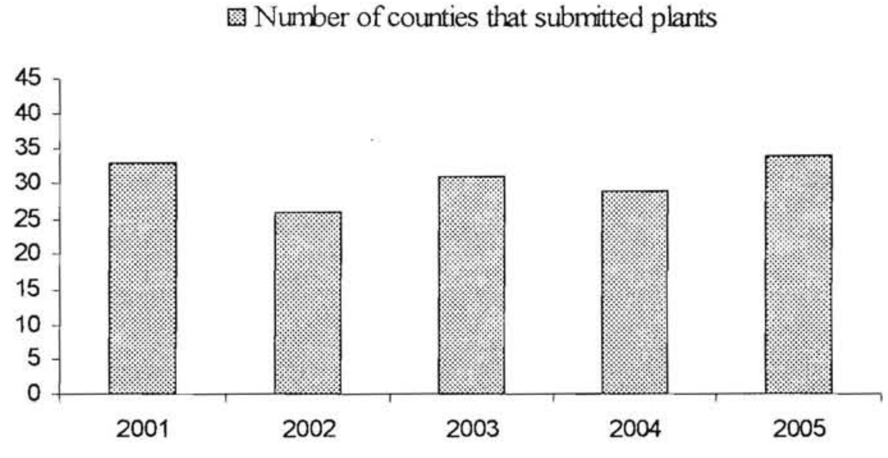

Figure 3. Number of Idaho counties that submitted plants was up from previous years.

Saltcedar control with metsulfuron. Ralph E. Whitesides and R. William Mace. (Department of Plants, Soils, and Biometeorology, Utah State University, Logan, Utah 84322-4820) Several postemergence herbicides, metsulfuron, imazapyr, triclopyr, and fosamine were evaluated for effectiveness in controlling saltcedar (TAARA). There were two locations, Ferron, and Kanab Utah. Individual trees were sprayed to wet with a CO_2 back pack sprayer using Turbojet 030 nozzles mounted on a two nozzle boom calibrated to deliver 100 gpa at 40 psi. The soils were silty clay loams with 7.9 pH and O.M. content of less than two percent. Treatments were applied October, 15 2004 in a randomized design, with four replications. Saltcedar plants ranged from 4 to 8 feet tall at application time. Visual evaluations for weed control were completed June 8, August 5, and October 19, 2005.

Evaluation of treatments in 2005 showed good season-long control for metsulfuron+imazapyr and imazapyr alone at both locations throughout the season. Imazapyr alone was more damaging to the understory of grasses and sedges than any of the other treatments. This understory was not homogenous at either location, but the imazapyr treatement was obviously killing all vegetation in the understory. The addition of fosamine to metsulfuron+imazapyr provided a slight improvement in control at the Kanab site when compared to the metsulfuron+imazapyr mixture. Initially the addition of fosamine did not improve results at Ferron, but by October the treatment effects were nearly equal. Metsulfuron+fosamine and metsulfuron+triclopyr were only marginally effective in June. By August, two months after application, these treatments showed essentially zero control of saltcedar.

Table. Visual evaluation of saltcedar control.

		Ferron, UT			Kanab,UT		
Treatment[1]	Rate	6/8/05	8/5/05	10/19/05	6/8/05	8/5/05	10/19/05
	lb ai/A	-------------------------------% control-------------------------------					
Metsulfuron+imazapyr	0.1875+1.0	85	90	74	100	75	83
Metsulfuron+imazapyr+ fosamine	0.1875+1.0 +24.0	60	50	72	100	83	93
Metsulfuron+fosamine	0.1875+24.0	40	3	0	20	0	0
Metsulfuron+triclopyr	0.1875+6.0	28	0	0	47	0	5
Imazapyr	4	97	96	98	100	100	100
Untreated check		0	0	0	0	0	0
$LSD_{(0.05)}$		23	6	24	3	11	15

[1] Organosilicone surfactant added at 0.25% v/v added.

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